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THE MANUFACTURE AND SALE
OF
SAINT EINSTEIN

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9 THE PRIORITY MYTH

It is well known in the Physics community that Albert Einstein was a career plagiarist. Immediately after the Annalen der Physik *published the Einsteins' 1905 paper on the theory of relativity, which wanted for a single reference to the published work of the Einsteins' predecessors, Walter Kaufmann dubbed the special theory of relativity the "Lorentz-Einstein" theory. Kaufmann was overly generous to Einstein at the expense of the Frenchman Henri Poincaré.*

> "The secret to creativity is knowing how to hide your sources."—ALBERT EINSTEIN

> "All this was maintained by Poincaré and others long before the time of Einstein, and one does injustice to truth in ascribing the discovery to him."—CHARLES NORDMANN

9.1 Introduction

It is easily proven that Albert Einstein did not originate the special theory of relativity in its entirety, or even in its majority.[2031] The historic record is readily available. Ludwig Gustav Lange,[2032] Woldemar Voigt,[2033] Oliver Heaviside,[2034] Heinrich Rudolf Hertz,[2035] George Francis FitzGerald,[2036] Joseph Larmor,[2037] Hendrik Antoon Lorentz,[2038] Jules Henri Poincaré,[2039] Paul Drude,[2040] Paul Langevin,[2041] and many others, slowly developed the theory, step by step, and based it on thousands of years of recorded thought and research. Einstein may have made a few contributions to the theory, such as the relativistic equations for aberration and the Doppler-Fizeau Effect;[2042] though he also rendered an incorrect equation for the transverse mass of an electron, which, when corrected, becomes Lorentz' equation.[2043]

Albert Einstein's first work on the theory of relativity did not appear until 1905. There is substantial evidence that Albert Einstein did not write this 1905 paper[2044] on the "principle of relativity" alone. His wife, Mileva Einstein-Marity, may have been co-author, or the sole author, of the work.[2045]

9.2 Opinions of Einstein and "His" Work

If Albert Einstein did not originate the major concepts of the special theory of relativity, how could such a historically significant fact have escaped the attention of the world for nearly a century? The simple answer is that it did not.

Some called Einstein's priority into question almost immediately. As early as the years 1905-1907, Max Planck,[2046] Walter Kaufmann,[2047] Paul Ehrenfest,[2048] Jakob Laub,[2049] Max von Laue,[2050] Hermann Minkowski, and Albert Einstein,[2051] himself, referred to the Einsteins' theory as being a mere interpretation and generalization of

Hendrik Antoon Lorentz' principle of relativity, which interpretation and generalization was first accomplished by Henri Poincaré,[2052] and later became known as the "Special Theory of Relativity".

In 1905, immediately after the appearance of the Einsteins' first paper on the principle of relativity, which did not contain any references to previous works, Walter Kaufmann coined the term "Lorentz-Einstein" for the theory, in recognition of Lorentz' priority,

> "Finally, there is a recently published theory of electrodynamics by Mr. A. Einstein, which leads to consequences which are formally identical to those of Lorentz' theory, and for which, therefore, the second equation applies, as well. [***] (Lorentz-Einstein) [***] The above results speak decidedly against the correctness of the Lorentzian, and, therefore, also the Einsteinian, fundamental assumption. If one considers this basic assumption as thereby disproved, then the attempt to base the whole of Physics including electrodynamics and optics on the principle of relative motion must be considered a failure."

> "Endlich ist noch eine von Hrn. A. Einstein[2] kürzlich publizierte Theorie der Elektrodynamik zu erwähnen, die zu Folgerungen führt, die mit denen LORENTZschen Theorie formell identisch sind, und für die deshalb auch die zweite Gleichung in Anwendung kommt. [***] (LORENTZ-EINSTEIN) [***] Die vorstehenden Ergebnisse sprechen entschieden gegen die Richtigkeit der Lorentzschen und somit auch der Einsteinschen Grundannahme. Erachtet man diese Grundannahme als hierdurch widerlegt, so würde der Versuch, die ganze Physik, einschließlich der Elektrodynamik und der Optik auf das Prinzip der Relativbewegung zu gründen, einstweilen als mißglückt zu bezeichnen sein."[2053]

Kaufmann again used the phrase "Lorentz-Einstein" in 1906, and reiterated the formal identity of the two authors' works,

> "Einstein's theory leads to the same formula as Lorentz'[.]"

> "Die Einsteinsche Theorie führt zu derselben Formel wie die Lorentzsche[.]"[2054]

> Max Planck stated in the early spring of 1906,

> "The'principle of relativity' recently introduced by H. A. Lorentz[1]) and more generally worded by A. Einstein[2])[.]"

> "Das vor kurzem von H. A. Lorentz[1]) und in noch allgemeinerer Fassung von A. Einstein[2]) eingeführte „Prinzip der Relativität''[.]"[2055]

In 1906, Planck referred to the theory of relativity as the Lorentz-Einstein theory and referenced Poincaré,

> "I have only done the calculations for those two theories, which are the most developed at this point: Abraham's [*Footnote:* M. Abraham, Ann. d. Phys. (4) 10, 105, 1903.], according to which the electron has the form of a rigid sphere, and Lorentz-Einstein's [*Footnote:* H. A. Lorentz, Versl. Kon. Akad. v. Wet. Amsterdam 1904, S. 809. A. Einstein, Ann. d. Phys. (4) 17, 891, 1905. Also confer with H. Poincaré, C. R. 140, 1504, 1905.], according to which the 'principle of relativity' is rigorously valid. In order to be concise, I will dub the first theory 'theory of the sphere', and the second 'theory of relativity'. [***] The Lorentz-Einstein theory is based upon the postulate that no absolute translation is provable."

> "Ich habe die Rechnungen nur für diejenigen beiden Theorien durchgeführt, welche bis jetzt die meiste Ausbildung erfahren haben: die Abrahamsche [*Footnote:* M. Abraham, Ann. d. Phys. (4) 10, 105, 1903.], wonach das Elektron die Form einer starren Kugel hat, und die Lorentz-Einsteinsche [*Footnote:* H. A. Lorentz, Versl. Kon. Akad. V. Wet. Amsterdam 1904, S. 809. A. Einstein, Ann. d. Phys. (4) 17, 891, 1905. Vgl. auch H. Poincaré, C. R. 140, 1504, 1905.], wonach das „Prinzip der Relativität" genaue Gültigkeit besitzt. Zur Abkürzung werde ich im folgenden die erste Theorie als Kugeltheorie, die zweite als „Relativtheorie" bezeichnen. [***] Der Lorentz-Einsteinschen Theorie liegt auch ein Postulat zugrunde, nämlich, daß keine absolute Translation nachzuweisen ist."[2056]

Relativistic theories were commonplace at the time. Friedrich Kottler wrote an article entitled "Gravitation and the Theory of Relativity" in 1903.[2057]

Albert Einstein believed he had a right to plagiarize these ideas of Lorentz, and others, if he could put a new spin on them. He asserted this "privilege" in 1907, and note that in order for Einstein to assert that his viewpoint is "new" he must have known what the "old" viewpoint was,

> "It appears to me that it is the nature of the business that what follows has already been partly solved by other authors. Despite that fact, since the issues of concern are here addressed from a new point of view, I believe I am entitled to leave out what would be for me a thoroughly pedantic survey of the literature, all the more so because it is hoped that these gaps will yet be filled by other authors, as has already happened with my first work on the principle of relativity through the kind efforts of Mr. *Planck* and Mr. *Kaufmann*."

> "Es scheint mir in der Natur der Sache zu liegen, daß das Nachfolgende zum Teil bereits von anderen Autoren klargestellt sein dürfte. Mit Rücksicht darauf jedoch, daß hier die betreffenden Fragen von einem neuen

> Gesichtspunkt aus behandelt sind, glaubte ich, von einer für mich sehr umständlichen Durchmusterung der Literatur absehen zu dürfen, zumal zu hoffen ist, daß diese Lücke von anderen Autoren noch ausgefüllt werden wird, wie dies in dankenswerter Weise bei meiner ersten Arbeit über das Relativitätsprinzip durch Hrn. P l a n c k und Hrn. K a u f m a n n bereits geschehen ist."[2058]

Rather than claim independence from Lorentz' work, in 1907, Einstein endorsed Kaufmann's and Planck's declarations that his work was merely an extension of Lorentz' prior work. In 1907, Einstein wrote a review article on the principle of relativity for the *Jahrbuch der Radioaktivität und Elektronik*, and again declared that his work was an interpretation of Lorentz' 1904 paper on electromagnetic phenomena in moving systems—though Einstein would later lie about this point.

In 1907, Einstein wrote to Johannes Stark, who edited the *Jahrbuch der Radioaktivität und Elektronik*, that the only work by Lorentz related to the special theory of relativity which he knew of was Lorentz' 1904 paper (which contains the "Lorentz transformation").[2059] This alone would indicate that when the Einsteins spoke of "Lorentzian electrodynamics" in their 1905 paper, they were speaking of Lorentz' work of 1904—a position held by Prof. G. H. Keswani. However, Einstein's statement is contradicted by a letter from Albert Einstein to Mileva Marić, written in 1901 in which Albert pledges to delve into the work of Lorentz.[2060]

Einstein stated on 19 December 1952,

> "I learned of [the Michelson-Morley experiment] through H. A. Lorentz' decisive investigation of the electrodynamics of moving bodies, with which I was acquainted before developing the special theory of relativity."[2061]

However, Albert Einstein lied to R. S. Shankland on 4 February 1950 and stated,

> "[I] had become aware of [the Michelson-Morley experiment] through the writings of H. A. Lorentz, but only after 1905 had it come to [my] attention."[2062]

In Einstein's famous lecture of 1922 in Kyoto, Japan, he recounts that he derived inspiration from "Michelson's experiment":

> "While I was thinking of this problem in my student years, I came to know the strange result of Michelson's experiment. Soon I came to the conclusion that our idea about the motion of the earth with respect to the ether is incorrect, if we admit Michelson's null result as a fact. This was the first path which led me to the special theory of relativity."[2063]

On 21 September 1909, Einstein stated the "principle of relativity" is the generalization of the empirical result of the Michelson experiment,

> "Michelson's experiment suggested the assumption that, relative to a coordinate system moving along with the earth, and, more generally, relative to any system in nonaccelerated motion, all phenomena proceed according to exactly identical laws. Henceforth, we will call this assumption in brief 'the principle of relativity.'"[2064]

R. S. Shankland recorded a letter Einstein had sent him in 1952, in which Einstein stated,

> "I learned of [the Michelson-Morley experiment] through H. A. Lorentz' decisive investigation of the electrodynamics of moving bodies, with which I was acquainted before developing the special theory of relativity."[2065]

Assuming Einstein did not intend to lie to Stark, one must further assume that when Einstein stated in the 1905 paper that,

> "[T]he electrodynamic foundation of Lorentz's theory of the electrodynamics of moving bodies is in agreement with the principle of relativity."[2066]

Einstein must have been alluding to Lorentz' 1904 paper, which paper he did not cite in 1905, but which paper he correctly found the most relevant of Lorentz' writings at the time. Prof. G. H. Keswani has arrived at this same conclusion on other grounds.[2067] Keswani avers that the Einsteins' 1905 paper's assertion of conformity between the relativity principle and Lorentzian electrodynamics could only have referred to Lorentz' paper of 1904, and that Lorentz' earlier efforts were not in conformity with the principle of relativity, according to Keswani, and Max Born would seemingly have agreed,

> "In the new theory of Lorentz the principle of relativity holds, in conformity with the results of experiment, for all electrodynamic events."[2068]

Albert Einstein clearly lied when he told Carl Seelig,

> "There is no doubt, that the special theory of relativity, if we regard its development in retrospect, was ripe for discovery in 1905. LORENTZ had already observed that for the analysis of MAXWELL's equations the transformations which later were known by his name are essential, and POINCARÉ had even penetrated deeper into these connections. Concerning myself, I knew only LORENTZ' important work of 1895—'La théorie électromagnétique de Maxwell' [*sic* (1892)] and 'Versuch einer Theorie der electrischen und optischen Erscheinungen bewegten Körpern'—but not LORENTZ' later work, nor the consecutive investigations by POINCARÉ. In this sense my work of 1905 was independent."[2069]

It is obvious that Einstein not only contradicted himself, but lied to both Johannes

Stark and Carl Seelig regarding Lorentz' work. Einstein probably lied to Stark in 1907 in order emphasize the freshness of Lorentz' 1904 work in 1905, thereby emphasizing the novelty of the work, and likely lied to Seelig many years later in order emphasize the distinction of Lorentz' earlier works from Lorentz' 1904 paper, and hence the Einsteins' 1905 paper, which contained the perfected form of the Lorentz Transformation the Einsteins had plagiarized from Lorentz and Poincaré. When Albert Einstein published the article Stark had requested in 1907 for the *Jahrbuch der Radioaktivität und Elektronik*, Einstein emphasized the fact that his work of 1905 was an extension of Lorentz' 1904 paper, and that his 1907 article would heal any wounds which existed between Lorentz' 1904 paper and the Einsteins' 1905 paper. When the Einsteins' 1905 paper was reproduced in the book *Das Relativitätsprinzip* in 1913 together with Lorentz' prior work of 1895 and 1904, Arnold Sommerfeld annotated the Einsteins' paper, which so obviously parroted Lorentz' prior work, with the following footnote—which we know, based on the above facts, to be untrue,

> "Die im Vorhergehenden abgedruckte Arbeit von H. A. Lorentz war dem Verfasser noch nicht bekannt."[2070]

We know from Maurice Solovine that Einstein had studiously read Poincaré's books *Science and Hypothesis* of 1902 and *The Value of Science* of 1904, which reprinted Poincaré's famous St. Louis lecture of 1904 and his 1898 work on relative simultaneity. We know from Einstein's citations that he was familiar with Poincaré's 1900 paper on the theory of Lorentz, which contained the clock synchronization procedure Einstein parroted, and which implicitly contained the formula $E = mc^2$, which Einstein also plagiarized from Poincaré. Therefore, Albert Einstein's statement to Carl Seelig that in 1905 he was unfamiliar with Poincaré's works, which followed from Lorentz' work of 1892 and 1895, was a deliberate lie.

Einstein stated in a lecture in Kyoto, Japan, on 14 December 1922, that,

> "At that time I firmly believed that the electrodynamic equations of Maxwell and Lorentz were correct. Furthermore, the assumption that these equations should hold in the reference frame of the moving body leads to the concept of the invariance of the velocity of light, which, however, contradicts the addition rule of velocities used in mechanics. Why do these concepts contradict each other? I realized that this difficulty was really hard to resolve. I spent almost a year in vain trying to modify the idea of Lorentz in the hope of resolving this problem."[2071]

Said "year in vain" was the year from Lorentz' work of 1904 to the Einsteins' 1905 paper, and the missing link required to "modify the idea of Lorentz" was supplied by Poincaré months before Mileva and Albert's 1905 paper appeared in print. Poincaré corrected the defects in Lorentz' theory, before the Einsteins, and thus rendered simultaneity fully relative from the additions of velocity perspective, perfecting the Lorentz group, and attaining full reciprocity for all inertial systems

and the covariance of the laws of physics, without a preferred reference frame.[2072] Poincaré also went far beyond this, and asserted that gravity propagates at light speed, and introduced the four-dimensional interpretation of the Lorentz group, before Minkowski or Einstein.

This new spin on the principle of relativity for which Einstein claimed sole credit, had already been spun in the papers of Henri Poincaré, and Einstein failed to acknowledge this fact in his 1907 review article, which was the perfect opportunity for Einstein to have made amends for the sins of his wife's and his 1905 paper, which lacked any references to, or even mention of, the work of Henri Poincaré. It appears that Einstein never gave Poincaré due credit for the extension of the principle of relativity to electrodynamics; or for the light postulate; or for the concept of, and the exposition on, relative simultaneity; or for the first covariant relativistic theory of gravity based on the presupposition that gravitational effects propagate at light speed; or for the introduction of four-dimensional space-time into the theory of relativity. Einstein was deeply indebted to Poincaré for these ideas, and failed to specifically credit him for them, though Einstein knew that they were Poincaré's ideas, not his.

In 1908, Alfred Heinrich Bucherer published a paper titled, "The Experimental Verification of the Lorentz-Einstein Theory".[2073] In 1909, Philipp Frank wrote of the "principle of relativity according to Lorentz" and "The Lorentzian theorem of relativity" and also employed the designation "Lorentz-Einstein".[2074] Walther Ritz, who once coauthored a paper with Albert Einstein,[2075] spoke of the "Lorentz-Einstein Theory of Relativity".[2076] Erich Hupka wrote of the "Lorentz-Einstein theory" and W. Heil wrote of the "Lorentz-Einstein relativity theory" in 1910.[2077] Max Born wrote in 1910 and 1911 of the "Lorentz-Einstein principle of relativity".[2078] Richard Hiecke wrote of the "Lorentz-Einstein Theory of Relativity" in 1914.[2079] George Braxton Pegram spoke of the "Lorentz-Einstein relativity theory in 1917.[2080] The designation "Lorentz-Einstein" was quite common at least through the 1920's, and was found in the writings of Emil Cohn, Ferdinand Lindemann, Arvid Reuterdahl, Erwin Freundlich and Hans Reichenbach, among many others.[2081] Hermann Weyl wrote of "Lorentz's Theorem of Relativity" and of the "Lorentz-Einstein Theorem of Relativity", in 1921.[2082]

While the theory was known most commonly as the "Lorentz-Einstein theory of relativity", it was really Hermann Minkowski who gave the theory its sex appeal based on Poincaré's innovations; and probably Minkowski, more than Larmor, Lorentz, Einstein and even Poincaré, created a stir for the special theory of relativity outside the small circle of theoretical physicists of the day—that is, before the media circus surrounding the eclipse observations of 1919 made Einstein internationally famous. Minkowski, in dramatic style, elevated the theory from an absurd proposition to an intriguing possibility in the eyes of many of his contemporary mathematicians, physicists and philosophers.

Minkowski acknowledged Woldemar Voigt's priority for the "Lorentz Transformation", the mathematical backbone of the special theory of relativity,

"In the interest of history, I want yet to add, that the transformations which

> play the main rôle in the principle of relativity were first mathematically formulated by Voigt, in the year 1887."
>
> "Historisch will ich noch hinzufügen, daß die Transformationen, die bei dem Relativitätsprinzip die Hauptrolle spielen, zuerst mathematisch von Voigt im Jahre 1887 behandelt sind."[2083]

Minkowski named Lorentz, Planck and Poincaré, together with Einstein,[2084] as the developers of the principle of relativity,

> "H. A. Lorentz has found out the 'Relativity theorem' and has created the Relativity-postulate as a hypothesis that electrons and matter suffer contractions in consequence of their motion according to a certain law."[2085]

and,

> "The credit for the development of the general principle [of relativity] belongs to Einstein, Poincaré and Planck, upon whose works I shall presently expound."
>
> "Verdienste um die Ausarbeitung des allgemeinen Prinzips haben Einstein, Poincaré und Planck, über deren Arbeiten ich alsbald Näheres sagen werde."[2086]

Planck[2087] and Poincaré attributed the principle of relativity to H. A. Lorentz,

> "Will not the principle of relativity, as conceived by Lorentz, impose upon us an entirely new conception of space and time and thus force us to abandon some conclusions which might have seemed established? [***] What, then, is the revolution which is due to the recent progress of physics? The principle of relativity, in its former aspect, has had to be abandoned; it is replaced by the principle of relativity according to Lorentz. It is the transformations of 'the group of Lorentz' which do not falsify the differential equations of dynamics. [***] No, it was the mechanics of Lorentz, the one dealing with the principle of relativity; the one which, hardly five years ago, seemed to be the height of boldness. [***] In all instances in which it differs from that of Newton, the mechanics of Lorentz endures. We continue to believe that no body in motion will ever be able to exceed the speed of light; that the mass of a body is not a constant, but depends on its speed and the angle formed by this speed with the force which acts upon the body; that no experiment will ever be able to determine whether a body is at rest or in absolute motion either in relation to absolute space or even in relation to the ether. [***] This is easy; we have only to apply Lorentz' principle of relativity."[2088]

In 1911, Max von Laue wrote of, "the principle of relativity of classical

mechanics," and of, "the principle of relativity of the Lorentz Transformation."[2089] Lorentz, himself, attributed the principle of relativity to Poincaré,

> "For certain of the physical magnitudes which enter in the formulas I have not indicated the transformation which suits best. This has been done by Poincaré, and later by Einstein and Minkowski. [***] I have not established the principle of relativity as rigorously and universally true. Poincaré on the contrary, has obtained a perfect invariance of the electromagnetic equations, and he has formulated the 'postulate of relativity,' terms which he was the first to employ."[2090]

Albert Einstein stated,

> "The term relativity refers to time and space. [***] This led the Dutch professor, Lorentz, and myself to develop the special theory of relativity."[2091]

Einstein, who knew that Lorentz had the power to end Einstein's masquerade at any time, wrote to Lorentz,

> "My feeling of intellectual inferiority with regard to you cannot spoil the great delight of [our] conversation, especially because the fatherly kindness you show to all people does not allow any feeling of despondency to arise."[2092]

Einstein was grateful to Lorentz, for his theory and for his tact,

> "Lorentz is a marvel of intelligence and exquisite tact. A living work of art! In my opinion he was the most intelligent of the theorists present".[2093]

At the 1953 centennial celebration of Lorentz' birthday, Einstein stated,

> "At the turn of the century, H. A. Lorentz was regarded by theoretical physicists of all nations as the leading spirit; and this with the fullest justification. No longer, however, do physicists of the younger generation fully realise, as a rule, the determinant part which H. A. Lorentz played in the formation of the basic principles of theoretical physics."[2094]

Robert Shankland records that,

> "[Einstein] repeatedly praised H. A. Lorentz and at our last meeting he told me: 'People do not realize how great was the influence of Lorentz on the development of physics. We cannot imagine how it would have gone had not Lorentz made so many great contributions.'"[2095]

Abraham Pais recounts that,

> "As [Einstein] told me more than once, without Lorentz he would never have been able to make the discovery of special relativity."[2096]

Adriaan D. Fokker wrote,

> "This transposition received the name of the Lorentz transformation of co-ordinates and time. After Einstein the same theory came to be known as the theory of relativity. [***] The invariance of the laws of nature had already been postulated by [Lorentz] in 1892."[2097]

Einstein stated in 1912,

> "To fill this gap, I introduced the principle of the constancy of the velocity of light, which I borrowed from H. A. Lorentz's theory of the stationary luminiferous ether, and which, like the principle of relativity, contains a physical assumption that seemed to be justified only by the relevant experiments (experiments by Fizeau, Rowland, etc.)."[2098]

Einstein professed in 1935, that it is the Lorentz Transformations which are fundamental in deducing the "two postulates" of special relativity, not the other way around, which means that the "postulates" are in fact corollaries, and that those who first induced the Lorentz transformation ought to be considered the founders of the special theory of relativity,

> "The special theory of relativity grew out of Maxwell electromagnetic equations. So it came about that even in the derivation of the mechanical concepts and their relations the consideration of those of the electromagnetic field has played an essential role. The question as to the independence of those relations is a natural one because the Lorentz transformation, the real basis of the special relativity theory, in itself has nothing to do with the Maxwell theory".[2099]

Einstein also stated,

> "This rigid four-dimensional space of the special theory of relativity is to some extent a four-dimensional analogue of H. A. Lorentz's rigid three-dimensional æther."[2100]

and,

> "I think, that the ether of the general theory of relativity is the outcome of the Lorentzian ether, through relativation."[2101]

and,

> "The four men who laid the foundations of physics on which I have been able to construct my theory are Galileo, Newton, Maxwell, and Lorenz."[2102]

Einstein's sycophantic behavior towards Lorentz may well explain why Lorentz did not take a stronger stance against Einstein's plagiarism. Another factor in Lorentz' reluctance to discuss Einstein's plagiarism may have been that Lorentz, together with Einstein, stood much to lose in a priorities dispute, and Lorentz owed much of his fame to Einstein's promotion. Lorentz owed a great debt of acknowledgment (which he most often paid prior to Einstein's sycophantic adoration) to Weber, Mossotti, Zöllner, Gerber, Mewes, Tisserand, Voigt, Heaviside, Hertz, FitzGerald, Poincaré and Larmor, among others—many others. That no articles from these men appeared in the 1913 book *Das Relativitätsprinzip* is a moral crime, one in which Hendrik Antoon Lorentz fully participated.

Lorentz, like Einstein, was a pacifist, even before World War I,[2103] and found an ally in Einstein against war and against Germany. In a letter to Einstein dated 28 October 1920, Max Born charged Lorentz with plagiarism, and with committing a gross injustice against Max Planck in order to curry favor with Lorentz' "well-fed friends amongst the Allies"—this at a time when Germans were starving.[2104] Max Born called Lorentz dishonest and ignoble.

Beyond all of this, Lorentz shared another character flaw with Einstein—supreme arrogance. At a conference in California, Lorentz stated, near the end of his life,

> "As to the second-order effect, the situation was much more difficult. The experimental results could be accounted for by transforming the co-ordinates in a certain manner from one system of co-ordinates to another. A transformation of the time was also necessary. So I introduced the conception of a local time which is different for different systems of reference which are in motion relative to each other. But I never thought that this had anything to do with the real time. This real time for me was still represented by the old classical notion of an absolute time, which is independent of any reference to special frames of co-ordinates. There existed for me only this one true time. I considered my time transformation only as a heuristic working hypothesis. So the theory of relativity is really solely Einstein's work. And there can be no doubt that he would have conceived it even if the work of all his predecessors in the theory of this field had not been done at all. His work is in this respect independent of the previous theories."[2105]

If he in fact uttered these words, Lorentz' statement is not only supremely arrogant—he took it upon himself to deny the legacies of many scientists, philosophers and mathematicians (most notably Voigt who introduced "local time" before Lorentz and Lorentz knew it), knowing that his legacy was secure—Lorentz' statement is also irrational. One usually gives the credit and honor of priority to she or he who originated the subject idea, and one does not give credit for the evolution of a theory to someone who later summarizes it.

Furthermore, Lorentz was under the gun when he made this statement, in that the special theory of relativity had been discredited by Miller, who also spoke at the gathering at which Lorentz made his statement. Lorentz was careful to distance himself from "Einstein's theory", while cautiously promoting himself, knowing he was widely considered the forefather of this theory, such that whether the special theory of relativity won or lost the day, Lorentz' legacy would remain intact. It is shameful that Lorentz took credit for Voigt's "Ortszeit" and gave Einstein credit for Poincaré's renouncement of the concept of absolute time and the assertion of relative simultaneity, and gave Einstein undue credit for Michelson's experimental results, if Lorentz in fact made the last of the above comments, which were published almost two years after the conference, and after Lorentz' death. Perhaps Lorentz' lecture notes have survived and will show that he did make the statements. Lorentz also must have known that Poincaré's work was vastly superior to the Einsteins'.

Lorentz also had political interests in promoting Einstein. Both were pacifists and Lorentz was interested in the success of the eclipse expeditions in 1919 because he hoped it would promote the interests of *rapprochement*. Lorentz delighted in Einstein's celebrity for many reasons. Lorentz wanted Einstein to come to Leyden, but Einstein knew that Lorentz would discover that Einstein had no talent. Lorentz must have known that Einstein was very well connected and had numerous important contacts in the press and in the publishing business.

Though the press claimed that Einstein was the greatest and most original thinker the world had ever seen. Einstein wrote to Lorentz on 19 January 1920,

> "Nevertheless, unlike you, nature has not bestowed me with the ability to deliver lectures and dispense original ideas virtually effortlessly as meets your refined and versatile mind. [***] This awareness of my limitations pervades me all the more keenly in recent times since I see that my faculties are being quite particularly overrated after a few consequences of the general theory stood the test."[2106]

Paul Ehrenfest, who was close to Lorentz and Einstien, already knew this about Einstein and wrote to Einstein on 2 September 1919,

> "No one here expects any accomplishments, all simply want you nearby."[2107]

In 1905 and 1906, Paul Ehrenfest considered Lorentz' 1904 paper on special relativity and Poincaré's Rendiconti paper on space-time as the most significant work (both historically and scientifically) on the subject of the principle of relativity. Paul Ehrenfest and his wife Tatiana attended David Hilbert's 1905 Göttingen seminars on electron theory, which described Lorentz' and Poincaré's work on special relativity. They knew that Einstein did not create the theory of relativity. Paul Ehrenfest wrote to Albert Einstein on 9 December 1919,

> "I hear, for ex., that your accomplishments are being used to make propaganda, with the 'Jewish Newton, who is simultaneously an ardent

> Zionist' (I personally haven't *read* this yet, but only *heard* it mentioned). [***] But I cannot go along with the propagandistic fuss with its *inevitable* untruths, precisely *because* Judaism is at stake and *because* I feel myself so thoroughly a Jew."[2108]

As for the alleged inevitability of Einstein's hypothetical genesis of the theory of relativity sans all predecessors, Einstein wrote in late 1907,

> "That the supposition made here, which we want to call the 'principle of the constancy of the velocity of light', is actually met in Nature, is by no means self-evident, nevertheless, it is—at least for a system of coordinates in a definite state of motion—rendered probable through its verification, which Lorentz' theory based upon an absolutely resting æther has ascertained through experiment."
>
> "Daß die hier gemachte Annahme, welche wir „Prinzip von der Konstanz der Lichtgeschwindigkeit" nennen wollen, in der Natur wirklich erfüllt sei, ist keineswegs selbstverständlich, doch wird dies — wenigstens für ein Koordinatensystem von bestimmtem Bewegungszustande — wahrscheinlich gemacht durch die Bestätigungen, welche die, auf die Voraussetzung eines absolut ruhenden Äthers gegründete Lorentzsche Theorie durch das Experiment erfahren hat."[2109]

The "supposition" was, in Einstein's eyes, not a self-evident truth, but an empirical observation—not *a priori*, but *a posteriori*. In fact, Einstein depended upon the Michelson-Morley result, which he later cited in this 1907 paper as compelling a change in Lorentz' theory of 1895 *and 1904*, which change Einstein argues was the result of the merger of Lorentz' theory with the principle of relativity, a merger made by Poincaré before the Einsteins. Einstein makes clear in this 1907 article that his 1905 work on the principle of relativity was an evolution of Lorentz' 1904 paper, and Einstein told Shankland that he learned of Michelson's experiments in Lorentz' work, before 1905.

The so-called "Lorentz Transformation" which is contained in Lorentz' 1904 paper, first appeared Joseph Larmor's work before Lorentz adopted it. The theory of relativity was not a popular theory among scientists in the early part of the twentieth century, and Lorentz was likely glad to have Einstein on the team to help popularize the unpopular theory. Making much of Einstein's plagiarism would have entailed the risk that Lorentz' theoretical work would itself have been blackened by the scandal. Planck and Kaufmann forced Einstein to acknowledge Lorentz early on, and Lorentz' legacy was thus secured.

Poincaré died in 1912. He is not known to have mentioned Einstein in the context of the theory of relativity in any positive sense. Of course, it would have been ludicrous for Poincaré to have referenced Einstein when describing his own work, which Einstein plagiarized. It is disappointing that Lorentz did not do more to restore Poincaré's legacy, though he did credit Poincaré with perfecting his theory, before

Einstein and Minkowski.

While Einstein was demonstrably a sycophant, he had another side to his personality, as sycophants often do. Einstein would not hesitate to arrogantly express ruthless disdain for those who had nothing to offer him and those whom he wished to smear in order to avoid scandal and criticism. This is abundantly clear in Einstein's letters and statements. Einstein's smear tactics and his infamous cowardly avoidance of criticism, as well as his reticence in response to accusations of his plagiarism have already been addressed.

In 1912 Johannes Stark accused Einstein of plagiarism. Einstein did not deny the charge, but arrogantly held,

> "J. Stark has written a comment on a recently published paper of mine[1] for the purpose of defending his intellectual property.[2] I will not go into the question of priority that he has raised, because this would hardly interest anyone, all the more so because the law of photochemical equivalence is a self-evident consequence of the quantum hypothesis.[3]"[2110]

The "self-evident" ploy was one of Einstein and his coterie's favorite tactics to manipulate credit for the ideas of others through fallacy of *Petitio Principii*. Knowing the published results others had derived, Einstein and his friends would assert the results, *later*, as "natural consequences" of "their" subsequent theory, which conclusions they had also irrationally presumed in their premises, as if this gave them priority for the thoughts others had published before them, because they would falsely claim that they had derived what others were forced to hypothesize.[2111] Einstein would turn the deductive synthetic scientific theories of his predecessors on their heads and argue the same theories inductively, as if that gave him the right to take credit for them. He would do this without making reference to the works of his predecessors and then would later lie and claim that he had had no knowledge of the prior works.

Einstein had a very different attitude when it came to his alleged priority. Contrary to the impression some would have us believe, that Einstein was oblivious to the issue of priority, Einstein had written to Stark on 17 February 1908,

> "I find it somewhat strange that you do not recognize my priority regarding the connection between inertial mass and energy."[2112]

Einstein and his followers often promoted the theory of relativity as if revolutionary, a supposedly unprecedented departure from all that came before it. The issue of priority was very important to Einstein and to his supporters. Had it not been, Einstein would have been more honest and forthcoming when he wrote his papers and when he described the history of the theory of relativity.

But others had not forgotten Poincaré. In 1912, shortly after Poincaré's untimely death, Vito Volterra wrote in a tribute to Poincaré,

> "But a celebrated experiment was performed by Michelson and Morley

which kept account of the terms depending on the square of the aberration, and even this experiment, as is well known, gave a negative result.

In a famous paper of 1904 Lorentz showed that this result could be explained by introducing the hypothesis that all bodies are subjected to a contraction in the direction of the motion of the earth.

This paper was the point of departure for the later investigations. The results of Poincaré, Einstein and Minkowski followed closely that of Lorentz. In 1905 Poincaré published a summary of his ideas in the 'Comptes Rendus' of the French Academy of Sciences. An extended memoir on the same subject appeared shortly afterwards in the 'Rendiconti' of Palermo.

The basic idea in this set of investigations is founded upon the principle that no experiment could show any absolute motion of the earth. That is what is called the *Postulate of Relativity*. Lorentz showed that certain transformations, called now by his name, do not change the equations that hold for an electromagnetic medium; two systems, one at rest, the other in motion, are thus the exact images each of the other, in such a way that we can give every system a motion of translation without affecting any of the apparent phenomena."[2113]

In 1913, Arthur Gordon Webster wrote in his memorial to Poincaré,

"The development of Maxwell's electromagnetic theory that has taken place in the last twenty-five years has led to a theory that has attracted the greatest interest among mathematical physicists and has, in fact, become in certain parts of the world no less than a mania. I refer to the so-called principle of relativity, a name which was given to it first, if I am not mistaken, by Poincaré. This principle is no less than a fundamental relation between time and space, intended to explain the impossibility of determining experimentally whether a system, say the earth, is in motion or not. In an elaborate paper published in 1905 in the *Palermo Rendiconti* entitled, 'Sur la dynamique de l'électron,' he defines the principle of relativity by means of what he calls the Lorentz transformation. If the coordinates and the time receive the following linear transformation

$$x' = kl(x + \varepsilon t), \quad t' = kl(t + \varepsilon x), \quad y' = ly,$$
$$z' = lz, \quad k = \frac{1}{\sqrt{1 - \varepsilon^2}}$$

the function $x^2 + y^2 + z^2 - t_1^2$ and the equations of electric propagation will remain invariant. From this follows the impossibility of determining absolute motion. Poincaré then submits the Lorentz transformation, which he shows belongs to a group, to an examination with regard to the principle of least action, which he shows holds for the principle of relativity. He further shows that by aid of certain hypotheses gravitation can be accounted for and shown

to be propagated with the velocity of light."[2114]

In 1913, Ernst Gehrcke wrote,

"The theory of relativity is nothing but a completely novel interpretation of the theory of the electrodynamics and optics of bodies in motion, which Lorentz had already developed. The theory of relativity is *not* distinguished by the creation of substantially new equations, but by a substantially new *interpretation* of the known transformation equations of Lorentz. The arguments made against this *interpretation* condemn it, not the equations themselves, which, as was stated, are not Einstein's, but rather Lorentz' equations, and still stand intact today."

"Die Relativitätstheorie ist nichts anderes, als eine völlig neuartige Interpretation einer schon von LORENTZ entwickelten Theorie der Elektrodynamik und Optik bewegter Körper. Das Charakteristikum der Relativitätstheorie besteht *nicht* in der Aufstellung wesentlich neuer Gleichungen, sondern in der Aufstellung einer wesentlich neuen *Interpretation* der bekannten Transformationsgleichungnen von LORENTZ. Gegen diese *Interpretation* richten sich die gemachten Einwände, nicht gegen die Gleichungen selbst, die, wie gesagt, keine EINSTEINschen, sondern LORENTZsche Gleichungen sind und die bis heute unangegriffen dastehen."[2115]

Alfred Arthur Robb spoke to the issue in 1914,

"Although generally associated with the names of Einstein and Minkowski, the really essential physical considerations underlying the theories are due to Larmor and Lorentz."[2116]

Einstein had already conceded this fact in early 1911,

"In fact, there are no fundamental differences between Minkowski's and Lorentz's theory."[2117]

Einstein saw the only difference between the two as being a "top down" versus "bottom up" approach to the *same* problem with the *same* results, as in inductive versus deductive reasoning of the same problem with the same solution.

Harry Bateman asserted his priority over Albert Einstein, in 1918,

"The appearance of Dr. Silberstein's recent article on 'General Relativity without the Equivalence Hypothesis'[2118] encourages me to restate my own views on the subject. I am perhaps entitled to do this as my work on the subject of General Relativity was published before that of Einstein and Kottler,[2119] and appears to have been overlooked by recent writers."[2120]

In 1920, Johannes Riem stated,

"Auf Wunsch der Schriftleitung soll hier der Versuch gemacht werden, zu zeigen, worum es sich eigentlich bei dem jetzt so viel genannten und mit so großer Reklame verbreiten Prinzip handelt, das an sich so merkwürdig und allen Erfahrungssätzen so sehr widersprechend ist, daß Einstein selber erzählt, er habe erst Monate lang darüber nachgedacht, ehe er dahinter gekommen sei, daß es kein Unsinn sei. Dabei ist zu betonen, daß es nicht etwa fertig aus Einsteins Kopfe entsprungen ist. Zunächst ist der berühmte Mathematiker Riemann zu nennen, dessen Habilitationsschrift von 1854 die Gedanken gibt, die weiter geführt, zu Einstein führen, indem Riemann zeigte, daß Physik und Geometrie zusammengehören. Erheblich später hat dann Lorentz 1895 und Minkowski 1907 die Lehre weiter ausgebaut, letzterer führte schon die Verbindung von Raum und Zeit als Weltpostulat ein und benutzte es dazu, die elektrodynamischen Grundgleichungen für bewegte Materie abzuleiten. Endlich hat dann Einstein alle diese Gedankengänge in mathematischer Weise vertieft und einen die ganze Mechanik, Physik und Astronomie umfassenden Bau daraus gemacht, freilich in einer Weise, die der elementaren Darstellung durchaus spottet. Gleichzeitig mit dieser Entwicklung ist dann eine zweite gegangen, die, von gleichen Gedanken ausgehend, zu anderen Folgerungen kommt und sich daher Einstein gegenüber kritisch verhält, seine Schlüsse zum Teil ablehnt. Das sind die Entwicklungen von Rudolf Mewes in Berlin, der schon 1889 in einem Aufsatz über das Wesen der Materie und des Naturerkennens die Relativität der Materie und der von einander untrennbaren Begriffe Raum und Zeit nachweist. Fußend auf dem Weberschen Grundgesetz und dem Dopplerschen Prinzip, hat er schon drei Jahre vor Lorentz eine Relativitätstheorie aufgestellt, welche außer der relativen Bewegung der Körper zueinander auch noch deren Drehbewegung berücksichtigt, ein Umstand, der bei Einstein nicht vorhanden ist.

Wir kommen so zu einem nach Einsteins Meinung ganz allgemeinen Grundgesetz der Natur, dessen Aufstellung ihn nach der Behauptung der Tagespresse mit Newton auf eine Stufe stelle oder noch darüber. Dem gegenüber ist nicht scharf genug zu betonen, daß erstens sein Prinzip nicht von ihm aufgefunden ist, sondern nur erweitert, und daß ferner der Streit für und wider noch weit davon entfernt ist, ein Ende zu haben. See hat in den „Astronomischen Nachrichten" soeben mehrere Aufsätze erscheinen lassen, die sich scharf gegen Einstein wenden, seine Leugnung des Äthers als unsinnig bezeichnen, dagegen betonen, wie die amerikanischen Physiker und Astronomen Einstein ablehnen, und Michelson selber sich dagegen verwahrt, seinen Versuch so zu deuten, wie es Einstein tut."[2121]

Charles Nordmann averred, in 1921,

"The only time of which we have any idea apart from all objects is the

> psychological time so luminously studied by M. Bergson: a time which has nothing except the name in common with the time of physicists, of science.
>
> It is really to Henri Poincaré, the great Frenchman whose death has left a void that will never be filled, that we must accord the merit of having first proved, with the greatest lucidity and the most prudent audacity, that time and space, as we know them, can only be relative. A few quotations from his works will not be out of place. They will show that the credit for most of the things which are currently attributed to Einstein is, in reality, due to Poincaré. [***] I venture to sum up all this in a sentence which will at first sight seem a paradox: in the opinion of the Relativists it is the measuring rods which create space, the clocks which create time. All this was maintained by Poincaré and others long before the time of Einstein, and one does injustice to truth in ascribing the discovery to him."[2122]

On 28 March 1921, *The New York Times* reported that Edmund Noble claimed to have anticipated the deductions Einstein made from the theory of relativity. Noble published a relativistic article in the journal *The Monist* in 1905,[2123] which set forth a research program for a unified field theory, a relational theory of a finite (of necessity) universe in which space and time exist only as the universe itself, etc. Though Noble does not note the fact, it is interesting that the article which follows his in *The Monist* was written by David Hilbert,[2124] from whom Einstein plagiarized the generally covariant field equations of gravitation of the general theory of relativity, and from whom Einstein plagiarized the unified field theory concept.

This volume of *The Monist* of 1905 also contains an English translation of Poincaré's famous St. Louis lecture of 1904,[2125] which iterated so many of the essential elements of the special theory of relativity, before Einstein, and which lecture Einstein must have read when reading Poincaré's book *The Value of Science*. Poincaré and Hilbert were frequent contributors to *The Monist*, an Open Court publication—a publishing house under the direction of Paul Carus, which helped bring Ernst Mach's works to the English speaking audience. Monistic[2126] and Anti-Kantian philosophy defined the research program of the general theory of relativity in the Nineteenth Century. Einstein considered himself an "Anti-Kantian", and certainly pursued the reasoning of Bolliger, who iterated "Mach's principle" in terms of a Boscovichian dynamistic unified field theory.[2127]

On 3 April 1921, *The New York Times* quoted Chaim Weizmann,

> "When [Einstein] was called 'a poet in science' the definition was a good one. He seems more an intuitive physicist, however. He is not an experimental physicist, and although he is able to detect fallacies in the conceptions of physical science, he must turn his general outlines of theory over to some one else to work out."[2128]

Einstein told Leopold Infeld, "I am really more of a philosopher than a physicist."[2129]

On 27 April 1921, Gertrude Besse King wrote in *The Freeman* of New York,

"ALADDIN EINSTEIN. THE popular interest in America in Professor Einstein's theories has astonished the professor. The public who does not know whether the theory of relativity has accounted for the alteration of mercury or of Mercury, waylays his steps, and delights, with the exception of a mere alderman or two, to do him honour. Gifted newspaper-reporters herald him as the originator of the theory of relativity, which, by the way he is not, and question him as to the ultimate nature of space, though only a mathematical physicist who is also a philosopher could understand the professor's answers.

This general interest in an extremely difficult science is not quite what it seems. Probably Professor Einstein does not realize how sensationally and cunningly he has been advertised. From the point of view of awakening popular curiosity, his press-notices could hardly have been improved. The newspapers first announced his discovery as revolutionizing science. This sounds well, but its meaning, after all, is rather vague. Then they printed a series of entertaining oddities, supposedly deducible from his hypothesis, although most of them could have been equally well deduced from the conclusions of Lorentz or Poincaré: for example, moving objects are shortened in the direction of their motion. This is a gay novelty until one learns the proportion of the reduction, which is calculated to divest the statement of interest to any but scientists. Further, our newspapers told us that if we were to travel from the earth with the speed of light, and could see the clock we left behind, it would always remain at the same moment, permanently pausing, unable to reach the next tick. But we should be unable to travel at the rate of light for a number of reasons, the most interesting and perhaps the most decisive being that such a speed would cause our mass to be infinite! Finally, our informants assert that no point in space, no moment of time can serve as a permanent base for measurement; we can measure only the relations of space, the relations of time, never absolute space or time; and even to measure space-relations, we have to take into account time! What a fascinating dervish-dance of what we used to regard as immutable fixities! Is it possible that these delicious contradictions are serious and accredited doctrines among those who know? Yet so they appear, for though Professor Einstein is always careful in stating that his hypothesis enjoys as yet only a tentative security, his methods are vouched for by the experts, his procedure is according to Hoyle, and the crowd is at liberty to gorge its appetite for marvels untroubled by the ogres of scientific orthodoxy.

Aside from the fact that Professor Einstein comes as a distinguished and somewhat mysterious foreigner to partake of our insatiable hospitality, his popular welcome is to be accounted for by the spell of wizardry that the press has cast upon his interpretations. For it is the necromancy of these strange theories, not their science, that catches the gaping crowd. Reporters are often good, practical psychologists. Instinctively they have divined the public eagerness for miracles, without grasping the factors that feed this taste. They know that most of us are essentially children still clamouring for fairy tales.

> Man is congenitally restless with the prison-house of this too, too solid world. He is always looking for short-cuts to power. Since he can not find them to his mental satisfaction as once he could through the miracles and divine dispensations of the Church, or through the magic and occultism that were his legitimate resources in the Middle Ages, he now turns to the wonders of science and philosophy. Here, even in theories that he does not understand, he can find release for his cramped position, here he can taste the intoxicating freedom of a boundless universe, and renew his sense of personal potency. [. . .]"[2130]

Arvid Reuterdahl wrote in *The Bi-Monthly Journal of the College of St. Thomas*, Volume 9, Number 3, (July, 1921):

"Einstein and the New Science.

BY

ARVID REUTERDAHL

HISTORICAL NOTE ON THE NEW SCIENCE.

A New Science has been born, a science in which metaphysics and philosophy find a prominent place. This statement conjures before your vision the internationally celebrated figure of Professor Dr. Albert Einstein, who was born in 1879 in the town of Ulm, Wurtemberg, Germany. Although Dr. Einstein, through his colossal and unprecedented advertising campaign, has done more than any other man to bring this New Science before the world, nevertheless, the year of birth of this new departure in scientific thought cannot be considered as coincident with the appearance, in 1905, of Dr. Einstein's first contribution to the subject of Relativity.

On the contrary, we must look back to the year 1887 as the proper birth year of the New Science, which bids fair to inaugurate a new era in intellectual thought. In that year the famous Michelson-Morley experiment was performed at Cleveland, Ohio. At the time Dr. Albert A. Michelson was Professor of Physics at the Case School of Applied Science. Dr. Edward W. Morley was Professor of Chemistry at the same institution. The writer, because of the far reaching significance of this experiment, considers the year 1887 as marking the birth of the New Science.

THE PIONEERS OF THE NEW SCIENCE.

The New Science was, in part, foreshadowed by the work of Baron Karl von Reichenbach in the years 1844 and 1856. Reichenbach, in his various works, laid the foundation to the theory of radiation. He also held that physiological organisms exhibited characteristics of a decidedly electrical nature.

In the years 1870 and 1871, Aurel Anderssohn of Breslau, Germany, announced the theory that there is no force of attraction extant in the

universe. He maintained that gravitation, that is, universal attraction of material systems, is not due to a force but is a mutual effect produced by radiation from bodies.

Dr. Johannes Zacharias expanded the limited principle of Anderssohn into practically universal proportions. The results of the earliest work of Zacharias were presented in a lecture before the Physical Society of Breslau in the year 1882. In the hands of a capable and a prodigious worker as Zacharias the elementary suggestion of Anderssohn grew into The Mass-Pressure Theory of Electricity and Magnetism. The essential principle of this theory was publicly demonstrated in Berlin (November, 1908) by means of a colossal rotating electromagnet. The careful and exhaustive experimental work of Zacharias confirmed the vision of Anderssohn that the force of gravitation is merely fictitious.

'Kinertia,' during the period of time from 1877 to 1881, convinced himself that the so-called attractive force of gravitation was an illogical inference not warranted by facts. (For more complete details refer to the author's article, 'Kinertia Versus Einstein' which appeared in The Dearborn Independent, April 30, 1921.) On the 27th day of June 1903, 'Kinertia' filed with the 'Kgl. Preussische Akademie Der Wissenschaften' a description of a mechanical device and an account of an experiment by which 'gravity' could be produced experimentally. (The writer is in possession of the original acknowledgment of the receipt of this deposition.) The 'gravity machine' of 'Kinertia', when water only is used, generates a spiral vortex in space similar to the vortex of a spiral nebulae. When lead balls are projected from the machine by means of either water or compressed air, then the balls describe elliptical orbits, like the planets, while advancing along the neutral axis of rotation. The resultant path, in the latter case, is therefore an elliptical spiral. Many years later (1911-1915 inclusive) Dr. Einstein presented this same theory to a then receptive scientific world with the result that he was subsequently proclaimed a 'greater than Newton.'

'Kinertia' concludes that the effects formerly attributed to the action of a 'force' called gravitation are due to acceleration. He includes a dynamic principle in his concept.

It is an incontrovertible fact, therefore, that 'Kinertia' announced the now famous, 'Principle Of Equivalence,' many years before the alleged discoverer Einstein won the excessive plaudits of the over-enthusiastic scientific world. The work of 'Kinertia,' however, is free from the erroneous sophistical solipsism of Einstein.

Dr. J. Henry Ziegler, of Zurich, Switzerland, in the year 1902, laid the foundation of a cosmic theory in a lecture entitled, 'Die Universelle Weltformel und ihre Bedeutung fur die wahre Erkenntnis aller Dinge.' This theory is of basic and far reaching significance to the New Science. Ziegler's cosmology is based upon the fundamental conception that the world is a unitary structure generated from the universal trinity of space, time and force. Ziegler does not commit the solipsistic error of Einstein by omitting the

inclusion of a genuine Absolute Principle in his system. Any cosmological theory which endeavors to construct the universe upon purely relative fundamentals leads to the ultimate verdict 'ignorabimus'. Absolute truth becomes impossible and knowledge is merely a matter of individual opinion. Einstein's system is of this latter type and the name ''solipsism' is therefore a proper and fitting designation for the Einsteinian Theory of Relativity. The significant and universal relationship of light to the physical and chemical manifestations of matter led Ziegler to regard light as an absolute essential in physical phenomena. In Ziegler's theory we find, therefore, the root of the only absolute in Einstein's entire system. The fact that Dr. Einstein lived in Bern, Switzerland, at the time when Ziegler's theory of light was a topic of general discussion, leads one to justly question the extraordinary claims to originality of the founder of the Theory of Relativity.

In the same year (1902) that Dr. Ziegler first announced his theory to the world, the writer presented a brief outline of his Space-Time Potential and Theory of Interdependence. At the Inaugural Meeting of the American Electrochemical Society, held at Philadelphia, April 5, 1902, the writer presented his conclusions in a lecture entitled 'The Atom of Electrochemistry.'

In this lecture the writer showed that the physical universe is ultimately reducible to centers of activity (action point-instants) which undergo compensating changes and displacements in conformity with the requirements of the whole cosmos regarded as a unitary, interacting, and interdependent system of multiplicity. This unitary multiplicity system is its own continuum. Action-at-a-distance between its ultimates is not only postulated as inevitably necessary between the primordial centers regarded as discrete (which is an incontrovertible fact of experience), but is also inherent in the fundamental concept of a unitary continuum whose principal constituents are space, time and interdependent interaction.

The writer, consequently, found it possible at that time (1902), to dispense with the old inconsistent ether hypothesis. Moreover, he took occasion, in this lecture, to protest against the attempts of the pangeometers to mathematically manufacture reality by conceptual extensions of actuality. The mythical edifice erected by Minkowski and Einstein, based upon the merely speculative mathematical contributions of the non-Euclideans, has not caused him to feel any necessity whatsoever to modify his views of 1902. This lecture has been fully developed in a work published by the Devin-Adair Company of New York City, bearing the title, 'Scientific Theism Versus Materialism, The Space-Time Potential.'

The great contribution of Ziegler has afforded the writer profound pleasure. Ziegler, working independently in Switzerland, evolved the theory of the unitary triune, Space, Time, and Force. The present author developed his Space-Time Potential in the United States without being aware of the conclusions of Ziegler. The word 'Potential' was used merely to emphasize the fact that the Space-Time Chart is potentially receptive to the play of

energy or substance. Ziegler and the present writer are at one in their emphasis upon the dynamic element in the universe which has been so blatantly omitted in the system of Einstein.

It is with utmost pleasure that I here call particular attention to the fact that Ziegler was the first to advance a complete theory of light from the standpoint of the New Science. Einstein has nowhere in his works referred to the work of Ziegler, despite the fact that the much heralded Doctor, undoubtedly, owes a great debt to the illustrious Swiss savant.

Dr. H. Fricke completed his investigations concerning the nature of gravitation and space in the year 1914. The war delayed the publication of this work which finally appeared in 1919 under the title 'Eine neue und einfache Deutung der Schwerkraft'. For Fricke the old ether disappears, but he replaces it with a field of force. The static or stationary ether of Lorentz gives way before the energetic and mobile medium of Fricke which, however, like space, with which it is identified, retains abiding properties. Gravitation (Schwerkraft) is regarded, in the theory of Fricke, as a continuous stream of energy which acts as a *concurrent* system in the equilibration of the *excitant* systems in the universe. Cosmic bodies exhibit outgoing radiational and ingoing gravitational fields of force and all fields of activity are, in their last analysis, moving fields of force. Dr. Einstein, who, it seems, is not in the habit of extending recognition to the deserving, has nevertheless, reluctantly admitted that this theory of Fricke is both highly significant and original. Fricke has announced a New Cosmic Law of far reaching consequences. This epoch-making law may be briefly stated as follows: In vacuous space, if we disregard all other disturbing influences, a definite temperature pertains to every gravitational field. It follows that the temperature of cosmic space does not correspond to the absolute zero, but it is proportional to the gravitational field present in each particular location. Fricke, moreover, concludes that the work done by gravitation is not only changed into heat, but, in part, appears as a directed motion of cosmic bodies.

The homogeneity of inertial resistance and gravitation is a basic principle with Fricke. In cases of inertia the medium of Fricke has a decelerating action toward ponderable masses in conformity with the same laws which govern the accelerative force in the case of gravitation. This conception plays an important role in the theory of Einstein which, however, lacks even the semblance of an explanation. The Pressure Theory of Fricke not only affords an explanation of this cosmic phenomenon but also obviates the difficulties, ably pointed out by Maxwell, in a mechanical theory of gravitation.

In the United States we find Dr. Robert T. Browne in the front rank of the new scientific movement. In his great work 'The Mystery of Space', Dr. Browne emphasizes the actuality of a genuine dynamic element in space. He fully appreciates the weakness and danger of the Relativistic position. For him the universe is inexplicable without an Absolute Principle.

Dr. Charles F. Brush, the world famous electrical engineer and scientist of Cleveland, Ohio; with a series of carefully conducted experiments has

challenged the investigation of the Hungarian Baron, Eötvos, performed with a torsion-balance in the year 1890. The issue involved in both investigations is the equivalence or non-equivalence of the inertial and the gravitational mass of a body. Eötvos concludes that the two are equivalent. The General Theory of Relativity of Einstein relies upon the correctness of the conclusions of Eötvos. (See, Relativity, by A. Einstein, pages 80 to 83 inclusive.) The conclusions of Eötvos may be stated in another manner: The magnitude of the effect of gravitation does not depend upon the kind of the material. According to Eötvos, one unit of mass of bismuth should be affected in precisely the same manner as one mass unit of zinc by the gravitational influence. Dr. Brush, on the contrary, asserts that his experiments indicate that the gravitational field exerts a greater influence upon the same mass of bismuth than it does upon precisely the same mass of zinc. The inference from Dr. Brush's experiments is that gravitation takes cognizance, as it were of those subtle differences in matter which we ordinarily group under the term 'qualities'.

The significance of the issue here involved is almost staggering when one reflects upon its far reaching import to the New Science. The old school of science built its stupendous edifice upon the assumption of 'sameness' in its ultimates. Diversity is the result of differences in the number of identical ultimates. For many years the writer has been of the opinion that the physical universe cannot be constructed from mere number. On the contrary, it is my firm conviction, grounded in reason and experience, that observable diversity owes its being to genuine and individually different characteristics in the ultimate particles out of which material aggregates are formed (See author's 'Scientific Theism Versus Materialism, The Space-Time Potential,' paragraph 82, page 44).

Einstein's elaborate speculative edifice falls to the ground, if the momentous experimental results of Dr. Brush are completely substantiated. Practically all the foundation stones of Einstein's structure are composed of unproven, volatile material.

J. G. A. Goedhart, Officer of the Royal Netherlands Navy, Retired, in his work 'L'Orbite En Spirale Dans La Mecanique Celeste' (The Spiral Orbit In Celestial Mechanics, Amsterdam, Netherlands, 1921) presents Six Principal Laws pertaining to the movements of celestial bodies. At this time Goedhart's Second Law is of particular interest because of its relation to the work of 'Kinertia' and the alleged originality of Einstein's conclusions. Goedhart's Second Law is: 'Secondary celestial bodies revolve around the centers of gravitation of planetary systems in eccentric logarithmic spiral orbits, the asymptotes of which are ellipses'.

The work of Goedhart is of unique significance to the scientific world at the present time because it proves conclusively that the spiral orbit, in the case of a planet, can be derived without recourse to the Minkowski-Einstein, four-dimensional, Space-Time speculative product.

Dr. Sten Lothigius of Stockholm, Sweden, in a brochure entitled

'Esquisse D'Une Theorie Nouvelle De La Lumiere' (Sketch Of a New Theory Of Light; Stockholm, 1920) presents a 'Thread-Theory' of light. In his theory of light Lothigius gives a more tangible significance to the usual term 'ray of light'. For him a light-ray is a continuous and coherent structure. Along the axis of transmission undulatory crests may therefore appear without the auxiliary assistance of an ether. Referring to the hypothetical ether, Lothigius states: 'Here lies someone who lived long although he never existed'. It would be difficult to condense a criticism of so vast a subject into fewer words.

Professor P. Lenard, the illustrious physicist, whose brilliant investigations concerning the behavior and properties of certain types of radiations or rays, formed, in part, the basis of the award of a Nobel Prize, has rendered the New Science a service of immeasurable value in stabilizing its formative tendencies during the disruptive attack of Einsteinism.

Lenard's fearless attack on the theory of the 'Zauberkünstler' (Z. K.) (Einstein) has had an exceptionally wholesome influence in preserving the dignity and sanity of the scientific world.

In this connection the forceful exposures of 'Z. K.' by Paul Weyland, E. Gehrcke, H. Fricke, E. Guillaume, and A. Patscke, deserve particular mention.

Dr. Lenard's work, 'Uber Relativitätsprinzip, Äther, Gravitation,' is of such profound import that it cannot be lightly set aside by the mere flippant gesture of Einstein.

Professor Lenard is now preparing a work, exposing the errors of Einsteinism.

Dr. Rudolf Mewes, the distinguished physicist and engineer, with his contribution, 'Raumzeitlehre oder Relativitätstheorie in Geistes—und Naturwissenschaft und Werkkunst', has rendered a lasting service to the New Science. His first work on Space, Time, and Relativity appeared in 1884, thus antedating Einstein by twenty one years.

Camille Flammarion, the eminent French astronomer, writing in the 'Revue Mondiale', calls attention to the fact that Denis Diderot was undoubtedly the first to present an outline of a theory of relativity. Flammarion repudiates the Space-Time Combination of Minkowski and Einstein.

Professor Henri Poincaré, the famous French physicist and mathematician, advisedly ignores the name of Einstein in his lectures on 'Relativity'.

In this short resume it has been impossible to do justice to the momentous issues brought before the intellectual world by the Pioneers of the New Science. Many names have, undoubtedly, been omitted, not intentionally, however, but because of lack of first hand information.

CONTRIBUTORS TO THE THEORY OF RELATIVITY

(In Einstein's works passing references are found to the influential contributions of Cristoffel, Riemann, Ricci, Levi-Civita, Gauss, and

Hamilton in mathematics; and to Galilei, Newton, Minkowski, and Lorentz in physics.)

In the year 1869, E. B. Christoffel laid the basis for a new type of calculus which was later used by Einstein in his speculative development of the Theory of Relativity. (See Crelle's Journal fur die Math., Vol. LXX, 1869). Riemann developed the work of Christoffel. In the hands of Ricci and Levi-Civita these contributions took the form of the Absolute Differential Calculus, used by Einstein in his mathematical treatment of Relativity.

Certain functions developed by Sir William R. Hamilton, and known as the Hamiltonian Functions, were also used by Einstein. It would, indeed, have been difficult for Einstein to avoid the references to these men which are found in 'Die Grundlage der allgemeinen Relativitätstheorie', Annalen der Physik, Band 49, No. 7, 1916, (see pages 782, 799, and 804) It so happens that their names have been permanently associated with particular mathematical devices.

Professor Einstein mentions the work of Newton and Galilei, merely in passing, and by way of contrast with his own system which, by means of this delicate stratagem, is thereby made to assume far greater significance than the work of Galilei and Newton, because of its alleged inclusive universality. Einstein seems to be reasonably certain that no serious competition can arise from the graves of the great.

The great German mathematician Karl Friedrich Gauss, receives post-mortem glorification by having his name associated with the four-dimensional system of coordinates which has proved a useful instrument for Einstein.

Without the 'Space Time' contribution of Hermann Minkowski, the electrodynamics of Maxwell-Lorentz, and the H. A. Lorentz Transformation, the Einsteinian tower would reduce to a mere excavation. Consequently, conservative references are made, always in passing, however, to the work of these men.

ADDITIONAL BASIC CONTRIBUTIONS TO THE THEORY OF RELATIVITY.

(Einstein either advisedly ignores or is unaware of the contributions of Anderssohn, Zacharias, 'Kinertia', Larmor, Gerber, Palagyi, Ziegler, Reuterdahl, Mewes, Fricke, and Varicak).

Anderssohn paved the way to a new conception of gravitation (1870-1871).

Zacharias extended the principle of Anderssohn to include electrical and magnetic phenomena (1882).

'Kinertia' developed the Principle Of Equivalence (1877-1881) many years before its announcement by Einstein (1911-1915).

Larmor's work, 'Aether And Matter', was published in the year 1900. Einstein's dissociation of the name of Larmor from Lorentz is incomprehensible.

Paul Gerber, in the year 1898, developed a formula descriptive of the

perturbed motion of the Planet Mercury. (See, Zeitschrift fur Mathematik und Physik, 1898). Professor Dr. E. Gehrcke fully realizing the great importance of this work of Gerber, arranged for its reprinting in Annalen der Physik (1917, Vol. 52, page 415). Einstein made his calculations for the motion of the perihelion of Mercury in the year 1915.

Melchior Palagyi published, in the year 1901, a contribution entitled 'Neue Theorie des Raumes und der Zeit' (Engelmanns Verlag in Leipzig) which contained the essentials of the Minkowski-Einstein Space-Time conception. Minkowski's first paper appeared in 'Der Göttinger Mathematischen Gesellschaft,' Nov. 5, 1907. In the following year his Cölner lecture, entitled 'Raum und Zeit', was delivered. This was reprinted in Annalen Der Physik, Vol. 47, No. 15, page 927; June 15, 1915.

Zeigler, in the year 1902 announced his new cosmic theory involving the unitary triune, Space, Time, and Force, together with Light as the universal, physical absolute.

Einstein's first paper bears the date September 1905. It was written in Bern, Switzerland where Ziegler's theory was much discussed.

The present writer's first paper was published in the year 1902. This paper briefly outlined the basic elements of his complete work 'Scientific Theism Versus Materialism, The Space-Time Potential', which appeared in 1920.

The present author's direct and simple method of calculating the deflection of light, due to the Sun, is a closer approximation to the observed 'bending' than the result obtained by the more indirect and involved method of Einstein. (See work cited, pages 271 and 272).

Rudolf Mewes' contributions, when they appear in a collected form, will exert exceptional influence upon the position of Lorentz. In fact, the older works of both Mewes and Gerber will then attain unique significance.

H. Fricke, in his work (1914-1919), presented a physical basis for the Principle Of Equivalence which was arbitrarily announced by Einstein from purely speculative reasons. Fricke's researches on the relation of heat to gravitation are certain to open fruitful fields of investigation for the New Science.

Varicak, the mathematician, was the first (1915) to point out that the Principle of Relativity leads directly to the formulae of non-Euclidean geometry. (See, Sitzungsberichte der Berliner Akademie 1915, page 847). Einstein's fabric is woven from the fibers supplied by the metageometers.

A retrospective view of the above facts can result in but one question: What original contribution has Einstein made which warrants the, now common, verdict that he is 'a greater than Newton'?

The Scientific American (May 14, 1921), in an unwarranted, sarcastic editorial attack on the present writer, answers this question as follows: 'He (Einstein) has formulated mathematically and as a concrete whole ideas which have had a rather nebulous existence before him, cementing the structure with ideas to which he has himself given birth. His crowning

achievement is the precise mathematical formulation; this has never been approached or approximated in any way.' This is surely an extraordinary claim, especially in view of the fact, that the editorial itself was called forth because the writer demanded, in the name of justice, that credit be given to the originators of those 'nebulous' ideas, without which the Theory of Relativity would have been an impossibility.

The case is analogous to that of the builder who appropriated sufficient bricks to build a house, and when payment was demanded, replied: 'I have furnished the cement, which binds the bricks into a structure, therefore I owe you nothing for the bricks.'

THE 'MAIN MEMBERS' OF EINSTEIN'S STRUCTURE.

The relations of the 'main members' in Einstein's structure may, most readily, be illustrated by a reinforced concrete arch bridge composed of two ribs or segments, hinged at the crown (center of span) and at the abutments. A reinforced concrete floor, laid in the bed of the stream, connects the two thrust-resisting abutments. The left abutment in Einstein's arch is the Lorentz Transformation. Non-Euclidean Space-Time (Minkowski) constitutes the right abutment, and the Michelson-Morley Experiment is the connecting floor between the abutments.

The left arch rib is The Absolute Velocity of Light, while the Principle Of Equivalence constitutes the right arch rib. The three alleged experimental verifications of Einstein's theory form the three hinges. From left to right we may think of these hinges as being, 1st, The Perturbations of the Planet Mercury; 2nd, Displacement of the Spectral Lines towards the Red; and 3rd, The Deflection of Light in a Gravitational Field.

TESTS OF THE MEMBERS.

The limited scope of this article prevents a full discussion of the structural value of the members. 'The Fallacies Of Einstein,' now in preparation by the writer, will consider these and other matters in detail.

RIGHT ABUTMENT.-NON-EUCLIDEAN SPACE-TIME.

It can be shown that the Minkowski-Einstein Space-Time is a mathematically camouflaged type of four-dimensional space. In the invariant form of the General Quadratic Differential, which is basic to Relativity, the last term is formed by multiplying the velocity of light by time. Velocity is reducible to length divided by time. Therefore time is eliminated from this term, leaving it as a pure spatial expression. Consequently we have here

nothing but a new version of four-dimensional space which is not a physical reality. The writer challenges the relativists and the metageometers to construct a model of the four co-ordinate axes required by this conceptual space. This demand can be satisfied in the case of three dimensional space, which is our only real space.

Conclusion.

The right abutment of Einstein's arch bridge is merely mythical and not a physical reality. From the standpoint of engineering this verdict is sufficient to condemn the entire structure. Certainly pure science ought not to be less exacting in its demands than the applied science of engineering.

THE FLOOR. - MICHELSON - MORLEY - MILLER EXPERIMENT.

This experiment involves the ether, and the possibility of relative motion between the earth and the ether. The constancy of the velocity of light was assumed in the experiment.

Known Facts.

The motion and velocity of the earth.

The constant velocity of light.

Unknown Facts.

(The experiment assumed the existence of the ether. This assumption takes too much for granted.)

Does the medium called 'The Ether' exist?

Assuming the existence of the ether, then in regard to its possible motion, only two assumptions can be made: viz.,

1st. The ether is stationary,

2nd. The ether is in motion.

Michelson and Morley, using an interferometer, failed to detect any relative motion between the earth and the ether. Miller and Morley, with a much larger interferometer, were unable to detect any relative motion.

Sir Oliver Lodge, assuming that the ether was carried along with moving bodies, experimented with rapidly rotating discs only to obtain negative results. Both of the above possibilities proved futile in the attempt to determine the earth's motion in respect to the ether.

At the time when these experiments were performed science was not prepared to abandon the ether because of its *conceptual* usefulness in explaining the phenomena of light and electro-magnetics.

In the New Science the old inconsistent ether is being replaced by interactional vehicles and interdependent activities.

Classical mechanics and the theory of relativity as held by Newton took cognizance of relative velocities computed by reference to arbitrary systems of co-ordinates. If the Michelson-Morley experiment had yielded a positive result, indicating that the earth's velocity could be calculated in reference to a stationary ether, then the measurement of so-called 'absolute motion' would have been possible. The ether would then have constituted a universal and fixed reference system.

Because of the negative results of these experiments, Einstein expanded

the older notions of relativity to include these later results. He concludes therefore, that an *absolute* determination of *uniform* motion is impossible, and he holds that the ether cannot be used as a reference system by which relative uniform motion may be detected.

It should be recalled that Archimedes failed to find a fixed point in the universe. Michelson, Morley, Miller, and Lodge also failed in the more modern case of the ether. Then the voice of the Prophet of Relativity was heard crying from the house-tops, 'There is no Absolute! Everything is conditioned and relative! Truth itself is variable!' We listen but we are not convinced. We conclude that the relativists have sought the philosopher's stone in vain, for they have searched for a static point in the dynamic world. They have tried to achieve the impossible. We become content then and decide to continue making observational references from 'fixed' points that move.

The negative result of the Michelson-Morley experiment may, with confidence, be regarded as a conclusive proof that there is no ether. If this position is entertained, then interactional vehicles, acting in conjunction with Space-Time (properly interpreted), must be introduced in order to function in the cases of light and electro-magnetic phenomena. Einstein, however, has not allowed this phase of the problem to disturb his equanimity. On the contrary, he has seized upon the Larmor-Lorentz Transformation as the only way out of the difficulty.

Conclusion.

At the present time the results of the Michelson-Morley-Miller experiments must be accepted as experimental facts. The abuse of these results by Larmor, Lorentz, and Einstein, in no way influences the previous statement. Notwithstanding its Eisteinian misapplication and abuse, the floor must certainly be pronounced as structurally safe.

The experiment actually proves that the time required for light to travel from an initial to a final observation point, in a closed vectorial configuration is independent of the path.

The result of the Michelson-Morley trial, therefore, substantiates the writer's theory of light. (See discussion in this article under caption, 'A New Theory Of Light.')

LEFT ABUTMENT. THE FITZGERALD-LARMOR-LORENTZ TRANSFORMATION.

Assuming that the ether exists, Fitzgerald conceived the idea that if the material composing a body contracted along lines and planes parallel to the direction of motion through the ether, then the negative results of the Michelson-Miller experiment could be explained. According to the modern view matter is composed of electrons which are identical in size and deterministic characteristics. This is merely an arbitrary assumption which is not warranted by the great diversity manifest in the physical universe. However, the assumption, it appeared, would obviate such difficulties as would arise from the differences in the structural material of the

interferometer. Moreover, it would serve to generalize this entire class of phenomena—a generalization purchased with a sacrifice of truth.

Larmor and Lorentz, adopting the suggestion of Fitzgerald, conceived its mathematical form. The amount of the contraction in the direction of motion must be something definite. Moreover, it must agree with that space and time coefficient for moving bodies which now constitutes an important element in the left and right abutments of Einstein's structure. The 'plot' was a master stroke of ingenious imagination. Since we have bound ourselves to refrain from mathematical developments in this article we are forced merely to label this Space-Time Motion expression for purposes of discussion. We shall designate it as the 'Space-Time Coefficient.' The writer, in his work, has referred to this expression as the Fundamental Scalar of Einstein's Relativity. It is used in both Scalar and Vector Analysis.

With this expression known, (derived by *Euclidean* geometry from Space and Time considerations and not from experimental evidence) Larmor and Lorentz could readily *speculatively determine* the amount of the contraction in the direction of motion. If then the diameter of an electron at 'rest' is known, its contracted diameter could be calculated by multiplying the 'rest-diameter' by the Space-Time Coefficient. This is a pathetic illustration of the fact that the Relativists, whilst disclaiming any knowledge of 'fixed' points, persistently employ moving points (electron in this case) as 'fixed'. They are continually cutting the eternally moving infinite chain of relativities in order to 'fix' a point. As a speculation their theory is interesting. Practically it cannot be consistently applied.

Knowing the mass of the electron at 'rest' its so-called 'transverse mass can be *speculatively determined* by introducing this known mass into the Space-Time Coefficient. The 'transverse mass' is therefore based upon that diameter of the electron which is *parallel* or *coincident* with its direction of motion.

If we align one arm of the Michelson interferometer in the direction of the earth's motion, then the time required by light (according to Lorentz, a type of motion in the stationary ether) to travel from a point to a mirror and back again *ought to be* greater than if light travels an *equivalent* distance (twice the sum of the distance from the point to the mirror) in a *continuous and unreversed* path. This statement assumes the constancy of the velocity of light. The Michelson-Morley-Miller experiment showed *no difference* in time. In fact the other arm of the interferometer, constructed at right angles to the first, gave the same time interval. The two arms were identical in all essential details. Moreover, *no difference* in the time period could be detected by swinging the interferometer on its axis into any position whatsoever.

If that interferometer arm which was parallel to the direction of the earth's motion would only be sufficiently accommodating to always contract in length that precise amount which would compensate the theoretical excess in the time period, then all would be well, because light would then travel over a shorter path and the time-excess would disappear. The science of

mathematics is a boon to the modern school of scientific speculators. By its manipulations we can produce the most gratifying compensations and accommodations. It does not seem to be particularly important if the alleged compensations are actual physical facts. The principal issue is, the derivation of a satisfactory *mathematical* result.

In any event, if physical experiment should fail to cope with the situation, it must be determined mathematically and then imposed upon our long-suffering physical universe. Fortunately for Relativity, Larmor and Lorentz, in their Space-Time Coefficient, had the *mathematically*, *built-to-order*, instrument of precision which unerringly could *speculatively* annihilate the alleged difficulty.

Hence, if the length of that arm of the interferometer which moved in the earth's direction of motion, was multiplied by the Space-Time Coefficient (a reduction expression) then this length would be sufficiently decreased to compensate for the supposed time-excess.

This contraction theory of Larmor and Lorentz, in the hands of Einstein, became a means of producing a confusing pyrotechnic display designed to intellectually impress the masses. Serious calculations were made concerning the diminution of a human being due to motion. The poor victim, we are told, is totally unaware of the change in his dimensions because his associates are all *suffering* diminution in the same relative proportion. Everything in motion contracts in the same relative ratio. One cannot even physically *determine* the actual amount of the alleged contraction. It always eludes you. This fact is an extraordinarily ingenious protective element inserted, inadvertently perhaps, into the Theory of Relativity. Nothing can be verified experimentally. Reality has been dethroned and mathematics has become the final creator, director, judge, jury, and arbiter of the type and destiny of a physical universe which, no longer, is permitted a voice in these matters.

By way of summarizing the results of this discussion of the contraction theory, the writer desires merely to restate that which is now self-evident.

The Larmor-Lorentz contraction theory is purely a mathematical device designed to meet an emergency. It has not been shown by physical experiment that an electron contracts in the manner claimed by the theory. The relativists themselves take great delight, it seems, in pointing out that, from the standpoint of their own theory the affair is beyond proof or disproof. One must conform, without murmur, to the precepts laid down in the Relativistic Koran. If this work, however, is regarded as the product of a fallible mind, then we may venture into that real world which lies beyond the confines of Relativity and there discover facts which serve, like dynamite, to cause the collapse of this speculative structure.

The experiments of Kaufmann and others have shown that the mass of an electron increases as its velocity increases. (Below a certain limiting velocity the mass remains practically constant.) As this velocity approaches the velocity of light, the mass increases towards an infinite amount. Lorentz and Einstein employed the same expression to mathematically describe this

experimentally observed increase that was used in the calculation of the contraction of the electronic diameter in the direction of its motion. The writer desires to call particular attention to the dangerous dilemma which arises from this maneuver.

Left Horn.

If the mass of the electron at rest is divided by the Space-Time Coefficient, in which the velocity of the electron equals that of light, then the expression indicates a resulting infinite mass for the moving electron.

It should be noted that the Kaufmann Effect is an observed fact and that the mathematical expression is merely an attempt to describe an actuality. Therefore, a true scientist, in contradistinction to a mathematical speculator, will abide by the result of an experiment whenever mathematical speculation and actual observation disagree.

Right Horn.

If the diameter of the electron at rest is multiplied by the Space-Time Coefficient, in which the velocity of the electron equals that of light, the expression indicates a zero value for the diameter. In other words, the electron will have no diameter at all. In the absence of any statement to the contrary on the part of the Relativists we are at liberty to asume that a similar fate befalls all lines of the electron which are parallel to the direction of motion. It follows that, if the Larmor-Lorentz contraction hypothesis is true, the mass of the electron reduces, in this case, to zero.

The two horns of this dilemma have been presented with complete recognition of a somewhat similar expression for the so-called 'longitudinal mass.'

Between these two horns, the proper choice is apparent at once, if facts and not speculation shall be our guide. Therefore, we discard the right horn as untenable because it is incompatible with the left horn which is based upon facts. Moreover, we demand that the advocates of the contraction theory, if they desire serious consideration for their claims, prove their contentions by an experiment. We cannot accept the subterfuge that this is not possible. Whatever we accept as truthfully descriptive of the physical world must be verifiable by experimental observation. Any theory which cannot meet this requirement is not worthy of serious consideration.

The Space-Time Coefficient owes its origin in Relativity to mathematical speculations concerning Space, Time, and Motion, depicted in the terms of Euclidean geometry. Nowhere do we find even a trace, in Relativity, of its source in an actual dynamic world. It is not surprising that it is continually misapplied by the Relativists. If the Relativists had first probed for its supporting source in the physical universe, then this very origin would have served as an unerring guide in its future application. In his investigations concerning Interdependent and Independent Motion the writer has shown that its origin is grounded in the facts of dynamic action which exhibit interdependent motion. (See Scientific Theism etc., pages 273-28O).

The contraction hypothesis is a flagrant case of the misapplication of a

mathematical product to physical reality. The Larmor-Lorentz contribution to the Theory of Relativity must be discarded because it is not only contrary to known facts, but it is also incapable of experimental verification.

Conclusion. The Left Abutment of Einstein's arch is not only inadequate to withstand the thrust, but also non-existent as a genuine physical fact.

LEFT ARCH RIB. THE CONSTANCY OF THE VELOCITY OF LIGHT.

Without entering into refined particulars we may state that, 'The Second Postulate of Einstein's Theory' maintains that the velocity of light, in a vacuum, is the same for all observers and is independent of the relative motion existing between the observer and the source of light.

Einstein regards this constancy of light as a necessary assumption in his theory. In this he has shown unusual caution. The reason for his prudence is that he cannot suggest even a semblance of an explanation of this glaring exception to his world-scheme of Relativity. This situation is not devoid of humor. That member in his arch which is indisputably sound he regards as a postulate. The Michelson-Morley Experiment, of course, is exempt from the previous implied criticism for the reason that the result of this experiment must be regarded, at the present time, as an *experimental fact*. The interpretation, however of this result, is an entirely different matter. The Relativistic version is palpably fallacious. Another test has been proposed. It is evident from the nature of the Einsteinian arch that the outcome of this proposed test can have no beneficial bearing upon the stability of Einstein's structure.

We have already shown that the Arch fails for a negative result. It is self-evident that a positive result, being fatally inimical to the Larmor-Lorentz Contraction, is of less value, and therefore cannot prevent the collapse of the structure.

Although Einstein has failed utterly to find even a clew to that greatest of all world mysteries, The Constancy of Light, nevertheless, the New Science stands ready with a solution.

A NEW THEORY OF LIGHT.

The New Science has found it necessary to abandon the ether hypothesis in its inconsistent and antequated form. The only physically known is differential matter in motion in the sympathetic presence of the compensating integrator Space-Time. This conception is the root of the author's Space-Time Potential in which Space and Time are regarded as the Intermutational Matrices of Reality. The writer has failed to find the word which will adequately express the thought which he desires to convey by the word 'Intermutational.' The idea cannot be expressed by the word 'Interactional' because action, in the physical universe, is always associated with matter. Space and Time are not material essences, therefore the word 'action, in any form whatsoever, cannot properly be associated with these basic matrices of reality. The 'inter-play' of Space and Time, although not genuine action, nevertheless *suggests* action, foreshaddows it from its very essence as a hope

which can be realized in the presence of dynamic substance. This is the thought which the writer has, so inadequately, attempted to express by the word 'Intermutational.' If there exists one characteristic in either Space or Time (real not conceptual) which is totally different and not found in the other, then Space and Time are not mere phases of a single entity Space-Time. That such distinct features exist becomes apparent upon reflection. Real Time is irreversible. Space is reversible. The limited scope of this article prohibits a detailed discussion of this phase of the subject. The mere hint, here given, is sufficient to prove that the Einsteinian single entity Space-Time is not grounded in experience. That actually existing, though shadowy phase of the 'inter-play' of Space and Time, which we have here termed 'intermutation' is impossible in a single entity Space-Time.

The writer has sought for an explanation of that greatest of all cosmic mysteries, the constancy of the velocity of light, at the very fountain-head of reality, the 'Intermutation of Space and Time.' An explanation cannot be found anterior to the fountain-head. The solution is therefore startling in its directness and simplicity. Only a brief exposition of the author's theory is possible in this article.

In order to make the content of this theory clear, let us erect a straight line, in any desirable direction, in Space. We will call this line the 'Space-Directrix.' It is evident that we can erect an infinite number of such directrices. Erect a plane perpendicular to the Space-Directrix. Regard this plane of sufficiently great dimensions to include all elements under investigation. Consider matter as the 'Now of Substance.' No other conception of matter conforms with observed reality. There is a 'Now' and a 'Future' for every kern (mass-acceleration unit) of reality. The 'Now' can be depicted in our plane, provided that we identify our consciousness with it. When this is done we will designate our plane as the 'Now Plane'. The 'Future' (substance) of every kern can be depicted as a *kern-extension filament* reaching beyond the Now Plane into Space. We give the name 'Cosmic Filaments' to all such extension filaments. This picture of the Cosmos is merely pictorially symbolic of a reality which defies the most profound attempts of finite represeiitation. In our picture, Time is represented by the Now Plane. In the Intermutative background of the Cosmos, Time corresponds to the 'dynamic urge' of substance and may therefore be regarded as an *Underlying* Principle of Motion, which in conjunction with Space, Substance, and all the Categorical and Empirical Determinations manifest as cosmic phenomena.

With Time regarded as an Underlying Principle of Motion, the question immediately arises: 'Have we any precise experiential knowledge of the 'Motion' of Time?' The answer is close at hand. So close, indeed that it has completely escaped the notice of both science and philosophy. The writer has found the answer at the very fountain-head of existence in the matrices of Time and Space whose intermutational motion is the underlying basis of the known constancy of the velocity of light. There is, of course, a material side

to this primordial relation, but this material phase of the problem must ultimately be grounded in the intermutational matrices which form the responsive equilibrating background of all physical reality. If we refer again to the Cosmic Model, presented ahove, the thought here outlined becomes clear. Let the Now Plane moves in such a manner that it is continuously perpendicular to a Space-Directrix. In cosmic phenomena, such as light and gravitation, the Now Plane moves, in reference to any initial point of reference in the Space-Directrix, with a velocity of 300,000 kilometers per second. In my Space-Time Potential I have given the name 'Kosmometer' to this cosmic unit of length. (Scientific Theism, page l73.) The cosmic unit of time is therefore that time period (one second) which is required for the Now Plane to travel a distance of one Kosmometer along a Space-Directrix. It is understood that the Now Plane in all its positions is perpendicular to the arbitrarily selected Space-Directrix. The velocity which arises in this manner is an Absolute Cosmic Velocity because it is the *constant cosmic ratio* of intermutation of the matrices of Time and Space. The converse is also true. The generation of this *constant cosmic ratio* is possible because Time and Space are distinct, though intermutational matrices. Einstein erroneously considers Space and Time as merely subjective precipitates from the single entity Space-Time.

As the Now Plane moves with this constant velocity, it continuously intersects the Cosmic Filaments whose 'Now Sections' responsively adjust themselves in such relative positions and configurations which conform with their inmost interactional nature and also with the co-responsive Cosmic Mold, Space-Time. Thus it is seen that intermutational Space-Time constitutes a cosmic chart capable of (the '*becoming-kinetic*' of substance) exhibiting deterministic future action. Herein lies the essence of the author's use of the word Potential in his 'Space-Time Potential.' The entire system is thus both interacting and unitary, and individually distinct forces, regarded as entities separate from matter, have no meaning. (Thus the 'force of gravitation', regarded as a separate and distinct entity is meaningless.) In such a unitary system the objections usually entertained against 'action-at-a distance,' completely disappear.

The material side of the phenomenon of light is in perfect harmony with its intermutational aspect in Space-Time. (See Scientific Theism, pages 172, 274, 275, and 276.) Here we deal with transverse and longitudinal displacements arising during the interaction of the *excitant* and *concurrent material systems*. The *ratio* of the velocities of the excitant and concurrent material system is that constant velocity which is known as the velocity of light. The concurrent system is composed of gyratory groups of monons which are interactionahly responsive to the presence of the constituent units of the excitant system. The latter travels in straight lines, unless subjected to the deflective interactional influence of other material systems. Normally to the direction of motion of the excitant units, the gyrational groups, constituting the concurrent system, undergo a cyclical augmentation in their

orbital radii. The result is a genuine physical light-wave which cannot be even conceived in a continuum like the ether which contains no real discrete parts.

The writer desires to point out a few of the results which follow from his theory.

1st. Cosmic Space and Time become genuine primordial realities. The Cosmic Now Plane moves with an Absolute, and known, velocity in reference to Space. The velocity of Cosmic Phenomena (light, gravitation etc.,) becomes known as a universal Cosmic Constant (that of Light).

2nd.

The discrepancy between the sum of the component vectors and the resultant vector in the ordinary velocity and force triangle is completely accounted for by this theory. The truth of this assertion follows from the fact that a displacement in this Now Plane is inseperably associated with, and actually impossible without, a coordinated displacement of the Now Plane itself along a Space-Directrix. Thus for every vector which is not perpendicular to the Now Plane two components are inevitable. Here then we have the ultimate source of the vector triangle and also the root of the above mentioned discrepancy.

3rd.

It follows, that in a closed vectorial configuration the time period between an initial and final point is independent of the path. Since the paths are unequal in length, it follows that the velocities also will be unequal.

In the case of the interferometer experiment, if we regard the Space-Directrix as parallel or coincident with the direction of the earth's motion, it follows that the observed time period, referred to the Now Plane, is independent of the path of the light-ray. The time period required for a net displacement of the ray *along the Space-Directrix*, is the same whether the path be a curve, a continuous broken line, two adjoining hypotenuses of right triangles, or the net resultant of a simple forward and backward motion. The governing element is the initial and final position of the Now Plane in reference to the Space-Directrix.

The interpreters of the Michelson-Morley experiment have not given due consideration to the fact that light is a *continuously generated* phenomenon. It is a generated (dynamic) vector *subject to interdependent interaction*.

The writer's theory permits variability in the velocity of both the *excitant* and the *concurrent* systems. It is only the *ratio* of these variable velocities which *remains constant*. The excitant system is actively responsive to interactional intensities. The concurrent system is continuously equilibrated and therefore exists in a neutral action phase. The excitant system is subject to acceleration in the presence of interacting fields. This obviates the dilemmas (like that arising out of the Doppler effect), difficulties, and omissions which are constitutionally inherent in Einstein's system.

The excitant system, when passing near the Sun, will be subject to its direct interactional influence, and also to the refractive effect due to its

corona. The combined result will be a retardation of the velocity of the excitant system.

The difficulties and possibilities of observational errors involved in this class of physico-astronomical investigations are both numerous and large. Such allowances for the combined influences which can be made are consequently, rather in the nature of assumptions than precise determinations. These effects, however, cannot be ignored. It would seem that Einstein, in his calculations, has taken no cognizance whatever of these combined influences. In the writer's calculations an attempt was made to make allowance for these disturbing effects by a reduction in the velocity of the excitant system. In the near future, comparatively accurate information may make it possible to substitute precise data for enforced assumption.

At the present time, therefore, the main significance of the writer's calculation lies in the directness and simplicity of the method employed, together with the additional important feature that whenever reliable information is available concerning the retardational influences mentioned above, a precise determination can be made without recourse to the unnecessarily complicated, and basically erroneous, hypothesis of a curved space.

It is important to note that Cosmic phenomena involve the Cosmic Now Plane whose movement in reference to any Space-Directrix is describable ia terms of the velocity of light.

The motion, however, of a discrete material system is describable in terms of a particular Now Plane which may be regarded as associated with the system.

4^{th}.

The perfect harmonious agreement between the dynamical behavior of substance and the cooperative responsiveness of Space-Time is evident from the fact that the same vectorial relations also arise from a study of the basic dynamic laws of the universe. These dynamic relations were first developed by the writer in the year 1904. They are treated in his work under the caption, 'Fundamental Physico-mathematical Relations of the Space-Time Potential' (pages 261-268 inclusive). The relations which pertain to Interdependent and Independent Motion follow directly from these basic dynamic relations. (See Scientific Theism, pages 278-279 inclusive). The Interaction Coefficient for Light was developed by the writer from these dynamic relations, which were based directly upon experimental facts. The author's Interaction Coefficient is identical in form with the Space-Time Coefficient of Larmor, Lorentz and Einstein. Not comprehending the nature of its interdependent source in both Space-Time and real dynamic action (not mathematically speculative) the Relativists misinterpreted its significance and grossly abused its use. The unsound Larmor-Lorentz Contraction hypothesis is only one of their many misapplications.

RIGHT ARCH RIB. THE PRINCIPLE OF EQUIVALENCE.

Stated briefly, the Principle Of Equivalence asserts the equivalence of

acceleration and gravitation. Einstein was not the first one to announce this Principle, even if he was the first to misinterpret it in order to link the mutilated product into his system.

Everyone grants that acceleration can be produced by *mechanical* means. Energy must then be expended in its production. The effects produced by acceleration mechanically-generated are precisely the same as the effects which result from its *cosmic generation*, generally described by the term 'gravitation.' The 'dynamic urge' in the case of gravitational acceleration is hidden in its cosmic generation. It is, however, just as much a reality as the energy which must be supplied to generate acceleration mechanically. The 'pure acceleration' of Einstein can therefore never be the equivalent of an actual and physically real 'dynamic urge.' 'Mere motion' is purely theoretical. The attempts of Einstein to account for physically real gravitation by means of the convenient substitute of 'pure acceleration,' can therefore result in nothing but complete failure.

The substitution of a term, empty of dynamic being, does not warrant Einstein's claim for Equivalence. This artifice is on par with many other similar sophistical half-truths emanating from the Father of Relativity. The affair is nothing more than a clever shift of terms in two causal series. Acceleration produced mechanically is an *effect* arising from the application of power. The word 'gravitation' invariably refers to that *cosmic cause* which is capable of producing *gravitational acceleration* as an *effect*. Therefore it follows, that acceleration is not equivalent to gravitation. No one has ever disputed, however, that both mechanically produced acceleration and gravitational acceleration can be discussed analytically under the general term 'acceleration.'

Sophistical half-truths are always productive of dilemmas. If Einstein claims that cause and effect (in the case cited) are equivalent, then it follows, with equal show of sanity, that black is white, evil is good, error is truth, etc., etc. On the other hand, if Einstein claims extraordinary originality in having made the 'astounding' discovery that gravitational and mechanical acceleration are types of acceleration, then we must freely concede the truth of the latter statement whilst marvelling at the unparalleled audacity of tbe claim.

It is here pertinent to call attention again, now, however, by way of contrast, to the substantial work of Anderssohn, Zacharias, 'Kinertia,' Mewes, and Fricke, whose serious endeavors to probe the phenomenon of gravitation to its ultimate source, constitute lasting records in the history of science.

In the light of all this we are utterly unable to account for the wave of enthusiasm which swept the scientific world when Einstein announced 'his great discoveries.'

Conclusion.

Einstein's type of the 'Principle Of Equivalence' is a mere quibble and inversion of words, which is another illustration of 'Much ado about

Nothing.' The right arch rib must consequently be declared worthless, because of the failure of this 'Principle' to establish a real 'dynamical' equivalence.

LEFT ABUTMENT HINGE. PERTURBED MOTION OF MERCURY.

It must be admitted that this 'hinge' is the strongest auxiliary member in Einstein's Arch. Dr. William H. Pickering has shown that a discrepancy of about 10% exists between the observed advance of the perihelion and the amount calculated by Einstein. (Dr. Pickering made allowance for the fact that the sun is an oblate spheroid. Einstein assumed it to be a perfect sphere.)

In this connection Jeffreys points out a serious weakness in Einstein's theory. There is, accoring to Jeffreys, 'no abritrary constituent (in Einstein's theory) capable of adjustment to suit empirical facts.'

Moreover, it is a significant fact that Einstein's theory is not successfully applicable to such other well known cases of perturbation as the secular acceleration of the Moon. In fact, his theory fails utterly in universal application. This fatal weakness in Einstein's theory has been revealed by the able work of Professor C. L. Poor.

We have previously mentioned the formula of Paul Gerber (1898) which covered this ground in a much simpler manner. Therefore, even here where the theory is the strongest, it is not indispensable. Its speculative complexity is a serious fault. Since three of the four 'main members' of the structure have collapsed, this auxiliary hinge cannot save the Arch of Einstein from complete destruction. This verdict is in complete harmony with Einstein's expressed opinion concerning his own theory: 'If any deduction from it should prove untenable, it (the theory in its entirety) must be given up. A modification of it seems impossible without destruction of the whole.'

It still remains for Einstein to admit the priority of Gerber.

Conclusion.

This hinge cannot save the Einsteinian structure. It is based upon a fallacious theory. It is not universal in its application. A simple and consistent substitute is available. Therefore this hinge must be discarded.

RIGHT ABUTMENT HINGE. DEFLECTION OF LIGHT.

As far as the results of the calculations are concerned no legitimate criticism can be presented. The percentage of error is comparatively small when the observational difficulties are considered. Here again, however, the theory is not indispensable. The deflection can be calculated with greater precision and by a more direct and simple method. Attention has already been drawn to this fact in the preceding.

This work of Einstein is, moreover, open to severe criticism on the ground of perversion of facts. The 'bending' of light-rays by the sun is used to strengthen the 'Curved Space' phase of this theory. The rays are supposed to follow the *geodesic lines* of Einstein's Curved World-Frame, and again we loose sight, in his theory, of the genuine cause of the phenomenon. In every phase of his system we encounter a departure from the direct and simple. Repeatedly the actual causes of a phenomenon are obscured by a complex

fabric spun in the looms of speculative mathematics. So in this case Einstein prefers the devious to the direct, perversion instead of simplicity, and *unreal* curved space becomes the all-important feature of the 'bending' instead of the simple interactional influence of the sun upon particles of matter. The direct attact of the problem should be as follows: Light-rays are composed of matter (since matter is the only known physical reality). The Sun is a great aggregate of matter. Groups of matter interact causing mutual deflections, whose relative amounts depend upon the magnitudes of the interacting groups. Therefore, light-rays being composed of very small particles of matter will be deflected when they pass near a great mass like the Sun.

Einstein's omission of the effects due to the Sun's atmosphere is a serious error.

The New Science has enough problems of real import with which to grapple without accepting the *unnecessary* burdens inconsiderately created by speculative mathematics. Any theory of unnecessary complexity must be regarded as a useless burden to the New Science. We have already seen the Einsteinian Arch crumble into dust. Whatever consideration we give to the hinges must be considered merely as formal and indulgent courtesy.

Conclusion.

The design of this hinge is based upon erroneous assumptions. The details of construction involve unnecessary and inconsistent complexity together with serious omissions. Since a simple and consistent substitute is available, this hinge must be rejected.

CROWN HINGE. DISPLACEMENT OF SPECTRAL LINES TOWARD THE RED.

The average result of all the experiments made, fails to support Einstein's theory. Einstein, while in the United States, publicly stated that he is willing to hazard the truth of his entire theory on the results of this experiment. Up to date the average result has been decidedly against The Theory of Relativity. It is, indeed, strange if science accepts the implied mandate of Einstein in regard to this 'hazard.' The risk involved in such an acceptance is enormous because the displacement is exceedingly small. Moreover, only a limited number of lines can be used in the experiment. Excessively large displacements are likely to occur because of the rapid motion in the line of sight. This excess will vitiate the entire experiment unless absolute allowance for it becomes possible.

Now Einstein is willing to risk the truth of his theory upon this slight probability of apparent experimental confirmation. It would seem that either he has the faith of one obsessed, or even now, he realizes that his theory has no basis in fact. In the latter event his proposal would tend to delay the arrival of that, for him, most potent moment when he would be forced to confess to the world that his intricately spun fabric is worthless.

Dr. Pickering points out that St. John, in an experiment conducted at Mt. Wilson, found a displacement for the cyanogen lines of only +0.0018A, whereas the displacement predicated by Einstein, from his Theory of

Relativity, should be +0.0080A. The actual discrepancy is +0.0062A which represents an excess of 344 per cent. If Einstein had genuine confidence in the alleged affirmative results obtained by Grebe, Bachem, Schwarzschild, and Evershed he would not have made, while in the United States, the public statement cited above. In his work 'Relativity' he refers to this experiment as follows: 'It is an open question whether or not this effect exists . . . . At all events, a definite decision will be reached during the next few years.' He is like a man who uses the technical machinery of the courts to delay the final and inevitable verdict.

In view of the above one can but marvel at the extraordinary reception, a mounting to a triumphal ovation, which was accorded a theory, built upon a foundation of quicksand, and 'hinging', according to its originator, upon an experiment yet to be proved.

Conclusion.

This hinge must be rejected because it is not only unsafe, but also non-existent.

SUMMARY OF RESULTS OF TESTS.

RIGHT ABUTMENT. NON-EUCLIDEAN SPACE-TIME.

Non-Euclidean Space-Time is based upon unsound and erroneous departures from, and extensions of, Euclidean geometry. The Minkowski and Einstein version of four-dimensional Space-Time reduces to a type of four-dimensional space which is not a reality. Therefore, the right abutment is structurally non-existent. The Space-Time idea is not even original with Minkowski and Einstein. Palagyi, in 1901, expounded the essentials of this theory.

THE FLOOR.-MICHELSON-MORLEY-MILLER EXPERIMENT.

At the present time the results must be regarded as experimental facts. The significance of these results has been misconstrued by Larmor, Lorentz, and Einstein. Relativity is based upon a wrong interpretation of these results. We, however, must pronounce the floor as structurally safe.

LEFT ABUTMENT. THE FITZGERALD-LARMOR-LORENTZ TRANSFORMATION.

The Larmor-Lorentz contraction theory is a purely speculative mathematical device designed to meet an emergency. Its contentions have not been substantiated experimentally. Moreover, the Relativists (including Einstein) maintain that an experimental proof is impossible. Therefore we are forced to conclude that the left abutment is conceptually unsound, experimentally unverifiable, and structurally nonexistent. This transformation is not due to Einstein but is the work of Larmor and Lorentz based upon a suggestion by Fitzgerald.

LEFT ARCH RIB. THE CONSTANCY OF THE VELOCITY OF LIGHT.

The constancy of the velocity of light is an experimentally established fact. The left arch rib is, therefore, a sound and safe structural member. This experimental fact was not discovered by Einstein.

RIGHT ARCH RIB. THE PRINCIPLE OF EQUIVALENCE.

As defined by Einstein it is a mere quibble and inversion of words. It is an erroneous substitution of effect for cause, followed by a claim of 'Equivalence' of the reversed product and its causal source. This is a pure case of 'Much ado about Nothing.' The experimentally sound feature of the principle has been misinterpreted by Einstein, and as such, becomes a self-destructive member of his Arch. The discovery of the real facts, which were perverted by Einstein, are not even due to him but must be accredited to Anderssohn, Zacharias, 'Kinertia,' and Fricke.

LEFT ABUTMENT HINGE. PERTURBED MOTION OF MERCURY.

Here we have the best agreement of Einstein's theory with observed facts. The unnecessary complexity of Einstein's method of calculation, however, eliminates the result from serious consideration. This element in his unstable structure cannot save a theory which so blatantly lacks internal consistency and external verification. Einstein's theory is here impossible because it lacks universal applicability. The priority of Gerber here removes all ground for claims to originality on the part of Einstein.

RIGHT ABUTMENT HINGE. DEFLECTION OF LIGHT.

Einstein's calculated deflection is in comparatively close agreement with the observed amount. The calculated is less than the observed by about 11 per cent. Einstein's deflection is twice the amount obtained by the use of Newton's gravitational expression. Newton's is less than the observed by about 56%. This, then, is the status of the calculations which brought Einstein into prominent opposition to Newton. Einstein has committed a serious error in neglecting to allow for the retardational effect of the Sun's atmosphere.

We have previously mentioned that a closer approximation can be derived by simple methods founded upon the readily verifiable laws of dynamics. Therefore this attempt of Einstein is merely historically interesting. Moreover, the basic assumptions of the Einsteinian calculations are erroneous, being founded upon an untenable theory. This hinge must therefore, be removed from the world structure because it is both lacking in possible precision, and also involves unnecessary complexity in design.

THE CROWN HINGE. DISPLACEMENT OF SPECTRAL LINES TOWARD THE RED.

Einstein hazards the stability of his whole structure upon this hinge. Experimental evidence, now at hand, is decidedly damaging to Einstein's position. He admits that his contentions have not been verified. This is borne out by his own statements, recently made, in the United States.

The proposed experiment involves extremely small displacements. Varying pressure in the solar atmosphere together with the rapid motion in the line of sight, constitute decidedly detrimental extraneous influences which increase the inevitable inaccuracy of the experiment. Therefore, whatever may be the result of this proposed experiment, its significance will be open to challenge. It is never safe to base, even a less important theory, upon such dangerous experimental ground-work.

We must therefore, even now, discard the future result of this experiment as having significant bearing upon the validity of Einstein's theory.

In view of these facts we draw the inevitable conclusion that the crown hinge is not only unsafe but also non-existent.

CRITICAL WORKS ON EINSTEIN'S RELATIVITY.

E. Gehrcke—Die Relativitätstheorie, Berlin, 1920.

H. Fricke—Der Fehler in Einsteins Relativitätstheorie, Berlin, 1920.

Edouard Guillaume—La Theorie de la Relativite, Lausanne, Switzerland, 1921.

Edouard Guillaume—La Theorie De La Relativite Et Sa Signification. (Revue de Metaphysique et de Morale.)

A. N. Whitehead—An Enquiry Concerning The Principles of Natural Knowledge.

Cambridge University Press, 1919.

A. Patscke—Umsturz der Einsteinschen Relativitätstheorie.

P. Lenard is preparing a work on the errors of Einsteinism.

Rudolf Mewes—Raumzeitlehre oder Relativitätstheorie. (Berlin, 1921. The Collected Works of Mewes dating from 1884 to 1899 inclusive.)

William H. Pickering—The Einstein Theories. (Scientific American Monthly, April, 1921.)

John T. Blankart—Relativity or Interdependence. (The Catholic World, Feb., 1921.)

J. E. Turner—Some Philosophic Aspects of Scientific Relativity. (The Journal of Philosophy, April 14, 1921.)

Arvid Reuterdahl—Scientific Theism Versus Materialism, The Space-Time Potential (1920).

The Fallacies Of Einstein. (Now in preparation.)

The writer has, in this brief article, presented facts not previously available in collected form. He will feel amply repaid for his labors if their presentation will further the cause of justice and truth."

From the *St. Paul Pioneer Press*, 21 August 1921,

"REVIEWER SAYS REUTERDAHL'S NEW BOOK CLEARLY DRIVES EINSTEIN TO THE ROPES

William Wyckoff Clark of St. Paul, graduate of the University of Minnesota in its earlier days, has made a clear study of the theory of relativity, and an article by him entitled 'Divine Relativity,' discussing a metaphysical aspect of the theory, will appear soon in the Homoletic Magazine, a leading scientific journal. Prof. Arvid Reuterdahl is dean of the department of engineering and architecture at the College of St. Thomas, and is widely known as a scientist. He challenged Einstein to a debate, some weeks ago, but never has had a reply from him.

Prof. Reuterdahl is receiving daily letters and telegrams of

commendation of his book attacking the Einstein theory. They have come from Berlin, where Einstein is at present, from Prague, from Jugo-Slavia and Switzerland as well as from scientists in America.

Dr. T. J. J. See, director of the United States Naval observatory at Mare Island, Calif., writes: 'I am glad that you have punctured Einstein's bubble, which justifies the remark that 'Einstein is the Doctor Cook of physical science'.'

By William Wyckoff Clark

EINSTEIN AND THE NEW SCIENCE, Dean Arvid Reuterdahl, College of St. Thomas, St. Paul.

In this article, appearing in the Journal of the College of St. Thomas and reprinted for general circulation, Dean Reuterdahl does three things creditably: First, he makes an accurate notation of the sources from which, it is claimed, Einstein acquired the various ideas composing the theory of relativity; offers a concise, vigorous and scholarly criticism of the theory; and, third, introduces an outline of his own striking and strikingly original Time-Space Potential, in so far as it is akin to relativistic principles.

The St. Paul mathematician is the most fearless and unrelenting foe of Einstein's relativity that has, up to the present time, voiced his criticism of the theory in the English language. German and French scientists have flayed Einstein and his teachings and his methods unmercifully, but for some reason or other, those English and American scientists, who have not joined the relativistic ranks, have maintained a very polite and kindly silence anent the theory. Many of them reject it, many of them adopt the Scotch verdict of 'not proven,' but few indeed are they who have taken pen in hand to write for publication even the mildest sort of adverse comment. Reuterdahl, therefore, enters an almost empty field. That he does so willingly and even joyfully no one who has read the very brief comments on relativity contained in his book, 'Scientific Theism,' will for a moment doubt. He is a fighter, but withal fair and dignified.

Leaves Case With Jury.

Without any waving of arms or shouting of 'plagiarist,' 'thief,' 'robber,' Reuterdahl introduces his evidence and leaves the case with the jury. He gives the names of scientists and mathematicians, with the titles and dates of publication of their various works, periodicals, etc., from which, it is claimed, Einstein obtained the data and the very ideas composing the theory of relativity, specifying accurately the subject matter appropriated. To such an extent and so thoroughly does Reuterdahl perform this work of exhibiting 'parallelism' that the possibility of honest, independent origination by Einstein is made to appear very remote and the burden is clearly placed upon his friends to show any original work of value by him in connection with the theory. Practically all that the author concedes to Einstein is a limited amount of grouping of ideas and an unlimited amount of self-glorifying advertisement.

In his criticism of relativity Reuterdahl is fair and discriminating,

conceding merit to certain parts of the theory and acknowledging as authentic a number of its important postulates. He very rightly regards Minkowski's Space-Time composite as one of the abutments on which the arch of relativity must necessarily rest. Minkowski is the man who coupled space and time together in an inseparable 'bund,' and then, in the ecstacy of delight over his achievement, made use of that expression which finds a place in every treatise on relativity, viz.: 'Henceforth Space in itself and Time in itself sink into mere shadows, and only a kind of bund of the two can be maintained as self-existent.' And it was Minkowski who worked out the process, on which all relativistic mathematics rests, in which time is treated as functionally equivalent to a fourth dimension of space.

'High Brow' Camp Annoyed.

The school of relativity is divided into two camps, on embracing those who frankly believe in a four-dimensional space with time actually one of the dimensions, and one embracing those who would merely assert that under certain conditions time enters the mathematics of relativity as quantitatively equivalent to a dimension of space. The latter group consider themselves the 'high-brows' of relativity and are much annoyed by the success which has attended the members of the other camp in conveying the impression to the public that relativity sponsors four-dimensional space.

In his consideration of the subject, Reuterdahl starts out with the new, original and highly important demonstration that Minkowski's mathematics really gives a four-dimensional space. From page 11 I quote:

> It can be shown that the Minkowski-Einstein space-time is a mathematically camouflaged type of four-dimensional space. In the invariant form of the General Quadratic Differential, which is basic to Relativity, the last term is formed by multiplying the velocity of light by time. Velocity is reducible to length divided by time. Therefore time is eliminated from this term, leaving it as a pure spatial expression. Consequently we have here nothing but a new version of four-dimensional space which is not a physical reality.

Relativists Put on Defensive.

Unless relativists are able to show that Reuterdahl is mistaken in this analysis of Minkowski's Time-Space mathematics, the theory is left tied up with and bearing the burden of a four-dimensional space: and relativity is seriously handicapped by Reuterdahl's initial attack.

Reuterdahl next takes up the celebrated Michelson-Morley experiment and concedes that at the present time its results must be accepted as experimental facts. He agrees with relativity in regarding the experiment as conclusive proof that there is no ether. Relativity fails to provide any substitute for the ether and thereby lays itself open to the charge of incompleteness in providing no medium for the transmission of light or other electro-magnetic waves.

Reuterdahl, however, avoids that mistake; his 'concurrent system' offers a satisfactory substitute for ether and one which is free from the inconsistent

and even contradictory properties ascribed by the scientists of the last generation to that medium.

Consideration is next given to the Fitzgerald-Lorentz contraction hypothesis and to the Larmor-Lorentz transformation equations. The importance of these matters to the theory of relativity amply warrants the extended space devoted to them by the writer, but his treatment is too technical to authorize an extended review of it at this time.

Reuterdahl considers the contraction theory to be a 'purely mathematical device designed to meet an emergency.' It has not been and cannot be confirmed by experiment; it is a 'flagrant case of the misapplication of a mathematical product to physical reality.'

Taking up the subject of the constancy of the velocity of light, Reuterdahl accepts the second postulate of Einstein's theory that this velocity, in a vacuum, is the same to all observers and is independent of the relative motion existing between the observer and the source of light. This is the startling postulate holding that, whether an observer were rapidly approaching a light source, or relatively at rest with it, or rapidly receding from it, in each of the three cases the waves of light would reach him with the same velocity. Paradoxical as this may seem, scientists in general accept it, although with great reluctance. In a recent letter to the writer of this review a former president of the American Academy for the Advancement of Science says:

> I quite agree with you that the postulate of relativity as to constancy of the velocity of light without reference to the motion of the stars is unsatisfactory, and I hope that at some time the experimental grounds for this assumption will be found to be less compelling than seems to me to be the case at present.

Under the circumstances, therefore, Reuterdahl's acceptance of this postulate is undoubtedly justified, especially so in view of the fact that he immediately points out the misinterpretation and misuse of the postulate by relativity.

Then follows that portion of the article which, to the philosophically inclined reader, will be found most intensely interesting, i. e., Reuterdahl's own theory of the velocity of light together with an altogether too brief outline of his Space-Time Potential. The reviewer has tried, but without success, to contract within the space at his disposal an understandable resume of this work. Any more concise presentation of it than the author himself gives would necessarily be incomplete. An understanding of it involves an acquaintance with the author's former work, 'Scientific Theism.' It is therefore with great regret that we dismiss the topic with the totally inadequate comment that Reuterdahl's Space-Time Potential and theory of light transmission are strikingly original, scientifically and philosophically consistent and worthy of the profoundest study.

Among the most outstanding features of relativity is Einstein's much-heralded 'Principle of Equivalence' between gravitation and acceleration. Reuterdahl performs a very important bit of work in showing that the

identifying of the two by relativity is a confusion of cause and effect which robs the 'principle' of all heuristic value, indeed of all verity. Acceleration is an 'effect,' one that can be produced mechanically or by the action of that 'cosmic cause' which we call 'gravitation.' But acceleration, an effect, and gravitation, a cause, can not be identical or equivalent.

We must pass over without adequate consideration Einstein's proposed three tests for his theory, the perturbed motion of Mercury, the deflection of light and the displacement of spectral lines. Regarding the first, Reuterdahl admits the accuracy of the relativistic calculations to within about 10 per cent, but shows that the same system of computation, applied to other cases of perturbation, produces inconsistent results.

Regarding Einstein's calculated deflection of light the author concedes its approximate correctness, a variance of about 11 per cent being shown, but points out that 'the deflection can be calculated with greater precision and by a more direct and simple method.'

The third test, the displacement of spectral lines toward the red, not being claimed by relativity to have been confirmed, is dismissed by Reuterdahl with but little more than the passing comment that Einstein is taking long chances on resting the validity of his entire theory on this doubtful base.

'Einstein and the New Science' is a valuable addition to relativistic literature. Students of the subject, whether favorably inclined to the theory or otherwise, can not afford to miss reading it."

On 24 August 1921, *The New York Times* reported on page 2,

"*CALL FITZGERALD FATHER OF RELATIVITY. English Writer Gives Him Credit for the Genesis of the Einstein Theory.* Special Cable to THE NEW YORK TIMES. LONDON, Aug. 23.—Referring to the conferring by the Royal Society of its fellowship on Dr. Robb for his work on relativity, a scientific correspondent of The Daily Chronicle says that the credit for the evolution of the theories of time and space is due to the initiative of three Irishmen: Professor G. F. Fitzgerald of Trinity College, Dublin; Sir Joseph Larmor, who is Lucasian Professor of Mathematics at Cambridge, and Dr. Robb.

Robb has admitted his indebtedness to Larmor, but, says, the correspondent, the theory of relativity owes its origin to Fitzgerald's explanation, as far back as 1888, of Nicholson's [*sic*] and Morley's failure to detect any relative motion between earth and ether.

He showed that if all bodies contracted in the same proportion in the direction of their motion we should have no fixed standard of length, as measuring rules and all scientific instruments would likewise change their dimesions [*sic*]. Hence we could not ascertain the exact size of things, nor detect their motion relatively to fixed absolute space.

This was known as Fitzgerald's contraction theory, which, in the hands of Larmor and Sovenx [*sic:* Lorentz?] of Leyden has led up to the remarkable theories of space and time since developed by Robb and Einstein."

In 1921, Wolfgang Pauli set the record straight in the *Encyklopädie der mathematischen Wissenschaften*,

> "The metamorphoses in physical concepts brought about by the theory of relativity was a long time in the making. As far back as 1887, Voigt observed in one of his works [***] that it is mathematically possible to introduce a time of position t' into a moving reference system, whose origin is a linear function of the spatial coordinates, while the unit of time, however, is taken to be constant. Whereby, one can assert, of course, that the wave equation
>
> $$\Delta\varphi - \frac{1}{c^2}\frac{\partial^2\varphi}{\partial t^2} = 0$$
>
> also remains valid in the moving system. [***] We now come to a review of the three works of *Lorentz*, *Poincaré* and *Einstein*, which contain the thoughts and developments which are the foundation of the theory of relativity. Lorentz' work led the way. Above all, it furnished the proof that Maxwell's equations are invariant under the transformation of coordinates [*Lorentz Transformation equations deleted*] provided that one at the same time suitably selects the field intensity in the primed system."[2131]

Pauli argues that Lorentz holds priority for the proof of invariance. Pauli next addresses Poincaré's contribution,

> "The formal gaps left by Lorentz's work were filled by Poincaré. He stated the relativity principle to be generally and rigourously valid. Since he, in common with the previously discussed authors, assumed Maxwell's equations to hold for the vacuum, this amounted to the requirement that all laws of nature must be covariant with respect to the 'Lorentz transformation' [The terms 'Lorentz transformation' and 'Lorentz group' occurred for the first time in this paper by Poincaré—*notation found in the original*]. The invariance of the transverse dimensions during the motion is derived in a natural way from the postulate that the transformations which affect the transition from a stationary to a uniformly moving system must form a group which contains as a subgroup the ordinary displacements of the coordinate system. Poincaré further corrected Lorentz's formulae for the transformations of charge density and current and so derived the complete covariance of the field equations of electron theory. We shall discuss his treatment of the gravitational problem, and his use of the imaginary coordinate *ict*, at a later stage (see §§ 50 and 7)."[2132]

After giving Poincaré his due credit, and acknowledging that Einstein holds no priority for the special theory of relativity, Pauli, half-heartedly, pays the seemingly obligatory homage to Einstein, the then recently emerged celebrity,

> "It was Einstein, finally, who in a way completed the basic formulation of this new discipline."[2133]

And it appears that Pauli was forced, or felt compelled, to praise Einstein with additional inappropriate and, evidently, insincere comments.

Einstein's work was not so well-received, nor so perfect, as his present day sycophantic advocates would have us believe.[2134] Louis Essen wrote,

> "But there have always been its critics: Rutherford treated it as a joke: Soddy called it a swindle: Bertrand Russell suggested that it was all contained in the Lorentz transformation equations and many scientists commented on its contradictions. These adverse opinions, together with the fact that the small effects predicted by the theory were becoming of significance to the definition of the unit of atomic time, prompted me to study Einstein's paper. I found that it was written in imprecise language, that one assumption was in two contradictory forms and that it contained two serious errors."[2135]

John T. Blankart stated in 1921,

> "The 'Kinertia' articles offer food for thought when considered in connection with the colossal claims made by Einstein's supporters concerning his almost super-human originality. In fact, one begins to doubt the justice of these claims and to wonder if the charges made by a fast growing group of German scientists who, like E. Gehrcke, P. Lenard, and Paul Weyland, hold that Einstein is both a plagiarist and a sophist, are not, after all, true. We have done little justice in the above to the rare dialectic skill with which Dr. Einstein has applied his intellectual anæsthesia to the minds of his readers. All intellectual obstructions have been removed, and the reader is prepared to venture forth boldly into the mysterious realm of 'curved' space *whose geometrical properties depend upon the matter present*. This most curious inference of Einstein is the master stroke in his skillful massing of inconsistent sophistries."[2136]

Sydney T. Skidmore wrote, in 1921,

> "THE MISTAKES OF DR. EINSTEIN
> *By* SYDNEY T. SKIDMORE
>
> WE begin this essay by saying that Einsteinism is an erudite elaboration of sophistry and is closely akin to, if indeed it does not spring from, the same root as classic sophistry. The tap root of that system of philosophy developed in the fifth century before the Christian era, and consisted in a denial of the existence of objective truth. Its thought and attitude can only become intelligible from a presentation of what 'objective truth' is, and for this, a little tax must be imposed on the reader's patience.
>
> Its definition is simple enough. It consists of, and includes, the being of

all created things and their relativities. It is objective because its essence is independent of subjective thinking which can apprehend it in part—can pick up pebbles of it from an ocean strand—and assemble what is gathered as knowledge. Since it inheres in the essence of created things it is coinstant with their creation.

Creation is originate; and all created things must have a beginning. The first creative act necessitated a 'where' for its occurrence, and that where has existed ever since as a changeless objective truth. Each creative act likewise necessitated a where, and the aggregate of all wheres, or whereness, constitutes a changeless, undistortable, frame of objective truth to which the term Space has been applied. Objective truth or 'isness' pertains to the wheres or loci in space, and since the loci are fixed, it also pertains to the changeless relations of loci.

The first creative act not only required a where, it also required a when—an instant—for its occurrence. Each creative act likewise required an instant, and the aggregate of all whens or whenness, constitutes another frame of objective truth, to which the term Time has been applied. Unlike loci, instants are not simultaneous, they are sequential, and their objective truth pertains to a procession rather than to a distribution.

In each creative event, therefore, three orders of objective truth are present, viz., cause, locus and instant. Since history is composed of events, and experience is concerned with them, the foregoing analysis may serve to show what the nature of objective truth is, and also that the objective truths, cause, space and time, supply and equip the generative arena of events, i.e., of physical phenomena.

Objective truths are presented in every fact and may be apprehended in all phenomena. They are not thoughts but they are thinkables, and are cognized by each mind according to its scope. Now, because the Eleatics failed to formulate it or define it as an abstract oneness, the Sophists denied that it had any existence whatever.

Since abstraction plays an important part in this discussion it must receive some attention. Abstraction consists in withdrawing attributes, or qualities, from their home correlatives in nature, and installing them in a psychical abode for mental contemplation. As the word stands it means the separation of something from something; but never a separation of something from nothing. Inception is usually the word for that. There must always be a residue from which the final abstraction is made. The relativity of attributes in and with a thing, although they are mentally withdrawn, is still codestructible only with the thing itself. An abstraction of qualities does not annihilate the residue; nor can a sound philosophy be constructed from the relativities of attributes alone, with the residue ignored. We give the following statement prodigious emphasis because it is so much involved in the reasoning farther on.

No amount of abstraction can resolve a thing to a philosophical nullity nor psychalize it into nonexistence. The residue with its relativities still

persists as objective truth.

The relativities of abstractions by themselves are subjective, mental, and may be correct, but are usually incorrect owing to the imperfection of mental action. True science is a developed knowledge of what *is* as revealed by discovery in wide open objectivity, and false or pseudo science is a knowledge of what *seems to be* as revealed by apprehendings in the inclusions of subjective recesses.

Since the Sophists denied the existence of objective truth they could not make it an objective goal of human endeavor. They must by necessity adopt a subjective goal, such as excellence, success, or victory. Truth, with them, was inherent in triumph. Whatever prevailed was true and true because it prevailed and truth had no other significance. It is easy to understand how such a philosophy as that should become reduced by human ambition, selfishness, and deceit, to the direct degradation. The success most esteemed by the Greeks was victory in debate, and after two centuries, Sophistry became such a system of thin verbal trickery that it fell into disrepute, and a stigmatum attached to its name.

Wherever the supreme goal of endeavor has been placed in things other than debate; and smartness of any kind has been substituted for objective truth, as an end anywhere, sophistry works the same degradation. While it appears to be always present as an inseparable corrupter, there have been some well marked epochs in which it acquired such dominance as to shape legislation and thinking and openly display its fruits. This occurred in the ancient sophistry of Greece as such; in medieval sophistry as Scholasticism; and in modern sophistry as Commercialism, Pragmatism, and Education. In war and politics it appears respectable as Strategy. In commercialism, somewhat less so as shrewdness; while in pragmatism and education it often wears the mask of efficiency.

Objective truths are distent and gloriously free. Subjective truths are stifled in mentality and subordinate to the ends of victorious achievement. Apprehendings of objective truths are obtained from objective things and, if incorrect, they may be checked up and corrected by reference to the things. Apprehendings of subjective truths are mental constructions, apart from things, and uncorrectable since subjectivity is not apt to correct itself. If they are crazed by mental inaccuracy the relativities of such truths are incurably queered likewise.

This presentation of sophistry as a system of thought, seems necessary to establish, by comparison, the validity of the statement made in the beginning of this essay; for we shall try to show that Einsteinism is sophistry, both in its nature, and in its dialectic construction.

It is purely subjective and Protagorean in that it ignores the objective truth of all steadfastness, and all relativity of steadfastness in general being.

There are two orders of relativity; that of the steadfast with changeables; and that of changeables with each other. Einstein relativity is exclusively of the second order. We are not aware that Einstein anywhere formally denies

the existence of steadfastness as objective truth, but since it cannot be psychalized he everywhere ignores it, and all arguments for Einstein relativity are based on its non-existence; and it is Einstein relativity, with its astounding pretensions, that we are criticising.

The primary positional steadfasts in nature are the loci (points) in space. The earth and all things in it move, but space units do not. All things in the earth have a first order relativity with the points of space, and a first or second order with each other according as their motions are alike or unlike each other. Now because the points of space are ultra to experience, imperceptible and unsubjective, together with their relativities, their being is summarily denied by sophists and ignored by Einsteinism; and all semblance of steadfastness, like that of car seats in a moving car, or houses on a moving earth, have no steadfast relativity with anything; it is only subjective thinking.

Einsteinism claims to open a vast extension of physics but, if adopted and followed, it would tend to a collapse of physics because it works from a psychological rather than from a physical basis. The two are in reversion. Physics stimulates discovery by trailing the scent of objective truths occluded in the unknown. Einsteinism represses discovery by holding truth corralled within subjectivity. Even Space and Time, the fundamental containers of those objective truths which physicists are continually transferring from the unknown to the known, are said to be 'devoid of the last vestige of physical objectivity.' (Schlick, pages 53, 76. Eddington, page 34) . [*Footnote:* We shall quote in this paper from Schlick's 'Space and Time', and from Eddington's 'Space, Time and Gravitation', because both these books are recognized as authoritative in Einstein literature and they are somewhat more definite and explicit than Einstein's own writing.]

Physical relativities are of the first order; Einstein relativities are of the second order and pertain to the relations of fluxing events as they are observed. Words such as cause, potential, and force, which are leaders in physics are of rare occurrence in Einstein literature and when used are slipped in edgewise. The relativity of physical effects with their causes is slightly discussed, but the relativity of mental states induced in observers when differently conditioned abounds, and forms the body of argument, and the plenitude of discussion.

Another citation, which shows how completely truth is restricted to the realm of subjective apprehendency, appears in the interpretations given to the Michelson and Morley experiment.

Those investigators truly assumed that if a non-viscous static aether existed, an aether wind opposite to the earth's motion must blow through the moving earth; and that the velocity of light would be different when moving against this wind, than when moving at right angles with it. A very delicate and crucial experiment showed that the earth's motion had no effect whatever on the velocity of light. Now what? Something must be wrong, either with the aether belief, or with the motion of light; and the

mathematicians proceeded to explain it, as they usually do, by tinkerings at space and time. Fitzgerald and Lorenz [*sic*] devised that everything in the line of motion transforms and contracts, and so increased time was exactly compensated by shortened distance, and the velocity of light, as shown by simultaneous arrival, was apparently unchanged.

This saved a clumsily apprehended aether belief from Michelson and Morley extinction; but Einstein proposed a different explanation. Quite indifferent to the fate of current aether belief, he found the difficulty lurking in the relativities of motion. All things, relatively at rest in a system, maintain that relativity whether the system, as a whole, is moving or not. The motion of a system, moving relatively with objects external to it, has zero effect on the relativity of things within it. The relative direction of city streets abides when their direction from the sun changes continually. Street cars run a mile east in the same time as when running north, although the earth rushes westward one thousand one hundred miles per minute, and northward not at all. The interferometer, mirrors, and source of light, in the Michelson experiment, were all in the same Earth system and therefore the light moved between them through equal distances in equal times, whatever the direction might be. This neither proves nor disproves the existence of an aether, but it does show that if an aether exist it is of such a character that currents and whirls in it do not perceptibly affect the velocity of light. It is not an externality by which the relativity of light movement with it can be sensibly apprehended. Now, because a static aether of a particular character does not exist, the reasoning dialectically pussyfoots into an assumption that there is neither aether nor staticity. The aether is of small consequence in the case, but it is essential to Einstein relativity to put out of existence the principle of staticity as an objective truth and the ultimate physical reference basis of all motion.

Whatever may be true in metaphysics it is certainly true, that in physics such a principle does and must exist, as a physical necessity. A bird does not take the air along with it in flight; a ship does not take the ocean with it in sailing; a moving car does not take the ties of the road bed with it, and no moving thing takes space with it. Air, ocean, and ties have a static relativity with the moving objects mentioned. Whatever moves has changing relations with everything that does not move precisely as it does; and static relations with everything that does: but a truce to such platitudes. Space contains all moving things which therefore have a shifting relativity with it, because it does not move like them. It is the physical ultimate of staticity since nothing physical exists external to it to which its motion can be referred.

The changing relativity of things with the points of space or instants of time is of the first order (primary) and all changing relativity of things with each other is of the second order (casual).

Einstein relativity is exclusively of the second order. The expounders of it deny that there is any other, and back up the denial by ignoring the staticity of space; but this they cannot do without postulating something in

metaphysics external to space which does not move as space does; and this they cannot do; so, to abolish its staticity, they must abolish space itself and replace it by a subjective creation.

Staticity must be removed from the space world to permit the entrance of Einstein curios and non-Euclidian queers. While it abides lineality abides. Forms in space are outlined in it by moveless points, and are differentiated from it just as an island boundary is different from the surrounding ocean. Points of space are located by rectilinear coordinates, and all other coordinates whether Gaussian, polar, or zigzag, only serve to locate places on the surface of a form in space, like the longitude and latitude circles on the surface of a terrestrial globe. They do not locate points of space; they merely locate points with reference to other points on the surface of a form in space. Hence arises the non-Euclidian sophistry of spherics, or eliptical space, and the Einstein sophistry of space curved and twisted around material bodies, like a swaddling striate aura, and the further sophistry that bodies moving through such space are impelled by inertia along curved rather than straight lines in accordance with a 'Principle of Least Action' that the longest way round is the shortest way home, because straight lines would lead across curving hurdles (Eddington, page 105).

Space as such has no form whatever. It is neither curved, flat, nor otherwise. The pure forms of things (the abstract residues) are defined in space by the fixed relativity of its moveless points. This statement squarely contradicts Einsteinism. It is based on logical inherences in objective creation, while its antithesis is grown from subjective apprehendings of shifting things. Whichever is truth, the other is devoid of truth and the choice is yours.

Staticity has been discussed at some length because it illustrates the attitude of Einstein relativity towards all objective truth. Because such truths, when postulated are imperceptible and make no psychic impression, words sophistically used present them as unreals, and cause them to appear as 'ambiguities and unnecessary thought elements', (Schlick, page 5) which should be thrown aside as meaningless and obstructive to a path that leads not to truth but to victory; not to amendment and improvement by new tributes of knowledge; but to a revolution of fundamental concepts which throws down an older and erects a new intellectual throne.

This revolution (when achieved) is a promise of something which will cause Newton and Copernicus to seem like infantile prattlers; 'inasmuch as the deepest foundations of our knowledge concerning physical nature have to be remodeled much more radically than after the discovery of Copernicus.' (Schlick, page 5.)

The signs of such an approaching revolution at present are not very auspicious. While one out of twenty, or possibly fifty, of savants are filling the world with a sounding applause of it, all the rest are waiting, silent, dubious, and withholding allegiance. Still it may come; for the human world delights in sophistry and dotes on truths of its own creation. Impressionism

which is so powerful in Art may also yet prevail in Philosophy.

That Einsteinism presents a revel in such truths is made evident by Eddington in Chapter XII: 'The conclusion is that the whole of those laws of nature which have been woven into a unified scheme—mechanics, optics, gravitation, electro-dynamics—have their origin not in any special mechanism of nature but in the workings of the mind.'

'Give me matter and motion,' said Descartes, 'and I will construct the universe.' 'The mind reverses this,' says Einstein. 'Give me a world in which there are relations, and I will construct matter and motion.' The world thus is what it is conceived to be; is what we think it is. That is precisely what Descartes and Einstein each professed to do. Both are subjectivists—sophists. One would replace the objective truths of real relations, by such queered relations as he could mentally construct from observed things, and the other would replace the objective truths of real things, by such queered things as he could mentally construct from observed relations. Both alike substitute their psychical apprehending of nature's content, for the content itself, and then call it truth.

Recent writings in current literature suggest that many inquiries are baffled in attempts to comprehend Einsteinism. They read about it and think there must be something in it, and so there is, but it is a something not included in their somethingness. It is shapen from non-Euclidian, or what is sometimes termed meta, geometry. This consists entirely of mental constructions that are purely subjective and correspond to nothing in nature. In fact it prides itself on a disbelief or at least a disregard of the existence of objective truth, and boasts that 'mathematicians are never so happy as when talking about something of which they know nothing.' (Eddington, page 14.) Really it is no geometry at all, for it measures nothing and disallows all mental standards. It is a fantastic jazz of mathematical symbols, devoid of quanta, in a dance hall, floored by a parquetry of ifs, supposings, and assumptions.

The attitude of Einsteinism toward physics, and the fate of physics by occlusion in this thing, misnamed geometry, is well stated by Eddington (page 183). 'As the geometry becomes more complex, the physics becomes simpler, until it finally almost appears that the physics has been absorbed into the geometry.' While parading the attractive banner of a 'New Physics' or a 'New Philosophy,' Einsteinism is really nothing but a special chapter in psychology, which is offered as a new style of incubator for hatching nature's eggs.

In popular discussion two things are mixed up in Einsteinism as if they belonged to it, but they do not. One of these is the prediction that space and time will have an end. This is nothing new. It is a philosophical deduct of long standing that whatever has a beginning is finite, and must have a boundary and an ending; and that space and time which began with creation will cease to be when created things become non-existent. The other is a scientific derivative from the electronic theory, and preceded Einstein by a

number of years. That theory changed the definition of mass from 'quantity of matter' in a body to 'quantity of force' in a body. The matter in a body is its mass or force in statu; the motion of a body is its mass or force in motu. Matter and motion together constitute the mass of a body and each is force with a modal difference. Mass and inertia are one and the same thing to which different names are given when differently apprehended.

This was all worked out physically before the time of Einstein and is no part of Einsteinism. If wonderful, it is a wonder of physical discovery and not a marvel of psychical geometry.

A peculiar feature of Einsteinism is that the crux of its doctrines is deeply submerged in mathematical obscurity. If one asks for proof he is told that it lies in mathematical profundities, quite beyond the reach of anyone other than an adept; and the unintelligible character of Einstein literature fully sustains the statement. Now the English language, with its rich vocabulary, direct idiom, and classic verbal quarries, is quite capable of expressing anything that has a meaning, and of rounding out the proof of any statement that admits proof. To understanding it is a wide open Bible; and cloistered secrets doled out by initiates for aweing the credulous are unnecessary. Proofs that vest in mathematical cryptograms are dubious. Mathematicians choose their own assumptions and, according to the assumption taken, they can prove that truth is truth; or falsehood is falsehood, or truth is falsehood, or falsehood is truth, with equal facility. Mathematics supplied cranks, cycles, and epicycles to Ptolemaic astronomy just as readily as it supplied ellipses, parabolas, and hyperbolas to Copernican. Cryptogramists follow rules of interpretation and have but slight regard for rules of philosophic sense.

A mathematician can only be trusted as far as he can be seen, or objectively checked up. Unlike space but quite like that of a political conscience, the mathematic psychology warps and twists in quaintest fashion to attain an end when left to its own devices. According to Einstein device, Space and Time are inseparable from matter. 'Space and Time determinations will henceforth be inseparably connected with matter and will have meaning only when connected with it.' (Schlick, page 4.) 'Time and Space can be dissociated from matter only by abstraction, i.e., mentally; the combination or oneness of space, time, and things is alone reality; each by itself is an abstraction' (a mental figment). (Schlick, page 6.) 'In this way Space and Time are deprived of the last vestige of physical objectivity, to use Einstein's words.' (Schlick, page 53.) 'Exactly so; Space is an abstraction of the extensional relations of matter.' (Eddington, page 8.) What matter has extensional relations with, is not stated; if it be with other matter, the thing that sustains the relationship is not stated; and you may find out if you can, but not from Einsteinism.

Since Space and Time as thus stated are mental investitures of matter, a bunch of it when moving must either take its space and time along with it as personal property, like clothes, color, or shape; or else find it as a place

endowment wherever it goes. We would much like to know whether space is regarded as the mental baggage of travelling matter, or is an omnipresent mental continuum which forms a 'oneness' with matter wherever the matter happens to be. We are not told which it is because that would resolve a psychologic mystery that can be handily employed in discussion. It is sometimes convenient to take it one way and sometimes the other.

The matter in other stars is assumed to be rather similar to that of the earth; but it is bunched together quite differently; and that would create different kinds of space and time. That presents no difficulty, however, because 'there are different kinds of possible space to choose from, no one of which can be regarded more likely than any other.' (Eddington, page 15.) The difficulty becomes serious, however, if it be true that space and time are purely mental determinations. Indeed it becomes an open question whether or not the stars have any space or time worth mentioning. Our mental determination of Arcturian space is restricted to a point; and unless there be a developed mentality in Arcturus, or somewhere else, the poor star has no space other than a point, and no time other than what is marked by star drift. Moreover, if there be any system of physics in Arcturus, it must be quite different from ours, unless the Arcturians have minds like ours, for, according to Eddington, as previously quoted, 'the laws of nature . . . have their origin, not in any special mechanism of nature, but in the workings of the mind.'

The vice of Einsteinism is that it transfers sense deception from ordinary things which check it up, to space, time, motion, and energy, which do not check it up, because their nature is ultra to experience.

From a puny bunch of relativity as psychologically impressed on differently conditioned observers, a mathematical explosive has been prepared for deranging established foundations of thought. A petty scheme of psychalized relativity is given as interpretative of a grand world universe filled with objective relativities that have not as yet been psychalized. Its nature is purely subjective and sophistical.— Q. E. D."[2137]

There were many others who publicly opposed Einstein, the theory of relativity, and the deception of the general public by the pro-Einstein press on similar grounds, including: Adler,[2138] Weinmann,[2139] Mohorovičić,[2140] Bergson,[2141] Guillaume,[2142] Patschke,[2143] Dingle,[2144] Dingler,[2145] Strasser,[2146] Guggenheimer,[2147] Lynch,[2148] Mackaye,[2149] Nordenson,[2150] Essen,[2151] Theimer,[2152] Gut,[2153] etc. Early bibliographies appear in Gehrcke's *Kritik der Relativitätstheorie*, Hermann Meusser, Berlin, (1924), pp. 95-98; and in H. Israel, *et al.*, editors., *Hundert Autoren Gegen Einstein*, R. Voigtländer, Leipzig, (1931), pp. 75-78.

In 1922, Stjepan Mohorovičić acknowledged what Albert Einstein did not,

"I must point out what is little known, that the French physicist H. Poincaré had already called attention to the fact that the Lorentz Transformations form a group, he had already shown in 1900 (therefore 5 years before Einstein)

> [*Footnote:* See the book, which is cited in note 22 {M. Abraham, *Theorie der Elektrizität*, Volume 2, Fourth Edition, Leipzig, Berlin, 1920}, S. 359. It appears that Poincaré did not mention Einstien even once in his lecture '*The New Mechanics*' (Leipzig, Berlin, 1911) for this reason.], how one can set clocks by means of light signals to Lorentz' local time. [***] Therefore we must understand the method of signaling (which, as we have stressed, H. Poincaré had already applied in 1900) only as an interpretation of Lorentz' formulas."

> "Ich muß darauf hinweisen, was weniger bekannt ist, daß schon der französische Physiker H. Poincaré darauf aufmerksam gemacht hat, *daß die Lorentzschen Transformationen eine Gruppe bilden*; er hat schon 1900 (also 5 Jahre vor Einstein) gezeigt [*Footnote:* Siehe das Buch, welches in Anmerkung 22 zitiert ist {M. Abraham, *Theorie der Elektrizität*. II. Bd. 4. Aufl. Leizig-Berlin 1920}, S. 359. Es scheint, daß deswegen Poincaré in seinem Vortrage »*Die neue Mechanik*« (Leipzig-Berlin 1911) Einstein nicht einmal erwähnt.], wie man die Uhren mittels der Lichtsignale auf die Lorentzsche Ortszeit richten kann. [***] [D]eswegen müssen wir die Methode der Signalisierung (welche — wie wir betont haben — schon H. Poincaré 1900 aufgebracht hat), nur als eine Interpretation der Lorentzschen Formeln auffassen[29]).'"[2154]

Stjepan Mohorovičić acknowledged Poincaré's priority for realizing that the Lorentz Transformations form a group. Mohorovičić cites Max Abraham's acknowledgment of Poincaré's priority for the clock synchronization method with light signals,[2155] and asserts that Poincaré did not mention Einstein even once in his lecture *Die neue Mechanik* (*La mécanique nouvelle = The New Mechanics*),[2156] because Einstein had plagiarized Poincaré's method of synchronizing clocks with light signals, which method is but an interpretation of Lorentz' "Ortszeit", and Poincaré's assertion of the group properties of the Lorentz Transformation.[2157]

Felix Klein had made similar assertions in a private letter to Wolfgang Pauli on 8 March 1921, that Poincaré was the first to recognize that the Lorentz Transformations form a group and that Poincaré felt an animosity towards Einstein, and this was the only explanation for the fact that Poincaré snubbed Einstein in Poincaré's Göttingen lecture on the new mechanics. Klein wrote,

> "Es ist nun doch einmal so, daß Poincarés erste Note in den Comptes Rendus 140 vor Einstein liegt und er im Anschluß daran (in den Rendiconti di Palermo) zuerst zeigte, daß es sich bei Lorentz um eine *Gruppe* von Transformationen handele. Von da aus ein Gegensatz, der allein es verständlich macht, daß P[oincaré] 1911 in seinem Göttinger Vortrag „sur la nouvelle mécanique" den Namen Einstein überhaupt nicht nennt."[2158]

Poincaré's silence also caught the attention of Max Born, who stated,

> "One of these series of lectures was given by Henri Poincare, April 22nd-28th 1909[.] The sixth lecture had the title 'La mécanique nouvelle.' It is a popular account of the theory of relativity without any formulae and with very few quotations. EINSTEIN and MINKOWSKI are not mentioned at all, only MICHELSON, ABRAHAM and LORENTZ. But the reasoning used by POINCARÉ was just that, which EINSTEIN introduced in his first paper of 1905, of which I shall speak presently. Does this mean that POINCARÉ knew all this before EINSTEIN? It is possible, but the strange thing is that this lecture definitely gives you the impression that he is recording LORENTZ' work."[2159]

Arvid Reuterdahl also was aware that Poincaré resented Einstein,

> "Professor Henri Poincaré, the famous French physicist and mathematician, advisedly ignores the name of Einstein in his lectures on 'Relativity'."[2160]

And Johannes Riem reiterated the fact,

> "Neben dieser Aufklärung durch die Presse ging dann eine wissenschaftliche Bekämpfung Einsteins, vor allem durch den Mathematiker und Ingenieur *Reuterdahl* am St. Thomas College, der selbst schon *vor* Einstein über Relativität gearbeitet und Einstein zu einer öffentlichen Aussprache aufgefordert hat, bei der dieser das Richterscheinen vorzog. Reuterdahl hat eine kleine leicht lesbare Broschüre im Journal seines College erscheinen lassen „Einstein und die neue Wissenschaft". Hierin untersucht er physikalisch die Grundlagen der neuen Lehre. Er zeigt seinen Landsleuten, wie schon lange vor Einstein zahlreiche Gelehrte das Richtige der Relativitätstheorie gefunden und diesem als Quelle gedient haben, ohne daß dieser auf diese seine Vorgänger hinwiese, so daß es ganz falsch ist, die Relativitätstheorie immer auf Einstein zurückzuführen, wie dies meist geschieht. Es ist dies so wenig berechtigt, daß z. B. Poincaré in seinen Vorlesungen über Relativität Einstein überhaupt nicht erwähnt. Quellenmäßig wird dann von Reuterdahl gezeigt, wie bedeutende Gelehrte die Einsteinsche Fassung der Relativitätstheorie als falsch bekämpfen und ganz andere Ueberlegungen and die Stelle setzen, wie *Lenard*, *Gehrcke*, *Fricke*, *Mewes* es tun. Endlich untersucht er das Einsteinsche Gebäude selbst auf seine Zusammensetzung, seine Grundlagen und Haltbarkeit, und findet, daß es ein Spiel mit Worten und Begriffen ist, denen in der Physik nichts tatsächliches entspricht. Es wäre sehr lohnend, die kleine Schrift von 26 Seiten zu übersetzen."[2161]

Alexander Moszkowski was very confused by the letter of recommendation Poincaré allegedly wrote for Einstein in 1911—which letter makes no mention of the theory of relativity.[2162] Moszkowski saw this as a reversal of the animosity Poincaré demonstrated towards Einstein in Berlin in 1910. Moszkowski wrote in 1921, describing his belief that Poincaré had come to recognize the "lasting importance of

Einstein's researches[,]" and had overcome any doubts about the accumulating number of hypotheses in the new mechanics,

> "On the 13th October 1910 a memorable event took place in the Berlin Scientific Association: Henri Poincaré, the eminent physicist and mathematician, had been announced to give a lecture in the rooms of the institute 'Urania'; an audience of rather meagre dimensions assembled. [***] It was at this lecture that we heard the name Albert Einstein pronounced for the first time. Poincaré's address was on the New Mechanics [***] At that time, early in 1916, only a few members of the Literary Society divined who it was that was enjoying their hospitality. In the eyes of Berlin, Einstein's star was beginning its upward course, but was still too near the horizon to be visible generally. My own vision, sharpened by the French lecture and by a friend who was a physicist, anticipated events, and already saw Einstein's star zenith, although I was not even aware at that time that Poincaré had in the meantime overcome his doubts and had fully recognized the lasting importance of Einstein's researches."[2163]

Poincaré did not mention Einstein in his lecture and Moszkowski must have heard Einstein's name from his friend. Poincaré's resentment of Einstein had nothing to do with the *ad hoc* hypotheses of the new mechanics, which he attributed to Lorentz, but was instead purely a product of Einstein's plagiarism, which fact was acknowledged by the experts Felix Klein and Stjepan Mohorovičić.

Moszkowski was simply lying to his reading audience. He knew quite well that Poincaré, himself, was the father of the new mechanics and that Einstein had plagiarized it from Poincaré, though in 1904, Poincaré had generously attributed the "new mechanics" to Lorentz, before the Einsteins had published on the subject. Poincaré famously stated in 1904,

> "From all these results, if they are confirmed, would arise an entirely new mechanics, which would be, above all, characterised by this fact, that no velocity could surpass that of light, any more than any temperature could fall below the zero absolute, because bodies would oppose an increasing inertia to the causes, which would tend to accelerate their motion; and this inertia would become infinite when one approached the velocity of light."[2164]

Moszkowski failed to emphasize the fact, which was known to him, that Poincaré was himself the father of this new mechanics and had coined the term in 1904. Poincaré did object to the growing number of *ad hoc* hypotheses, but Poincaré nevertheless created the special theory of relativity, and the Einsteins plagiarized the theory from him. The fact that Poincaré was aware of the fatal flaws in the theory, while the Einsteins irrationally pretended them away by deliberately confusing induction with deduction, does not change the fact that Poincaré created the theory and the Einsteins copied it directly from him. This proves that the Einsteins were not only opportunistic plagiarists, but that they were also incompetent and dishonest

scientists.

Moszkowski wrote,

> "For the theory asks us to brush aside habits of thought that have claimed an hereditary position in pre-eminent minds. One of the foremost physicists, Henri Poincaré, had confessed as late as 1910 that it caused him the greatest effort to find his way into Einstein's new mechanics. Another whole year passed before he gave up his last doubts. Then he passed with flying colours into Einstein's camp, and recommended Einstein's appointment to the Professorship at Zürich, in conjunction with the discoverer of radium, Madame Curie, in an exuberant letter which may add its note of appreciation here:
>
> 'Herr Einstein,' so wrote the great Poincaré, 'is one of the most original minds that I have ever met. In spite of his youth he already occupies a very honourable position among the foremost savants of his time. What we marvel at in him, above all, is the ease with which he adjusts himself to new conceptions and draws all possible deductions from them. He does not cling tightly to classical principles, but sees all conceivable possibilities when he is confronted with a physical problem. In his mind this becomes transformed into an anticipation of new phenomena that may some day be verified in actual experience. . . . The future will give more and more proofs of the merits of Herr Einstein, and the University that succeeds in attaching him to itself may be certain that it will derive honour from its connexion with the young master.'"

Moszkowski simply lied when he claimed that Poincaré had a difficult time understanding the theory Poincaré himself had created. Moszkowski simply lied when he attributed the theory Henri Poincaré had created to his plagiarist friend, who promised to make him rich, Albert Einstein.

A letter of recommendation would have been a matter of course and found no counterpart in Poincaré's published works. This alleged recommendation of Einstein was never met with public or private praise in the context of the theory of relativity, and it was Poincaré's nature to give such praise, which he so lavished on an undeserving Lorentz at every opportunity. Moszkowski made no such attack on Poincaré until after Poincaré had died and Moszkowski, who was a career sycophant, had made it his life's work to promote Einstein as a cult figure and in so doing promote himself and make his fortune. Alexander Moszkowski was biased and sought desperately to promote Einstein to the public. He wrote to Albert Einstein on 1 February 1917,

> "Regardless of what happens, I would like to continue the 'cult'; for you it is secondary, for me it is of paramount importance in life. Additionally, I have the encouraging feeling that, with my modest writing abilities, I may also serve the cause once in a while."[2165]

We know that Moszkowski's book of 1921 was deliberately deceitful, because he expressed very different feelings towards Poincaré in 1916 and 1917.[2166] Moszkowski's more immediate impression of Poincaré's lecture, in 1911, is on record,

> "Am humansten verfährt eigentlich noch Henri Poincaré, und unter den Büchern mit sieben Siegeln, die er sonst zu schreiben pflegt, ist seine Schrift über „Die neue Mechanik" noch das offenste. Anstatt von vornherein mit dem Geschütz unheimlicher Differentialgleichungen vorzurücken, vermenschlicht er die Aufgabe durch Einführung jenes Beobachters „Lumen", der uns zuerst von Camille Flammarion vorgestellt worden ist. Mit diesem Lumen, „wie ich ihn sehe" wollen wir uns zunächst ein wenig beschäftigen."[2167]

Though much has been made of Einstein's allegedly kinematic versus Poincaré's allegedly dynamic expositions of length contraction, which some assert indicates that Poincaré failed to understand the special theory of relativity, the facts are that Poincaré originated Einstein's plagiarized "kinematic" descriptions of length contraction and Poincaré went further by attempting a dynamic exposition of length contraction. This proves that Poincaré was the greater mind of the two, with the greater insight into the problem. Physics, as opposed to purely illustrative abstraction, compels a dynamic explanation for the physical dynamic interactions of matter in relative motion. To speak in terms of space and time without referring to physical bodies is scientifically meaningless.

It was Poincaré who first provided the quadri-dimensional exposition of length contraction, which Minkowski adopted, and which Einstein opposed for some time, and further which is truly the modern method of the theory of relativity as a mathematical formalism—a method of exposition which Einstein failed to understand for years, then when Minkowski published it in a form Einstein could almost understand, Einstein still opposed it for many years. Poincaré provided the conventionalist pseudo-kinematic exposition, the operational procedure and the space-time definition of length contraction, before Einstein and Minkowski manipulated credit for his ideas; and in 1909 Mittag-Leffler wrote to Poincaré that Ivar Fredholm recognized Poincaré's priority.[2168] The fact that Poincaré actually attempted to interject Physics back into this mathematical formalism, Metaphysics, conventionalism and operationalism, does not eradicate his proven priority for the rest of the theory, nor would a change of mind erase what he had once stated from the historic record or the minds of the plagiarists.

Those who deny Poincaré's priority based on perceived flaws in his theories which allegedly do not render the "perfect" theory of special relativity, *i. e.* the Einsteins' "two postulate" fallacy of *Petitio Principii*, do not deny Einstein's priority even when it is pointed out to them that the Einsteins' 1905 paper is not the modern form of the theory and contains numerous mistakes. These apologists for Einstein operate on a double standard. They also fail to realize that the special theory of relativity is an evolving theory and has yet to be perfected, and no arbitrary point can

be selected along this evolution and legitimately be called the first publication of the special theory of relativity.

Long before Einstein, Poincaré recognized the group properties of the Lorentz Transformation, perhaps as early as 1904, and wrote to Lorentz about his findings in a letter which is reproduced in Arthur I. Miller's *Albert Einstein's Special Theory of Relativity: Emergence (1905) and Early Interpretation, 1905-1911*, Addison-Wesley, Reading, Massachusetts, (1981), p. 81. Poincaré almost certainly wrote to the Einsteins, because it is highly doubtful that the Einsteins knew what a group was. Poincaré published this mathematical discovery in the *Comptes Rendus* on 5 June 1905 before the Einsteins had submitted their paper to the *Annalen der Physik*, and long before the final paper of the Einsteins was published—perhaps published with modifications. It was ludicrous for Moszkowski to claim that Poincaré failed to grasp what he had created and what Albert Einstein had openly opposed.

Olivier Darrigol stated in 1996,

> "The physicist-historian and the philosopher-historian usually argue that Einstein's new kinematics was an extremely important innovation that overthrew previous physical and philosophical concepts of time; and they tend to interpret Poincaré's, Lorentz's, and others' fidelity to the ether as a failure to understand Einstein's superior point of view. On the contrary, the social historian would argue that in 1905 Einstein's relativity had no stabilized meaning, that it could be read and used in various manners depending on the receiving local culture, and that it acquired a precise meaning only at the end of a complex, social structuring process."[2169]

In 1922, Ludwig Lange, who had fought so hard for so long against so many, sought, without success, for acknowledgment of his parentage of the inertial system concept, which he published some twenty years before the Einsteins' absolutism. Lange wrote, *inter alia*,

> "Als ich 1886 meine fünf Jahre lang fortgesetzen Forschungen über den Bewegungsbegriff abgeschlossen, in denen ich die relativistische Weiterentwicklung richtig vorausgesagt, im wesentlichen so, wie sie seitdem sich vollzogen hat, da harrte ich mit große Spannung, aber jahrelang vergeblich auf die werktätige Teilnahme der Physikerwelt. [***] Als ich nunmehr 1902 in der *Wundt-Festschrift* meine Revision des Systems der Inertialbegriffe herausgebracht hatte, überkam mich ein wohltuendes Gefühl der Befreiung, wie ich mir denke, daß es einer umfassenden und dabei nicht im mindesten zerknirschten Beichte auch sonst folgen mag. Von diesem Zeitpunkt an mußten aber immer noch drei weitere Jahre verstreichen, ehe mit Albert Einstein eine Denkrichtung unter den Physikern sich Bahn zu brechen begann, welche, wenn auch nur indirekt, auf verwandten Gedankengängen aufzubauen unternahm, und ein viertes Jahr mußte hinzukommen, bis H. v. Seeliger (1906) in der Astronomie meine Nomenklatur „Inertialsystem" mit dem erfolg einführte, daß sie sich seitdem

> bei seinen Fachgenossen nahezu völligdurchgesetz zu haben scheint, während in der Physikfreilich erst die Ansätze dazu wahrzunehmen sind; denn Einstein selber und sein Anhang sträuben sich aus unverständlichen Gründen immer noch dagegen, eine so bequeme und charakteristische Bezeichnungsweise anzuwenden. Nun, die Zeit wird kommen, wo man mich als den Vater jener Nomenklatur und als den sorgfältigen Analysator des Sprachgebrauches der Mechanik, der die Wichtigkeit der relativistischen Richtung für die Physik besonders früh erkannte, nach Verdienst schätzen wird."[2170]

Friedrich Kottler, author of *Gravitation und Relativitätstheorie*[2171] in 1903, revealed on March 31st, 1922, through the prestigious, widely read and well-respected *Encyklopädie der mathematischen Wissenschaften*,

> "*H. Poincaré,* Palermo Rend. Circ. Math. 21 (1906), p. 129-175, especially p. 175, Formula (14). — This work of *Poincaré's* is dated July 23, 1905 and is the elaboration of a memorandum by the same title in the Parisian C. R. 140 (June 5, 1905), pp. 1504-8. The 'postulate' of relativity was enunciated here for the first time, *before Einstein*."

> "*H. Poincaré,* Palermo Rend. Circ. Math. 21 (1906), p. 129-175, insbes. p. 175, Formel (14). — Diese Arbeit *Poincaré*s stammt vom 23. Juli 1905 und ist die Ausarbeit einer Note gleichen Titels aus den Paris C. R. 140 (5. Juni 1905), p. 1504-8. Hier wurde zum erstenmal, *vor Einstein*, das „Postulat" der Relativität ausgesprochen."[2172]

In 1923, Einstein's plagiarism became an international scandal, and some called for the revocation of his Nobel Prize. Thomas Jefferson Jackson See made a statement on 12 April 1923 picked up by the Associated Press and published in *The New York Times*,

> "Professor Westin charges Einstein with downright plagiarism, saying:
> 'From these facts the conclusion seems inevitable that Einstein cannot be regarded as a scientist of real note. He is not an honest investigator.' Thus Westin protested to the Directorate of the Nobel Foundation against the reward of Einstein."[2173]

T. J. J. See published numerous articles accusing Albert Einstein of plagiarism.[2174]

See's quote originates from Arvid Reuterdahl's article in *The Dearborn Independent* of 6 January 1923, in which Reuterdahl gives the fuller translation,

> "From these facts the conclusions seem inevitable that Einstein cannot be regarded as a scientist of real note; that he is not an honest investigator; and that no valid reason can be assigned for awarding him the Nobel premium. It behooves the Nobel directorate carefully to examine all the charges of

> plagiarism made against him before taking an irrevocable step which later may be regretted."

In 1923, Arvid Reuterdahl published two long letters in *The New York Times* spelling out the case against Einstein and declared,

> "No unprejudiced person can deny that, in the absence of direct and incontrovertible proofs establishing his innocence, Einstein must, in view of the circumstantial evidence previously presented, stand convicted before the world as a plagiarist."[2175]

Reuterdahl also published numerous articles accusing Einstein of plagiarism, the plagiarism of Reuterdahl's works, as well as those of others.[2176] Reuterdahl challenged Einstein to a debate over his priority and the soundness of the theory of relativity.[2177] Reuterdahl's challenge was heavily covered by the international press at the time. Einstein refused to accept the challenge.[2178]

Reuterdahl made public the priority of Johann Heinrich (aka J. Henri) Ziegler over Einstein. Ziegler lectured in Switzerland while Einstein lived there and while Einstein was developing his copy of Lorentz' theory. Ziegler asserted his priority over Einstein and accused Einstein of plagiarizing his work,

> "Now if it was already suspicious that the antedated 'hypothesis' of the constancy of the speed of light appears in Einstein's theory, then the new Einsteinian discovery of the replacement of the nonsensical æther by the integral primal atom of light and empty space must now appear to us beyond any doubt as an instance of plagiarism, though admittedly based on poor understanding. One can compare the premature, purely mathematical plagiarism to the copying of a Raphael painting by a modern cubist, where only the sharpest eye is still able to discover the resemblance with the original, but in the present case it was an attempt at an exact copy by a dull-witted incompetent."

> "War nun schon jene „Annahme" von der Konstanz der Lichtgeschwindigkeit in Einstein's Theorie verdächtig, so muß uns jetzt die neue Einstein'sche Entdeckung von der Ersetzbarkeit des sinnlosen Äthers durch die vollen Urlichtatome und den leeren Raum als ein ganz zweifelloses Plagiat erscheinen, aber allerdings als ein immer noch schlecht verstandenes. Das frühere, rein mathematische Plagiat kann man mit der Kopie eines Raphael'schen Gemäldes durch einen modernen Kubisten vergleichen, bei der nur schärfste Auge noch eine Ähnlichkeit mit dem Original zu entdecken vermag, das jetzige dagegen gleicht bereits einer gut gemeinten Kopie durch einen Stümper."[2179]

In 1927, Hans Thirring wrote,

"H. Poincaré had already completely solved the problem of time several years before the appearance of Einstein's first work (1905). Beginning with an article in Revue de Métaphysique et de Morale which appeared in 1898 (later reprinted in his book 'The Value of Science' as a chapter on the concept of time), Poincaré settled the general problem of time from the physical standpoint and had already there referred to the fact that the principle of the constancy of the velocity of light serves as a basis for a definition of time. Poincaré, in his work 'La Théorie de Lorentz et le Principe de Réaction' [*Relevant citations and quotations found in endnote*[2180]], then defined Lorentz' local time (Fig. 23) as time, which time is to be measured with clocks synchronized by light signals."

"Die Klärung des Zeitproblems war schon mehrere Jahre vor dem Erscheinen von EINSTEINS grundlegender Arbeit (1905) durch H. POINCARÉ weitgehend vorbereitet worden. Dieser hatte zunächst in einem im Jahre 1898 in der Revue de Métaphysique et de Morale erscheinenen (später als Kapitel über den Begriff der Zeit in seinem Buche „Der Wert der Wissenschaft" abgedruckten) Artikel das allgemeine Zeitproblem vom physikalischen Standpunkt aus behandelt und hatte dort schon erwähnt, daß sich auf den Satz von der Konstanz der Lichtgeschwindigkeit eine Zeitdefinition gründen läßt. Er hat dann in einer Arbeit „La Théorie de LORENTZ et le principe de réaction" (Arch. Néerland. (2) Bd. 5. 1900, Lorentz-Festschrift) die LORENTZsche Ortszeit (Ziff. 23) als die Zeit definiert, die durch mit Lichtsignalen synchronisierte Uhren gemessen wird."[2181]

On 7 February 1928, *The New York Times* reported on page 26,

"If [EINSTEIN] is the father of relativity, then LORENTZ is its grandfather."

In 1929, Robert P. Richardson published an extensive article on Einstein's plagiarism in *The Monist*, a publication famous for publishing the works of Mach, Hilbert, Poincaré, and others, from whom Einstein plagiarized,

"Thus, with what is known as the special theory, if we consider as paramount factor not the detail work but the guiding thoughts by which this was inspired, then the father of this special relativity theory was undoubtedly Henri Poincaré. [***] In the general theory of relativity the basic thought is that of Mach, *viz.* the replacement in dynamics of the law of gravitation by a law of motion. But in what Einstein built upon this basis the influence of Poincaré is again manifest. [***] And in view of all these facts one does not know at which to be most astounded: the magnanimity of Poincaré who was always over-anxious that there should be recognition of the labors of those who reaped where he himself had sown, the apathy of his friends after his death, or the peculiar attitude of Einstein and his coterie, exemplified by Born of Goettingen, who refers to Poincaré as one of those who

'collaborated' with Einstein in the development of the relativity theory!"[2182]

Similar remarks are found in the writings of Haiser and Zettl.[2183]

Accusations of plagiarism plagued Einstein throughout his career. *The New York Times* reported on 27 March 1931 on page 2 that Ira D. Edwards had attempted to sue Einstein for plagiarizing his book, which he had copyrighted in 1929. The *Times* reported that the suit was dismissed. It is difficult to prove accusations of plagiarism in a court of law, especially a specific instance of plagiarism, as opposed to a career-long pattern. This may be one reason why more individuals did not speak out against the plagiarist Einstein. They risked a defamation suit.

The *Dictionary of Scientific Biography*, in its article on Lorentz, states,

> "Einstein's 1905 special relativity paper provided Lorentz' theory with a physical reinterpretation. [***] Einstein deduced the Lorentz transformations and other results that had first been made known through Lorentz' and others' electron theories. [***] Lorentz admired, but never embraced, Einstein's 1905 reinterpretation of the equations of his electron theory. The observable consequences of his and Einstein's interpretations were the same, and he regarded the choice between them as a matter of taste. [***] Lorentz, and Einstein too, regarded the physical space of general relativity as essentially fulfilling the role of the ether of the older electron theory."[2184]

This statement is very significant. It reveals that the ultimate "fiction" (Vaihinger's sense of the term in his *Die Philosophie des Als Ob*) of both Lorentz' and the Einsteins' theories is the same, with any distinctions between the two theories being *metaphysical* (truly just semantic) and not *scientific*—the theories make the same predictions; and are, therefore, *scientifically speaking*, indistinguishable. The Einsteins' theory is a quasi-positivistic mathematical analysis of Lorentz' synthetic physical theory—a "dimensional disguise" for it.[2185] Albert Einstein did not grasp the distinction between Metaphysics and science. He stated in 1930 that, "Science itself is metaphysics."[2186]

In this context, Hendrik B. G. Casimir stated,

> "How[ever] brilliant Einstein's conception may have been, the quantitative treatment and the accompanying concretisation of the atomic concept [by Lorentz] proved to be a greater and as to its consequences more important occurrence."[2187]

Einstein hid from the many accusations that his theory was metaphysical nonsense—an inconsistent jumble of fallacies of *Petitio Principii*—nothing but an excuse to plagiarize. Einstein conceded that he was overrated as a physicist, and that the cult of personality surrounding him was unjustified.[2188] Einstein stated in 1921,

> "The cult of individuals is always, in my view, unjustified. To be sure, nature distributes her gifts unevenly among her children. But there are plenty of the

> well-endowed, thank God, and I am firmly convinced that most of them live quiet, unobtrusive lives. It strikes me as unfair, and even in bad taste, to select a few of them for boundless admiration, attributing superhuman powers of mind and character to them. This has been my fate, and the contrast between the popular estimate of my powers and achievements and the reality is simply grotesque."[2189]

A meeting was arranged to discuss Vaihinger's theory of fictions in 1920, and Einstein pledged that he would attend this meeting. Knowing that Einstein would be devoured in a debate over his mathematical fictions, which confused induction with deduction, Wertheimer and Ehrenfest helped Einstein fabricate an excuse to miss the meeting he had agreed to attend. Einstein was proven a liar.[2190] He also hid from many other criticisms, and Einstein refused to answer T. J. J. See's many charges of plagiarism,[2191] and refused to debate Reuterdahl or to answer his many charges of plagiarism.[2192] When Robert Drill[2193] criticized the theory of relativity, Einstein tried to persuade Max Born and Moritz Schlick to not respond to the critique, but if they did so, to hide from his arguments and merely ridicule Drill with insults.[2194] Einstein hid from the French Academy of Sciences.[2195] Einstein hid from Cardinal O'Connell.[2196] Einstein hid from Dayton C. Miller's falsification of the special theory of relativity.[2197] Einstein hid from Cartmel.[2198] Miller hammered Einstein in the press over the course of many years. *The New York Times Index* lists several articles in which Miller's and William B. Cartmels' falsifications of the special theory of relativity are discussed.[2199] Einstein and Lorentz were very worried by Miller's results and could not find fault with them.[2200] Einstein told R. S. Shankland not to perform an experiment which might falsify the special theory of relativity,

> "[Einstein] again said that more experiments were not necessary, and results such as Synge might find would be 'irrelevant.' [Einstein] told me not to do any experiments of this kind."[2201]

Einstein knew he was caught at the Arbeitsgemeinschaft deutscher Naturforscher meeting in the Berlin Philharmonic, and wanted to run away from Germany. Einstein desired to hide from the Bad Nauheim debate, in which he had threatened to devour his opponents,[2202] then Einstein—after being talked into appearing and after much hype promoting the event which attracted thousand of visitors—then Einstein, when losing the debate, ran away during the lunch break and again wanted to run away from Germany.[2203] Einstein prospered from hype and had no legitimacy as a supposed "genius". The press rescued him again and again, while he hid. Einstein was unable to defend "his" theories in the light of strict scrutiny.

T. J. J. See wrote in *The San Francisco Journal*, on 13 May 1923, in an article entitled, "Einstein a Second Dr. Cook?":

> "THE Magazine and newspaper press for the last eight years has been so filled with systematic propaganda, undoubtedly organized and directed by Einstein and his agents, that the public has become

familiar with the name of Einstein and with the phrase 'Theory of Relativity'. Not one lay person in a thousand has any idea what this all means; and as the people do not understand it, the phrases are passed on in joke, or assumed to represent something important in the higher lines of physical science. It is well known that about six years ago Einstein tried to cast a halo of glory about his head by allowing the report to go forth that not over twelve mathematicians in the world could understand his benighted theory of relativity. Of course this is preposterous, and nobody knows it better than Einstein himself. [***] In short, I have at length become convinced that Einstein is a faker, with considerable skill in deceiving the the press and public, so as to ding-dong into the unthinking the idea that he is a great mathematician and philosopher, who is improving on Newton. Let us first notice the errors of Einstein, and the cunning way in which he gets away from them, owing to the layman's inability to pin him down."

T. J. J. See wrote in *The San Francisco Journal*, on 20 May 1923,

"No doubt is entertained by leading German physicists—like Professor Dr. E. Gehrcke, director of the Imperial Physical and Technical Institute of Berlin, and Dr. P. Lenard of Heidelberg, winner of the Nobel Prize in physics—that Einstein appropriated improperly the Newton-Soldner formula published 122 years before. Let the Einstein shouters explain these embarrassing coincidences if they can!

These unprofessional proceedings of Einstein have been a scandal in Europe for some time. The discussion rages all over Germany and, in fact, all over Europe. The revolt against Einstein extends from Spain to Russia, from Sweden to Italy. The learned and honored Professor Dr. Westin of Stockholm protested to the Nobel Foundation against any recognition of Einstein, accusing him of downright plagiarism, saying:

'From these facts the conclusion seems inevitable that Einstein cannot be regarded as a scientist of real note; he is not an honest investigator.'

To the present day, be it said to the honor of the Royal Swedish Academy of Sciences, they refused Einstein any recognition on the theory of relativity. Is it any wonder that the Paris Academy of Sciences (October 14, 1921) came out with conspicuous proclamations by Professors Picard and Painleve against Einsteinism, and in favor of Newtonian mechanics? It was near this time that Einstein visited Paris and sought to have the academy invite him to address the institute, though not a member of it. As this proposed proceeding was unprecedented, half a dozen leading academicians served notice on the officials of the institute that they would not have it, threatening to resign if the invitation were extended to Einstein. This put a stop to the display of Einstein planned for Paris. In fact, his reception there seems to have been quite a frost. The French are careful of the dignity of the Academy of Sciences, and in this respect they set a much better example than the Royal Society of London, which early championed Einsteinism and now is sorry for it."

T. J. J. See wrote in *The San Francisco Journal*, on 27 May 1923, in an article entitled, "Einstein a Trickster?"

> "When the Lick eclipse work was reported to [Einstein], with my criticism, April 12, 1923, he admitted to the correspondent, Karl H. von Wiegand, April 14, 1923, that:
>
> 'In so far as precise measurement is concerned, Captain See may be said to be correct in denying that the tests proved the theory of relativity. But, he pointed out, under more favorable circumstances, even this might be removed.'
>
> 'Einstein said he was not worried by the attack of Captain See, but would leave it to the scientific world to settle the matter. It the fate of all scientists to arouse antagonism by revolutionary theories.' So feeble is [Einstein's] defense.
>
> As I had recalled the charges of plagiarism made against him by Gehrcke, Leonard and Westin, it will be seen that he does not answer these charges, but adroitly evades them. Thus it looks as if he has no defense and he wishes not to discuss it. The above statement of glittering generalities show the weakness of [Einstein's] case—a tacit admission that he has no answer, and thus he prudently keeps still, hoping the public will forget the charges. So far as I can tell from the careful study of the whole business Einstein is a faker. Apparently he belongs in the company of Dr. Cook of Polar exploration noise and notoriety."

William Cardinal O'Connell gave a speech on 7 April 1929, which attracted a great deal of attention. He stated, *inter alia*:

> "What does all this worked-up enthusiasm about Einstein mean? It evidently is a worked-up, fictitious enthusiasm, because I have never yet met a man who understood in the least what Einstein is driving at, and I have been so impressed by this fact I very seriously doubt that Einstein himself knows really what he means. Truth is always very clear when seen with a clear eye. The fact that any theory cannot be enunciated and only succeeds in befogging the mind, is a patent proof that it is not really truth. [***] [O]ne weakness of the American public is to run after novelties which have nothing in them but their newness. The American student body is very often misled into false channels of knowledge by the sudden appearance of these glittering meteors who from time to time shoot across the horizon. And then it seems there is some sort of organized clicque that boosts these sudden apparitions and as quickly disavows them and forgets them. [***] Now, for the moment, it is Einstein. Nobody knows what he is trying to reveal, but in a certain sense that adds mystery to his name[.] All this proves how careful the student youth must be in following this fanatical applause, which oftentimes is merely the outpouring of a sort of hero worship, but even as such can do endless harm to the impressionable mind of the young student."[2204]

Cardinal O'Connell wrote in the 12 April 1929 edition of the *Boston Evening American*,

> "I was rather amused the very next day to see by the Transcript that my opinion of Einstein's theory and purpose had been conveyed to Einstein himself—that not he, but Frau Einstein, said that Einstein did not wish to dispute with me about his theories and that my assertions left him cold. That struck me [***] as little convincing as his general attitude to all, even the greatest scientists of Europe and America, who face him from time to time with indisputable proof of the fact that his so-called new theory of relativity is not new at all, but that whatever there is in it of scientific value is nothing but a plagiarism of Von Soldner's system explaining the deflection of light published as far back as about 1810. [***] Again and again Einstein has been faced with what appears to be clear proofs of plagiarism and absolute philosophic sophistry by the best minds in Germany, and his only answer to them is what he now answers, 'he is indifferent—it leaves him cold.'"

The Vatican newspaper *Observatore Romano* praised Cardinal O'Connell's criticism of Einstein and the theory of relativity in an editorial on 23 May 1929.[2205]

Einstein's advocate, Albert von Brunn, boasted in 1931 that Einstein was not interested in "academic disputes" and presented this vice as if a virtue in order to excuse Einstein's inability to answer his critics. It was typical of the pattern of Einstein's apologists of turning Einstein's flaws into supposed virtues, his weaknesses into supposed strengths, through misguided heroic idolatry. Von Brunn wrote,

> "Some reasonable critics in philosophy and physics have allowed themselves to be called in among these 'authors', with whom relativist scientists need not, and actually also do not consider it beneath their dignity to cross swords. (Although Einstein himself, by nature a pure scientist, is uninterested in such academic disputes!)"[2206]

In 1931, Friedrich Jacob Kurt Geissler complained that Einstein had plagiarized his work on relativity theory, which included the relativity of time, space and simultaneity, and a relativistic analysis of mass, events and causality,

> "It is completely wrong, that the expression 'theory of relativity' or even 'relativity' is inseparably tied to the name 'Einstein', as the immoderate advertising has accomplished with the lay public and some scholars. Newton has already expounded a great deal upon the relative and the absolute in Mathematics and in Physics. Modern physicists, like E. Mach, whose work Einstein knows quite well and uses, have written about generalizing the concepts of relative space, relative time and motion (long before Einstein, 1865, 1901 'The Science of Mechanics; a Critical and Historical Account of Its Development' and later); Mansion (Paris 1863) holds that the notion of

> absolute motion is senseless and that the Ptolemaic and Copernican system are kinematically equally justified. Whereas Einstein first published something on relativity from 1905 on; I, myself, had already published an interdependent general 'feasible' theory of relativity in space, time, etc. in 1900; he, however, does not cite my book ('Eine mögliche Wesenserklärung. . .')."

> "Es ist grundverkehrt, den Ausdruck „Relativitätslehre" oder gar „Relativität" mit dem Namen „Einstein" als untrennbar zu kopulieren, wie es eine unmäßige Reklame beim Laienpublikum und einem Teil der Gelehrten fertig gebracht hat. Schon Newton spricht viel vom Relativen und Absoluten in der Mathematik und Physik. Moderne Physiker, wie E. Mach, den Einstein genau kennt und benutzt, haben über die Begriffe des relativen Raumes, der relativen Zeit und Bewegung verallgemeinernd geschrieben (längst vor Einstein, 1865, 1901 „Die Mechanik in ihrer Entwicklung" und später); Mansion (Paris 1863) hielt die absolute Bewegung für sinnlos und das Ptolemäische und Kopernikanische System für kinematisch gleichberechtigt. Eine zusammenhängende allgemeine „mögliche" Lehre der Relativität in Raum, Zeit usw. habe ich selbst schon 1900 veröffentlicht, während Einstein erst von 1905 ab einiges über Relativität veröffentlicht hat, mein Buch („Eine mögliche Wesenserklärung. . .") aber nicht anführt."[2207]

It is interesting to look for the source of the oft heard expression, "The Einstein Myth", which refers to the disingenuous glorification of Albert Einstein. The *Minneapolis Sunday Tribune* declared, on 10 April 1921, on page 11, that the "Einstein Theory of Relativity Is Branded Myth". Arvid Reuterdahl, a fine artist, produced a card which was distributed on the occasion of the "Albert Einstein Jubilee" at the Metropolitan Opera House in New York City on 16 April 1929 with a cartoon mockingly depicting a deified Einstein and his groveling sycophants, as well as a dignified dissenting physicist rejecting Einstein, on one side of the card, which declared on the other side,

> "Einstein's message to the audience, by the Associated Press from Berlin: 'YOU MEET TO CELEBRATE A MYTH BEARING MY NAME.' Comment by Dissenting Scientist: 'THE TRUEST WORDS THAT EINSTEIN EVER SAID.'"[2208]

On 27 November 1932, *The New York Times* published a letter by Melvin Green in section 2 on page 2 under the title, "The Einstein 'Myth.'" Melvin Green of Winchester, Virginia, wrote in his letter,

> "When I read some of Einstein's utterances, [***] and when I see all that he says taken as final absolute truth, I wonder whether we are not victims of an Einstein myth."

In 1979, Dean Turner and Richard Hazelett published a book exposing this myth, *The EINSTEIN Myth and the Ives Papers*.[2209] Who first referred to the "Einstein Myth" may never be known for certain, but what is certain is that the theories are mythological and Albert Einstein was a career plagiarist.

On 23 February 1929 *The New York Times* on page 15 quoted Robert Andrews Millikan on the source of Einstein's work,

> "**[Millikan] Traces Einstein's Contribution.**
> 'Einstein in 1905 generalized [the result of the Michelson-Morley experiment] by postulating that it is in the nature of the universe impossible to find the speed of the earth with respect to the ether,' [Millikan] said. 'This postulate rests most conspicuously upon and historically grew chiefly out of the negative result of the Michelson-Morey [*sic*] experiment.[']"

Hans Reichenbach published an article "Einstein's Theory Traced to Sources"on 26 January 1929 in *The New York Times* on page 3 and stated,

> "This is the aim of Einstein's new theory, which he has now completed. [A New Field Theory]. It uses as an aid a peculiar mathematical source which, in its origin, goes back to the Zurich mathematician Weyl and the English astronomer Eddington."

The New York Times on 2 September 1936, in a story which begins on the front page, quoted Elie Joseph Cartan on page 16,

> "It is unnecessary to recall the great services which tensor analysis has rendered to geometry and to mathematical physics. Every one is aware that Einstein's general theory of relativity might not have been conceived had this admirable instrument of research not been created, under the name of 'absolute differential calculus,' by G. Ricci and T. Levi-Civita."

Sir Edmund Whittaker in his detailed survey, *A History of the Theories of Aether and Electricity*, Volume II, (1953), included a chapter entitled "The Relativity Theory of Poincaré and Lorentz". Whittaker thoroughly documented the development of the theory, documenting the authentic history, and demonstrated through reference to primary sources that Einstein held no priority for the vast majority of the theory. Einstein offered no counter-argument to Whittaker's famous book, in which the following passage appeared,

> "Einstein published a paper which set forth the relativity theory of Poincaré and Lorentz with some amplifications, and which attracted much attention. He asserted as a fundamental principle the *constancy of the velocity of light*, i.e. that the velocity of light *in vacuo* is the same in all systems of reference which are moving relatively to each other: an assertion which at the time was widely accepted, but has been severally criticized by later writers."[2210]

Whittaker also wrote a biography of Einstein, in *Biographical Memoirs of Fellows of the Royal Society*, which reiterated the truth, that Einstein did not create the theory of relativity,

> "The aggregate of all the transformations so obtained, combined with the aggregate of all the rotations in ordinary space, constitutes a *group*, to which Poincaré* gave the name the group of *Lorentz Transformations*.
>
> Einstein [***] adopted Poincaré's Principle of Relativity (using Poincaré's name for it) as a new basis for physics and showed that the group of Lorentz transformations provided a new analysis connecting the physics of bodies in motion relative to each other. Notable results appearing in this paper for the first time were the relativist formulae for aberration and also for the Doppler effect."[2211]

Even among Einstein's admirers voices are heard which deny Einstein's priority. Max Born averred that,

> "Lorentz enunciated the laws according to which the measured quantities in various systems may be transformed into each other, and he proved that these transformations leave the field equations of the electron theory unchanged. This is the mathematical content of his discovery. Larmor (1900) and Poincaré (1905) arrived at similar results about the same time. It is interesting historically that the formula of transformation to a moving system, which we nowadays call Lorentz' transformation (see vi, 2, p. 200 formula (72)), were set up by Voigt as early as 1877 [*sic*[2212]] in a dissertation which was still founded on the elastic theory of light. [***] In the new theory of Lorentz the principle of relativity holds, in conformity with the results of experiment, for all electrodynamic events."[2213]

and,

> "As mentioned already, Lorentz and Poincaré have succeeded in doing this by careful analysis of the properties of Maxwell's equations. They were indeed in possession of a great deal of mathematical theory. Lorentz, however, was so attached to his assumption of an ether absolutely at rest that he did not acknowledge the physical significance of the equivalence of the infinite numbers of systems of reference which he had proved. He continued to believe that one of them represented the ether at rest. Poincaré went a step further. It was quite clear to him that Lorentz's viewpoint was not tenable and that the mathematical equivalence of systems of reference meant the validity of the principle of relativity. He also was quite clear about the consequences of his theory."[2214]

and,

> "I have now to say some words about the work of these predecessors of EINSTEIN, mainly of LORENTZ and POINCARÉ. [***] H. A. LORENTZ' important papers of 1892 and 1895 on the electrodynamics of moving bodies contain much of the formalism of relativity. [***] POINCARÉ's papers [***] show that as early as 1899 he regarded it as very probable that absolute motion is indetectable in principle and that no ether exists. He formulated the same ideas in a more precise form, though without any mathematics, in a lecture given in 1904 to a Congress of Arts and Science at St. Louis, U.S.A., and he predicted the rise of a new mechanics which will be characterized above all by the rule, that no velocity can exceed the velocity of light. [***] The reasoning used by POINCARÉ was just that, which Einstein introduced in his first paper of 1905 [***] Does this mean that POINCARÉ knew all this before Einstein? It is possible [***] Many of you may have looked up his paper 'Zur Elektrodynamik bewegter Körper' in *Annalen der Physik* (4), vol. 17, p. 811, 1905, and you will have noticed some peculiarities. The striking point is that it contains not a single reference to previous literature. It gives you the impression of quite a new venture. But that is, of course, as I have tried to explain, not true."[2215]

Einstein's friend, physicist Peter Gabriel Bergmann, asserted,

> "The Dutch physicist, Hendrik Antoon Lorentz (1853-1928) contrived a theoretical scheme according to which absolute motion of physical objects, including measuring rods, should compress them in such a manner that differences in the speed of light remained undetectable by any conceivable apparatus. Jules Henri Poincaré (1854-1912), the French mathematician, suggested that the consistent failure to identify the frame representing absolute rest indicated that no such frame existed, and that Newton's scheme of the multiplicity of inertial frames was valid after all. In 1905, Einstein combined Lorentz' and Poincaré's ideas into a new approach to the issue of frames of reference and so was able to explain why no experiment had uncovered the absolute motion of the earth, without contradicting Maxwell's theory of electricity and magnetism."[2216]

The Einsteins' 1905 paper failed to present references to the work it "combined" of Lorentz and Poincaré. That which was "new" in the "approach" is of minor significance. Poincaré's work was itself the combination of Lorentz' and Poincaré's ideas, which "combination" Mileva and Albert did not create, but simply repeated, parroting Poincaré's earlier works, virtually verbatim.

Prof. G. H. Keswani argued that,

> "As far back as 1895, Poincaré the innovator had conjectured that it is impossible to detect absolute motion. In 1900 he introduced the 'The principle of relative motion' which he later called by the equivalent terms 'The law of relativity' and 'The principle of relativity' in his book *Science*

and Hypothesis published in 1902. He further asserted in this book that there is no absolute time and that we have no intuition of the 'simultaneity' of two 'events' (mark the words) occurring at different places. In a lecture given in 1904, Poincaré reiterated the principle of relativity, described the method of synchronisation of clocks with light signals, urged a more satisfactory theory of the electrodynamics of moving bodies based on Lorentz's ideas and predicted a new mechanics characterized by the rule that the velocity of light cannot be surpassed. This was followed in June 1905 by a mathematical paper entitled 'Sur la dynamique de l'électron' in which the connection between relativity (impossibility of absolute motion) and the Lorentz Transformation given by Lorentz a year earlier was recognized. In point of fact, therefore, Poincaré was not only the first to enunciate the principle, but he also discovered in Lorentz's work the necessary mathematical formulation of the principle. All this happened before Einstein's paper appeared."[2217]

How do we account for the striking similarity between Lorentz' and Poincaré's writings and Einstein's words in both the "special" and "general" theories of relativity? Who published what, first? Was it mere coincidence that time after time Einstein repeated what Poincaré had earlier published? The record indicates that Poincaré held priority over Einstein, often by many years. Why is it that Albert's last name is a household word and is synonymous with "relativity", and Poincaré's name is substantially more obscure? Einstein believed,

"The secret to creativity is knowing how to hide your sources."[2218]

9.3 The Æther

Many criticized Einstein's theories as metaphysical "nonsense", as purely mathematical fictions lacking physical content. As Arthur Eddington explained,

"LET us suppose that an ichthyologist is exploring the life of the ocean. He casts a net into the water and brings up a fishy assortment. Surveying his catch, he proceeds in the usual manner of a scientist to systematise what it reveals. He arrives at two generalisations:

(1) No sea-creature is less than two inches long.

(2) All sea-creatures have gills.

These are both true of his catch, and he assumes tentatively that they will remain true however often he repeats it.

In applying this analogy, the catch stands for the body of knowledge which constitutes physical science, and the net for the sensory and intellectual equipment which we use in obtaining it. The casting of the net corresponds to observation; for knowledge which has not been or could not be obtained by observation is not admitted into physical science.

An onlooker may object that the first generalisation is wrong. 'There are plenty of sea-creatures under two inches long, only your net is not adapted

> to catch them.' The icthyologist dismisses this objection contemptuously. 'Anything uncatchable by my net is *ipso facto* outside the scope of icthyological knowledge, and is not part of the kingdom of fishes which has been defined as the theme of ichtyological knowledge. In short, 'what my net can't catch isn't fish.' Or—to translate the analogy—'If you are not simply guessing, you are claiming a knowledge of the physical universe discovered in some other way than by the methods of physical science, and admittedly unverifiable by such methods. You are a metaphysician. Bah!'"[2219]

The "ether", or "æther", is a hypothetical fluid, which may fill space and conduct electromagnetic waves such as light, and is perhaps an intervening medium between bodies, which causes gravity. Einstein tried to distinguish his work from Lorentz' by calling the æther "superfluous", which assertion Poincaré and countless others had long since enunciated. The existence of this "fluid" has been hotly disputed for thousands of years, but unless we deny dimension as an anthropomorphic delusion of consciousness, notional not real,[2220] "space" as extension without "material" must be *something*. An empty box contains *something*, even if we evacuate the air from it. We can give this *something* any name we like, but changing its name is a matter of semantics, not discovery.

One cannot speak of "propagation" without tacitly or overtly referring to a medium, and the 1905 paper speaks of "propagation". As Sir Arthur Schuster stated,

> "Einstein, in a paper of great interest and power, has developed this idea, calling his imagined law 'The principle of relativity,' because it stipulates—*a priori*—that only the relative motion between material bodies can be detected. It is impossible for me to discuss in detail the reasoning by which this principle is justified, and an account without explanations of its consequences would lay me open to the charge that I was playing with your credulity. Suffice, therefore, it to say that strict adherers to the principle cannot admit the existence of an æther, and yet may speak of the transmission of light through space with a definite velocity. They must further accept, as a consequence of their dogma, that identical clocks placed on two bodies moving with different velocities have different rates of going and that, even on the same body, identical clocks indicate different times, when the line joining their positions lies in the direction of motion. The motion must be determined relative to another body, which is supposed to be at rest, and a clock placed on that body must serve as the ultimate standard of time. The theory appears to have an extraordinary power of fascinating mathematicians, and it will certainly take its place in any critical examination of our scientific beliefs; but we must not let the simplicity of the assumption underlying the principle hide the very slender experimental basis on which it rests at present, and more especially not lose sight of the fact, that it goes much beyond what is proved by Michelson's experiment. In that experiment, the source of light and the mirrors which reflected the light were all connected together by rigid bodies, and their distances depended therefore

> on the intensity of molecular forces. Einstein's generalisation assumes that the result of the experiment would still be the same, if performed in a free space with the source of light and mirrors disconnected from each other but endowed with a common velocity. This is a considerable and, perhaps, not quite justifiable generalisation. I am well aware that Bucherer's experiments with kathode rays are taken to confirm the validity of Einstein's principle, but if we say that they are not inconsistent with it, we should probably go as far as is justifiable."[2221]

The Einsteins were under the spell of the new school of positivism which was to become "Logical Positivism", and which Sir Arthur Schuster would later catagorize as a cowardly cop out to ignorance, and further which "Logical Positivism" Karl Popper would systematically discredit as solipsism.[2222] The Einsteins may have believed that they could disguise their piracy of Poincaré's interpretation of Lorentz' theory, by stating it in Poincaré's quasi-positivistic form, without mentioning Poincaré. The Einsteins would have found references in Mach's work to,

> "Budde's conception of space as a sort of medium."[2223]

Schuster wrote against the emerging positivism, and the consequences of its cowardice,

> "I have during these lectures contrasted on several occasions the former tendency to base our technical explanations of natural phenomena on definite models which we can visualise and even constuct, with the modern spirit which is satisfied with a mathematical formula, and symbols which frequently have no strictly definable meaning. I ought to explain the distinction between the two points of view which represent two attitudes of mind, and I can do so most shortly by referring to the history of the electro-dynamic theory of light, the main landmarks of which I have already pointed out in the second lecture. The undulatory theory—as it left the hands of Thomas Young, Fresnel and Stokes—was based on the idea that the æther possessed the properties of an elastic solid. Maxwell's medium being quite different in its behaviour, its author at first considered it to be necessary to justify the possibility of its existence, by showing how, by means of fly wheels and a peculiar cellular construction, we might produce a composite body having the required properties. Although later Maxwell laid no further stress on the ultimate construction of the medium, his ideas remained definite and to him the displacements which constituted the motion of light possessed a concrete reality. In estimating the importance of the support which Maxwell's views have received from experiment, we must distinguish between the fundamental assumptions on which Maxwell based his investigations and the mathematical formulæ which were the outcome of these investigations. It is clearly the mathematical formulæ only which are confirmed and the same formulæ might have been derived from quite

different premises. It has always been necessary, as a second step of great discovery, to clear away the immaterial portions which are almost invariable accessories of the first pioneer work, and Heinrich Hertz, who besides being an experimental investigator was a philosopher of great perspicacity, performed this part of the work thoroughly. The mathematical formula instead of being the result embodying the concrete ideas, now became the only thing which really mattered. To use an acute and celebrated expression of Gustav Kirchhoff, it is the object of science to *describe* natural phenomena, not to *explain* them. When we have expressed by an equation the correct relationship between different natural phenomena we have gone as far as we safely can, and if we go beyond we are entering on purely speculative ground. I have nothing to say against this as a philosophic doctrine, and I shall adopt it myself when lying on my death-bed, if I have then sufficient strength to philosophise on the limitations of our intellect. But while I accept the point of view as a correct death-bed doctrine, I believe it to be fatal to a healthy development of science. Granting the impossibility of penetrating beyond the most superficial layers of observed phenomena, I would put the distinction between the two attitudes of mind in this way: One glorifies our ignorance, while the other accepts it as a regrettable necessity. The practical impediment to the progress of physics, of what may reluctantly be admitted as correct metaphysics, is both real and substantial and might be illustrated almost from any recent volume of scientific periodicals. Everyone who has ever tried to add his mite to advancing knowledge must know that vagueness of ideas is his greatest stumbling-block. But this vagueness which used to be recognised as our great enemy is now being enshrined as an idol to be worshipped. We may never know what constitutes atoms or what is the real structure of the æther, why trouble therefore, it is said, to find out more about them. Is it not safer, on the contrary, to confine ourselves to a general talk on entropy, luminiferous vectors and undefined symbols expressing vaguely certain physical relationships? What really lies at the bottom of the great fascination which these new doctrines exert on the present generation is sheer cowardice: the fear of having its errors brought home to it. As one who believes that metaphysics is a study apart from physics, not to be mixed up with it, and who considers that the main object of the physicist is to add to our knowledge, without troubling himself much as to how that knowledge may ultimately be interpreted, I must warn you against the temptation of sheltering yourself behind an illusive rampart of safety. We all prefer being right to being wrong, but it is better to be wrong than to be neither right nor wrong."[2224]

James Mackaye wrote in 1931,

"Einstein's explanation is a dimensional disguise for Lorentz's. [***] Thus Einstein's theory is not a denial of, nor an alternative for, that of Lorentz. It is only a duplicate and disguise for it. [***] Einstein continually maintains

that the theory of Lorentz is right, only he disagrees with his 'interpretation.' Is it not clear, therefore, that in this, as in other cases, Einstein's theory is merely a disguise for Lorentz's, the apparent disagreement about 'interpretation' being a matter of words only?"[2225]

Lorentz pointed out in 1913,

"The latter is, by the way, up to a certain degree a quarrel over words: it makes no great difference, whether one speaks of the vacuum or of the æther."

"Letzteres ist übrigens bis zu einem gewissen Grade ein Streit über Worte: es macht keinen großen Untershied, ob man vom Vakuum oder vom Äther spricht."[2226]

In 1980, Friedrich Hund wrote about the general theory of relativity and the æther,

"Man kann *Einsteins* Leistung als „Abschaffung des Äthers" bezeichnen, muß sich aber hüten, in einen Streit um Worte zu geraten. Heute, 75 Jahre später, kennen wir auch die „allgemeine Relativitätstheorie", die ein lokales „Inertialfeld" beschreibt, das was *H. Weyl* in seiner bildhaften Sprache den „Trägheitskompaß" nannte, die lorentzinvariante Einbettung des lokalen Geschehens in die weltweite Umgebung. Wir kennen weiter kosmologische Fakten, die isotrope Expansion des Systems der Galaxien und die isotrope 3K-Strahlung, die ein lokales spezielles Bezugssystem, *Weyls* „Sternenkompaß", festlegen. Diese Struktur des Universums, vielleicht nur des großen Ausschnittes aus ihm, der unserer Beobachtung zugänglich ist, sehen wir als geschichtlich geworden an. Diese Struktur hätte *H. Weyl* vielleicht Äther genannt und ihm „Kränze und Gesang geweiht.'."[2227]

In 1934, Albert Einstein confirmed Mackaye's assertions,

"Then came H. A. Lorentz's great discovery. All the phenomena of electromagnetism then known could be explained on the basis of two assumptions: that the ether is firmly fixed in space—that is to say, unable to move at all, and that electricity is firmly lodged in the mobile elementary particles. Today his discoveries may be expressed as follows: physical space and the ether are only different terms for the same thing; fields are physical states of space."[2228]

Einstein stated in 1953,

"It was here that H. A. Lorentz' act of intellectual liberation set in. With great logic and consistency he based his investigations on the following

> hypotheses: The seat of the electromagnetic field is empty space. [***] The really essential step forward, indeed, was precisely Lorentz' having reduced the facts to Maxwell's equations concerning empty space, or — as it was then called — the ether. H. A. Lorentz even discovered the 'Lorentz transformation', so named after him, — though ignoring its group-like quality. For him, Maxwell's equations concerning empty space applied only to a given system of co-ordinates, which, on account of its state of rest, appeared excellent in comparison to all other existing systems of co-ordinates. This was a truly paradoxical situation, since the theory appeared to restrict the inertial system more than classical mechanics. This circumstance, proving as it did quite incompatible with the empirical standpoint, simply *had* to lead to the special relativity theory."[2229]

Max Abraham stated in 1908,

"The æther is empty space."

"Der Äther ist der leere Raum."[2230]

We know that Einstein was familiar with this line from Abraham, because Gustav Mie quoted it to him in 1920 at the Bad Nauheim discussion.

Before Abraham was Horace Seal, who, in 1899, published the following,

> "All the text-books and authorities agree that the luminiferous ether fills all space and pervades all bodies, solid, gaseous, and liquid, in that space. If this is true, there is really no such thing as space as a void in which celestial objects move, but the word only remains as a term of measurement of the ether which pervades all bodies and is continuous, both in breadth, length, and depth through the whole universe. In fact, ether does not fill space, but *is* space, and the old measuring of space, which except among mathematicians excluded bodies moving in that space, with the discovery (an actual one) of the luminiferous ether, becomes obsolete. A possible objection to the above is, that loading the shoulders of what after all is only accepted as a convenient hypothesis with another one less perhaps acceptable, is unscientific. But even if the wave-theory of light, heat, &c., were not by now almost fully accepted as that of gravitation, the objection does not really apply, as this luminiferous theory is absolutely independent of hypothesis. It is not a successful guess, but an organized statement of facts, therefore its existence rests upon a solid foundation. [***] According to our theory a child gradually acquires rudimentary ideas of motion by marking the difference of quick and slow movements; but what he does not recognize until after years is, that when he is resting, this rest of his is not absolute rest, which is unknown, but only relative rest[.]"[2231]

Eugen Karl Dühring made similar arguments and even anticipated the general theory

of relativity in 1878.[2232] Bolliger also pursued this line of thought.[2233]

Without an æther, there is no logical ground for assuming light speed independence from the motion of the source. Without an æther of some sort at hypothetical "absolute rest"—at rest relative to itself, anisotropic light speed in at least one of two inertial frames of reference in motion with respect to each other would *not* violate the principle of relativity, but instead would be *compelled by it*. Therefore, the Einsteins' two postulate myth of 1905 depends upon the premise of an æther, or absolute space, or "preferred frame of reference".

Obviously, Einstein's efforts to disguise his piracy through semantics and internally inconsistent Metaphysics are nonsense, for physical states compel physical substance, the æther, and Lorentz stated in 1906,

> "We shall add the hypothesis that, though the particles may move, *the ether always remains at rest*. We can reconcile ourselves with this, at first sight, somewhat startling idea, by thinking of the particles of matter as of some local modifications in the state of the ether. These modifications may of course very well travel onward while the volume-elements of the medium in which they exist remain at rest."[2234]

Herbert Dingle derided Einstein's numerology, his "dimensional disguise for Lorentz's" physical theory,

> "This proposal became known as *the relativity theory of Lorentz*, and certain features of it call for attention here. [***] Like Maxwell, who realised the necessity, if he was to satisfy his mathematical desires, of postulating a 'displacement current' to justify them, so Lorentz, in order to justify his transformation equations, saw the necessity of postulating a physical effect of interaction between moving matter and ether, to give the mathematics meaning. Physics still had *de jure* authority over mathematics: it was Einstein, who had no qualms about abolishing the ether and still retaining light waves whose properties were expressed by formulae that were meaningless without it, who was the first to discard physics altogether and propose a wholly mathematical theory."[2235]

As Vaihinger stated,

> "Pure mathematical space is a fiction. Its concept has the marks of a fiction: the idea of an extension without anything extended, of separation without things that are to be separated, is something unthinkable, absurd and impossible."[2236]

Albert Einstein, who in 1905 had called the æther "superfluous", stated in 1920,

> "To deny the ether is ultimately to assume that empty space has no physical qualities whatever. [***] Recapitulating, we may say that according to the

> general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense."[2237]

The eminent physicist Oliver Heaviside, in a hand-written letter to Prof. Vilhelm Bjerknes, discussed Einstein's compulsory shift in position from claiming that the æther was superfluous to stating directly that the æther was fundamental to "Einstein's" theories,

> "I don't find Einstein's Relativity agrees with me. It is the most unnatural and difficult to understand way of representing facts that could be thought of. His distorted space is chaos [***] The Einstein enthusiasts are very patronizing about the 'classical' electromagnetics and its ether, which they have abolished. But they will come back to it by and by. [***] But you must work fairly, with the Ether, and Forces, & Momentum etc. <u>They</u> are the realities, without Einstein's distorted nothingness. [***] And I really think that Einstein is a practical joker, pulling the legs of his enthusiastic followers, more Einsteinisch than he. He knows the weakness of his 2<u>nd</u> Theory. He only does it to annoy [***] I can't get away from Einstein the Joker. [***] Did such a clever man as Einstein not see the significance of Poisson's theorem? It is said that it was by noticing some of H. A. Lorentz' formulas, and those of Minkowski, led him to the result. Well, we must believe it, if he says so, and like the silent parrot, think the more."[2238]

In 1938, Einstein and Infeld averred, in a statement highly reminiscent of Ernst Haeckel's *Die Welträthsel* of 1899,

> "Our only way out seems to be to take for granted the fact that space has the physical property of transmitting electromagnetic waves, and not to bother too much about the meaning of this statement. We may still use the word ether, but only to express some physical property of space. This word ether has changed its meaning many times in the development of science. At the moment it no longer stands for a medium built up of particles. Its story, by no means finished, is continued by the relativity theory."[2239]

Haeckel wrote,

> "I. Ether fills the whole of space, in so far as it is not occupied by ponderable matter, as a *continuous substance;* it fully occupies the space between the atoms of ponderable matter.
>
> II. Ether has probably no chemical quality, and is not composed of atoms. If it be supposed that it consists of minute homogeneous atoms (for instance,

> indivisible etheric particles of a uniform size), it must be further supposed that there is something else between these atoms, either 'empty space' or a third, completely unknown medium, a purely hypothetical 'interether'; the question as to the nature of this brings us back to the original difficulty, and so on *in infinitum*.
>
> III. As the idea of an empty space and an action at a distance is scarcely possible in the present condition of our knowledge (at least it does not help to a clear monistic view), I postulate for ether a special structure which is not atomistic, like that of ponderable matter, and which may provisionally be called (without further determination) *etheric* or *dynamic* structure."[2240]

Herbert Spencer addressed the root of the problem of confusing pure Mathematics with Physics,

> "To sum up this somewhat too elaborate argument:—We have seen how in the very assertion that all our knowledge, properly so called, is Relative, there is involved in the assertion that there exists a Non-relative. We have seen how, in each step of the argument by which this doctrine is established, the same assumption is made. We have seen how, from the very necessity of thinking in relations, it follows that the Relative is itself inconceivable, except as related to a real Non-relative. We have seen that unless a real Non-relative or Absolute be postulated, the Relative itself becomes absolute; and so brings the argument to a contradiction. And on contemplating the process of thought, we have equally seen how impossible it is to get rid of the consciousness of an actuality lying behind appearances; and how, from this impossibility, results our indestructible belief in that actuality."[2241]

Surely, the assertion of a physical æther is a scientific hypothesis, which recognizes the need of the real behind the relative, while the abstract set of human rules which constitute "space-time" represent nothing real or imagined. Einstein failed to understand the distinction between Physics and Metaphysics. He stated,

> "I believe that physics is abstract and not obvious[.]"[2242]

Carlo Giannoni saw that Einstein's theory differed only philosophically from the Poincaré-Lorentz theory, and Giannoni stresses the importance of the fact that Lorentz employed the principle of relativity in his 1904 paper.[2243]

9.4 The So-Called "*Lorentz* Transformation"

The mathematical transformations in relativity theory are called "Lorentz Transformations",[2244] an appellation supplied by Emil Cohn[2245] and Henri Poincaré.[2246] The record indicates that Woldemar Voigt,[2247] Oliver Heaviside, George Francis FitzGerald, Hendrik Antoon Lorentz, Joseph Larmor, Henri Poincaré, Emil Cohn, Paul Langevin, and others, began developing the mathematical expressions

of the theory of relativity some 18 years before Einstein, and completed them before Einstein published on the subject.

9.4.1 Woldemar Voigt's Space-Time Transformation

The "Lorentz Transformation" is not Lorentz' transformation, as is, and was, widely known,

> "Nor did Lorentz discover these equations. They were first used by Voight[*sic*]."[2248]

The *Brockhaus Enzyklopädie* succinctly states,

> "Voigt [***] presented (among the introduction of the term 'Tensor') a theory of elasticity; in the treatment of optical properties, he formulated for the first time in 1887 the formulas, which later became known through the special theory of relativity as the Lorentz-Transformation."
>
> "Voigt [***] lieferte (unter Einführung des Begriffes >Tensor<) eine Elastizitätstheorie; bei der Behandlung der opt. Eigenschaften formulierte er 1887 erstmalig die später als Lorentz-Transformation durch die Spezielle Relativitätstheorie bekanntgewordenen Formeln."[2249]

In 1887, Woldemar Voigt published the following relativistic transformation of space-time coordinates:

$$x' = x - vt, \quad y' = \frac{y}{\gamma}, \quad z' = \frac{z}{\gamma}, \quad t' = t - \frac{vx}{c^2},$$
$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}.$$

Hermann Minkowski stated,

> "Maxwell's and Lorentz' theory are not really opposites, but rather the rigid and the non-rigid, Zeppelin's and Parseval's electron. In the interest of history, I want yet to add, that the transformations which play the main rôle in the principle of relativity were first mathematically formulated by Voigt, in the year 1887. With the aid of these transformations, Voigt had already drawn conclusions at that time regarding the Doppler Effect."
>
> "Nicht die Maxwellsche und die Lorentzsche Theorie sind die eigentlichen Gegensätze, sondern das starre und das unstarre, das Zeppelinsche und das Parsevalsche Elektron. Historisch will ich noch hinzufügen, daß die

> Transformationen, die bei dem Relativitätsprinzip die Hauptrolle spielen, zuerst mathematisch von Voigt im Jahre 1887 behandelt sind. Voigt hat damals bereits mit ihrer Hilfe Folgerungen in bezug auf das Dopplersche Prinzip gezogen."

To which Voigt responded,

> "Mr. Minkowski recalls an old work of mine. It addressed the application of the Doppler Effect to some special cases which arise due to the elastic theory of light, not the electromagnetic. It had already at that time revealed some of the consequences, which were later arrived at through the electromagnetic theory."
>
> "Herr Minkowski erinnert an eine alte Arbeit von mir. Es handelt sich dabei um Anwendungen des Dopplerschen Prinzips, die in speziellen Teilen auftreten, aber nicht auf Grund der elektromagnetischen, sondern auf Grund der elastischen Theorie des Lichtes. Indessen haben sich damals bereits einige derselben Folgerungen ergeben, die später aus der elektromagnetischen Theorie gewonnen sind."[2250]

9.4.2 Length Contraction

In 1905, Mileva and Albert Einsteins asserted, without reference to prior authors,

> "A rigid body which, measured in a state of rest, has the form of a sphere, therefore has in a state of motion—viewed from the stationary system—the form of an ellipsoid of revolution with the axes
>
> $$R\sqrt{(1 - v^2/c^2)}, R, R.$$
>
> Thus, whereas the Y and Z dimensions of the sphere (and therefore of every rigid body of no matter what form) do not appear modified by the motion, the X dimension appears shortened in the ratio $1 : \sqrt{(1 - v^2/c^2)}$, i.e. the greater the value of v, the greater the shortening. For $v = c$ all moving objects—viewed from the 'stationary' system—shrivel up into plane figures. [*Footnote:* That is, a body possessing spherical form when examined at rest.] For velocities greater than that of light our deliberations become meaningless; we shall, however, find in what follows, that the velocity of light in our theory plays the part, physically, of an infinitely great velocity."[2251]
>
> Henri Poincaré stated, in 1904,

> "From all these results, if they are confirmed, would arise an entirely new mechanics, which would be, above all, characterised by this fact, that no velocity could surpass that of light, any more than any temperature could fall below the zero absolute, because bodies would oppose an increasing inertia to the causes, which would tend to accelerate their motion; and this inertia would become infinite when one approached the velocity of light."[2252]

Roger Joseph Boscovich argued, in 1763, in the second supplement to his *Natural Philosophy,*

> "21. Again, it is to be observed first of all that from this principle of the [invariance] of those things, of which we cannot perceive the change through our senses, there comes forth the method that we use for comparing the magnitudes of intervals with one another; here, that, which is taken as a measure, is assumed to be [invariant]. Also we make use of the axiom, *things that are equal to the same thing are equal to one another*; & from this is deduced another one pertaining to the same thing, namely, *things that are equal multiples, or submultiples, of each, are also equal to one another*; & also this, *things that coincide are equal*. We take a wooden or iron ten-foot rod; & if we find that this is congruent with one given interval when applied to it either once or a hundred times, & also congruent to another interval when applied to it either once or a hundred times, then we say that these intervals are equal. Further, we consider the wooden or iron ten-foot rod to be the same standard of comparison after translation. Now, if it consisted of perfectly continuous & solid matter, we might hold it to be exactly the same standard of comparison; but in my theory of points at a distance from one another, all the points of the ten-foot rod, while they are being transferred, really change the distance continually. For the distance is constituted by those real modes of existence, & these are continually changing. But if they are changed in such a manner that the modes which follow establish real relations of equal distances, the standard of comparison will not be identically the same; & yet it will still be an equal one, & the equality of the measured intervals will be correctly determined. We can no more transfer the length of the ten-foot rod, constituted in its first position by the first real modes, to the place of the length constituted in its second position by the second real modes, than we are able to do so for intervals themselves, which we compare by measurement. But, because we perceive none of this change during the translation, such as may demonstrate to us a relation of length, therefore we take that length to be the same. But really in this translation it will always suffer some slight change. It might happen that it underwent even some very great change, common to it & our senses, so that we should not perceive the change; & that, when restored to its former position, it would return to a state equal & similar to that which it had at first. However, there always is some slight change, owing to the fact that the forces which connect the points of matter, will be changed to some slight extent, if its position is

altered with respect to all the rest of the Universe. Indeed, the same is the case in the ordinary theory. For no body is quite without little spaces interspersed within it, altogether incapable of being compressed or dilated; & this dilatation & compression undoubtedly occurs in every case of translation, at least to a slight extent. We, however, consider the measure to be the same so long as we do not perceive any alteration, as I have already remarked.

22. The consequence of all this is that we are quite unable to obtain a direct knowledge of absolute distances; & we cannot compare them with one another by a common standard. We have to estimate magnitudes by the ideas through which we recognize them; & to take as common standards those measures which ordinary people think suffer no change. But philosophers should recognize that there is a change; but, since they know of no case in which the equality is destroyed by a perceptible change, they consider that the change is made equally.

23. Further, although the distance is really changed when, as in the case of the translation of the ten-foot rod, the position of the points of matter is altered, those real modes which constitute the distance being altered; nevertheless if the change takes place in such a way that the second distance is exactly equal to the first, we shall call it the same, & say that it is altered in no way, so that the equal distances between the same ends will be said to be the same distance & the magnitude will be said to be the same; & this is defined by means of these equal distances, just as also two parallel directions will be also included under the name of the same direction. In what follows we shall say that the distance is not changed, or the direction, unless the magnitude of the distance, or the parallelism, is altered."[2253]

George Francis FitzGerald wrote, in 1889,

"I HAVE read with much interest Messrs. Michelson and Morley's wonderfully delicate experiment attempting to decide the important question as to how far the ether is carried along by the earth. Their result seems opposed to other experiments showing that the ether in the air can be carried along only to an inappreciable extent. I would suggest that almost the only hypothesis that can reconcile this opposition is that the length of material bodies changes, according as they are moving through the ether or across it, by an amount depending on the square of the ratio of their velocity to that of light. We know that electric forces are affected by the motion of the electrified bodies relative to the ether, and it seems a not improbable supposition that the molecular forces are affected by the motion, and that the size of a body alters consequently. It would be very important if secular experiments on electrical attractions between permanently electrified bodies, such as in a very delicate quadrant electrometer, were instituted in some of the equatorial parts of the earth to observe whether there is any diurnal and annual variation of attraction,—diurnal due to the rotation of the earth being

> added and subtracted from its orbital velocity; and annual similarly for its orbital velocity and the motion of the solar system."[2254]

Hendrik Antoon Lorentz had averred the same in 1892,[2255] and stated, in 1895,

> "The displacement would naturally bring about this disposition of the molecules of its own accord, and thus effect a shortening in the direction of motion in the proportion of 1 to $\sqrt{1 - v^2/c^2}$, in accordance with the formulæ given in the above-mentioned paragraph."[2256]

In 1904, Lorentz affirmed that,

> "§ 8. Thus far we have only used the fundamental equations without any new assumptions. I shall now suppose *that the electrons, which I take to be spheres of radius R in the state of rest, have their dimensions changed by the effect of a translation, the dimensions in the direction of motion becoming kl times and those in perpendicular directions l times smaller.*
>
> In this deformation, which may be represented by (1/*kl*, 1/*l*, 1/*l*) each element of volume is understood to preserve its charge."

9.4.2.1 Dynamic Length Contraction

In Lorentz' synthetic physical theory, length contraction is a dynamic theorem following from Maxwell's and Heaviside's[2257] work on the dynamics of the æther.

9.4.2.2 Kinematic Length Contraction

In the Einsteins' fallacy of *Petitio Principii* of 1905, a change in length is merely presupposed without any physical theory to justify it, then the precise factor is arrived at through induction from the allegedly observed invariance of light speed, which is an allegedly known empirical fact, not an *a priori* postulate. No one disputes that Einstein knew Lorentz' contraction hypothesis. The Einsteins simply used the idea without crediting Lorentz, then Einstein called it a natural consequence of the "two postulates" in 1907. Since the "postulates" are empirical observations, the "natural consequences" are arrived at through induction, not deduction. In other words, the hypothesis of length contraction is more fundamental than the law of light speed invariance.

One must first propose *a priori* a change in length before one can derive the precise factor of it through induction from the supposed empirical fact of light speed invariance, and the so-called "natural consequence" is instead the inductively determined factor arrived at from the presupposed *a priori* and *ad hoc* hypothesis that length must change with velocity relative to the "resting system" (in the Einsteins' 1905 paper the "resting system" is Newton's absolute space) in order for light speed to be invariant in "moving systems" (in the Einsteins' 1905 paper

"moving systems" are systems in motion relative to Newton's absolute space). This presupposed change in length is more *ad hoc* in the Einsteins' 1905 paper than it is in Lorentz' synthetic theory, which attempts a dynamic exposition on it, as physics must.

It was Poincaré, not Einstein nor Minkowski, who first recognized the group properties of the Lorentz Transformation and reciprocal length contraction and who introduced a quadri-dimensional exposition on length contraction, which renders it—in terms of a mathematical quadri-dimensional space-time—a matter of cognitive perspective. Later, many would attempt to mask Einstein's plagiarism by arguing the issue of perspective, which nowhere appeared in the Einsteins' work of 1905, where length contraction is merely presupposed without justification, then inductively demonstrated with Poincaré's operationalist thought experiment of clocks synchronized by light signals on the suppositions that light speed is invariant and that length must change to render it so.

9.4.3 Time Dilatation

Roger Joseph Boscovich argued, in 1763, in the second supplement to his *Natural Philosophy,*

> "24. What has been said with regard to the measurement of space, without difficulty can be applied to time; in this also we have no definite & constant measurement. We obtain all that is possible from motion; but we cannot get a motion that is perfectly uniform. We have remarked on many things that belong to this subject, & bear upon the nature & succession of these ideas, in our notes. I will but add here, that, in the measurement of time, not even ordinary people think that the same standard measure of time can be translated from one time to another time. They see that it is another, consider that it is an equal, on account of some assumed uniform motion. Just as with the measurement of time, so in my theory with the measurement of space it is impossible to transfer a fixed length from its place to some other, just as it is impossible to transfer a fixed interval of time, so that it can be used for the purpose of comparing two of them by means of a third. In both cases, a second length, or a second duration is substituted, which is supposed to be equal to the first; that is to say, fresh real positions of the points of the same ten-foot rod which constitute a new distance, such as a new circuit made by the same rod, or a fresh temporal distance between two beginnings & two ends. In my Theory, there is in each case exactly the same analogy between space & time. Ordinary people think that it is only for measurement of space that the standard of measurement is the same; almost all other philosophers except myself hold that it can at least be considered to be the same from the idea that the measure is perfectly solid & continuous, but that in time there is only equality. But I, for my part, only admit in either case the equality, & never the identity."[2258]

Joseph Larmor agreed with Boscovich and set the scale for time dilatation thereby completing the misnamed "Lorentz Transformation", which Lorentz, Poincaré and the Einsteins later adopted.

9.4.4 The Final Form of the Transformation

The components of the "Lorentz Transformation" evolved as follows: From the Aristotelian-Bradwardine-Galilean Transformation,[2259] we have,

$$x' = x - vt, \quad y' = y, \quad z' = zt, \quad t' = t.$$

Voigt (1887) introduced the relativity of simultaneity,

$$t' = t - \frac{vx}{c^2}.$$

FitzGerald (1889) introduced the scale factor of length contraction, giving mathematical voice to Boscovich's concept,

$$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}.$$

Larmor (1894-1900) introduced the scale factor of time dilatation in order to quantify the Boscovichian concept of time dilatation, and published the "Lorentz Transformation" in 1897,

$$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}, \quad y' = y, \quad z' = z, \quad t' = \frac{t - \frac{vx}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}.$$

Lorentz, himself, acknowledged Voigt's priority, and was uncomfortable with Poincaré's term "Lorentz Transformation". Lorentz wrote to Voigt,

> "Of course I will not miss the first opportunity to mention, that the concerned transformation and the introduction of a local time has been your idea."[2260]

Lorentz kept his word:

> "In a paper „Über das Doppler'sche Princip", published in 1887 (Gött. Nachrichten, p. 41) and which to my regret has escaped my notice all these

> years, Voigt has applied to equations of the form (6) (§3 of this book) a transformation equivalent to the formulae (287) and (288). The idea of the transformations used above (and in §44) might therefore have been borrowed from Voigt and the proof that it does not alter the form of the equations for the *free* ether is contained in his paper."[2261]

and,

> "It was these considerations published by me in 1904, which gave rise to the dissertation by Poincaré on the dynamics of the electron, in which he has attached my name to the transformation of which I have just spoken. I am obliged to again note the observation that the same transformation itself was previously hit upon in an article from Mr. Voigt published in 1887, and I did not remove the artifice from it to the fullest extent possible. In fact, for certain of the physical magnitudes which enter in the formulas I have not indicated the transformation which suits best. This has been done by Poincaré, and later by Einstein and Minkowski. To discover the 'transformations of relativity', as I will call them now, . . ."

> "Ce furent ces considérations publiées par moi en 1904 qui donnèrent lieu à POINCARÉ d'écrire son mémoire sur la Dynamique de l'électron, dans lequel il a attaché mon nom à la transformation dont je viens de parler. Je dois remarquer à ce propos que la même transformation se trouve déjà dans un article de M. Voigt publié en 1887 et que je n'ai pas tiré de cet artifice tout le parti possible. En effet, pour certaines des grandeurs physiques qui entrent dans les formules, je n'ai pas indiqué la transformation qui convient le mieux. Cela a été fait par POINCARÉ et ensuite par M. EINSTEIN et MINKOWSKI. Pour trouver les «transformations de relativité», comme je les appellerai maintenant".[2262]

Though Lorentz denied knowledge of Voigt's Transformation, it is quite likely Lorentz did know of it. Lorentz was keenly interested in theories which would explain Michelson's negative result, as did Voigt's theory which was published in the highly respected and widely read *Nachrichten von der Königlichen Gesellschaft der Wissenschaften und der Georg-Augusts-Universität zu Göttingen*.[2263] Given that Voigt's Transformation differs from the "Lorentz Transformation" of modern relativity theory, some have wondered why Lorentz credited Voigt with the transformation. Prof. Wilfried Schröder published a collection of letters between Emil Wiechert and Lorentz, "Hendrik Antoon Lorentz und Emil Wiechert (Briefwechsel und Verhältnis der beiden Physiker)", *Archive for History of Exact Sciences*, Volume 30, Number 2, (1984), pp. 167-187. In addition to the fact that Lorentz again denied his friend Poincaré's legacy, Lorentz' letters are noteworthy for their elucidation of his thought process and the development of his imperfect versions of the transformation which ill-advisedly bears his name. Schröder's article should be read by all interested in the history of the "Lorentz Transformation".

Among the highlights regarding Voigt's work we find: Wiechert to Lorentz 28 November 1911,

> "Nun kenne ich von Ihnen aus jener Zeit die Arbeit Arch. neerl. 25, 363, 1892, das in Leiden 1895 erschienene Buch, und die Arbeit Proc. Amsterdam 1904, p. 809. Giebt es wohl noch andere Arbeiten, die für die Relativitätstheorie in Betracht kommen?"

Lorentz to Wiechert 21 December 1911,

> "In der Arbeit von 1899 benutze ich eine Substitution, die in der im Bornschen' Referat benutzten Bezeichnungsweise folgendermaßen lautet:
>
> $$z' = az - bct, \quad \frac{1}{a}t' = at - \frac{b}{c}z.$$
>
> und erst in 1904 habe ich ihre Transformation
>
> $$z' = az - bct, \quad t' = at - \frac{b}{c}$$
>
> eingeführt, die sich übrigens schon viel früher bei Voigt findet (Über das Dopplersche Prinzip, Gött. Nachrichten, 1887)."

Wiechert to Lorentz 15 February 1912,

> "In Ihrer Arbeit von 1899 (Archives Néerlandaises) benutzen Sie die Transformation
>
> $$t' = t - k^2 \frac{w}{c^2} x.$$
>
> In der Arbeit 1904 (Proceedings) lautet die Gleichung 5:
>
> $$t' = t\frac{l}{k} - kl\frac{w}{c^2}x \left(\text{statt } t' = kl\left(t - \frac{w}{c^2}x \right) \right).$$
>
> Das ist nun doch nicht die Transformation, die man als „Lorentz-Transformation" bezeichnet. Ich vermute aber, dass es sich nur um einen Druckfehler handelt, denn die folgenden Formeln entsprechen der richtigen Formel. Dies ist doch eine richtige Ansicht?
>
> Sie sagen, dass Prof. W. Voigt schon 1887 die Transformation benutzt habe. Es scheint mir aber, dass dieses *nicht* der Fall ist. W. Voigt scheint mir

für die Zeiten t' und t stets die gleichen Einheiten zu benutzen."

Lorentz to Wiechert 5 March 1912,

"4. Was die Formeln von Voigt betrifft, so sind diese so wenig von oben angeführten (1) verschieden, dass man, wie mir scheint, wohl sagen kann, er habe die Rel.transformation angegeben. Die von ihm zu Grunde gelegten Differentialgleichungen behalten nämlich ihre Form, wenn man x, y, z, t alle mit ein und derselben Konstante multipliziert. Man findet nun in seiner Abhandlung über das Doppler'sche Prinzip die Substitution (die Formeln 10) auf S. 45)

$$\xi = x - kt,$$

$$\eta = qy,$$

$$\zeta = qz,$$

$$\tau = t - \frac{kx}{w^2}$$

wo w die Fortpflanzungsgeschwindigkeit bedeutet, und

$$q = \sqrt{1 - \frac{k^2}{w^2}}$$

ist.

Sie bemerken zu Recht, dass t und τ hier den gleichen Koeffizienten haben. Aber es kommt jetzt in der zweiten und dritten Gleichung der Koeffizient q vor. Setzt man

$$\xi = qx', \eta = qy', \zeta = qz', \tau = qt',$$

so verwandeln sich die Gleichungen in

$$x' = \frac{1}{q}x - \frac{k}{q}t, y' = y, z' = z, t' = \frac{1}{q}t - \frac{k}{qw^2}x,$$

und dies hat wirklich die Gestalt von (1), wenn man w mit c identifiziert und

$$a = \frac{1}{q}, \quad b = \frac{k}{q^2}$$

setzt."

In 1900, Joseph Larmor published the following chapter in his most famous work, the award winning essay *Aether and Matter*, which was "completed at the end of the year 1898", and had Larmor already published the "Lorentz Transformation" in near modern form in 1897,[2264]

"CHAPTER XI

MOVING MATERIAL SYSTEM : APPROXIMATION CARRIED TO THE SECOND ORDER

110. THE results above obtained have been derived from the correlation developed in § 106, up to the first order of the small quantity v/C, between the equations for aethereal vectors here represented by (f', g', h') and (a', b', c') referred to the axes (x', y', z') at rest in the aether and a time t'', and those for related aethereal vectors represented by (f, g, h) and (a, b, c) referred to axes (x', y', z') in uniform translatory motion and a time t'. But we can proceed further, and by aid of a more complete transformation institute a correspondence which will be correct to the second order. Writing as before $''$ for $' - \frac{\cdot}{P^{\theta}}\epsilon\,'\epsilon$ the exact equations for $(\omega\epsilon\ \varepsilon\epsilon\ \vartheta)$ and (a, b, c) referred to the moving axes (x', y', z') and time t' are, as above shown, equivalent to

$$4\pi\frac{df'}{dt''} = \frac{dc'}{dy'} - \frac{db'}{dz'} \qquad -(4\pi C^2)^{-1}\frac{da'}{dt''} = \frac{dh'}{dy'} - \frac{dg'}{dz'}$$

$$4\pi\varepsilon\frac{dg'}{dt''} = \frac{da'}{dz'} - \frac{dc'}{dx'} \qquad -(4\pi C^2)^{-1}\varepsilon\frac{db'}{dt''} = \frac{df'}{dz'} - \frac{dh'}{dx'}$$

$$4\pi\varepsilon\frac{dh'}{dt''} = \frac{db'}{dx'} - \frac{da'}{dy'} \qquad -(4\pi C^2)^{-1}\varepsilon\frac{dc'}{dt''} = \frac{dg'}{dx'} - \frac{df'}{dy'}.$$

Now write

$$(x_1, y_1, z_1) \text{ for } \left(\varepsilon^{\frac{1}{2}} x', y', z'\right)$$

$$(a_1, b_1, c_1) \text{ for } \left(\varepsilon^{-\frac{1}{2}} a', b', c'\right) \text{ or } \left(\varepsilon^{-\frac{1}{2}} a,\ b + 4\pi v h,\ c - 4\pi v g\right)$$

$$(f_1, g_1, h_1) \text{ for } \left(\varepsilon^{-\frac{1}{2}} f', g', h'\right) \text{ or } \left(\varepsilon^{-\frac{1}{2}} f,\ g - \frac{v}{4\pi C^2} c,\ h + \frac{v}{4\pi C^2} b\right)$$

$$dt_1 \text{ for } \varepsilon^{-\frac{1}{2}} dt'' \qquad \text{or } \varepsilon^{-\frac{1}{2}} \left(dt' - \frac{v}{C^2} \varepsilon dx'\right),$$

where $\varepsilon = \left(1 - v^2/C^2\right)^{-1}$; and it will be seen that the factor ε is absorbed, so that the scheme of equations, referred to moving axes, which connects together the new variables with subscripts, is identical in form with the Maxwellian scheme of relations for the aethereal vectors referred to fixed axes. This transformation, from (x', y', z') to (x_1, y_1, z_1) as dependent variables, signifies an elongation of the space of the problem in the ratio $\varepsilon^{\frac{1}{2}}$ along the direction of the motion of the axes of coordinates. Thus if the values of (f_1, g_1, h_1) and (a_1, b_1, c_1) given as functions of x_1, y_1, z_1, t_1 express the course of spontaneous change of the aethereal vectors of a system of moving electrons referred to axes (x_1, y_1, z_1) at rest in the aether, then

$$\left(\varepsilon^{-\frac{1}{2}} f,\ g - \frac{v}{4\pi C^2} c,\ h + \frac{v}{4\pi C^2} b\right)$$

and $$\left(\varepsilon^{-\frac{1}{2}} a,\ b + 4\pi v h,\ c - 4\pi v g\right),$$

expressed by the same functions of the variables

$$\varepsilon^{\frac{1}{2}} x',\ y',\ z',\ \varepsilon^{-\frac{1}{2}} t' - \frac{v}{C^2} \varepsilon^{\frac{1}{2}} x',$$

will represent the course of change of the aethereal vectors (f, g, h) and (a, b, c) of a correlated system of moving electrons referred to axes of (x', y', z') moving through the aether with uniform translatory velocity $(v, 0, 0)$. In this correlation between the courses of change of the two systems, we have

$$\frac{d\left(\varepsilon^{-\frac{1}{2}} f\right)}{d\left(\varepsilon^{\frac{1}{2}} x'\right)} \quad \text{equal to} \quad \frac{df_1}{dx_1} - \frac{v}{C^2}\frac{df_1}{dt_1},$$

$$\frac{d}{dy'}\left(g - \frac{v}{4\pi C^2} c\right) \quad \text{,,} \quad \frac{dg_1}{dy_1}$$

$$\frac{d}{dz'}\left(h + \frac{v}{4\pi C^2} b\right) \quad \text{,,} \quad \frac{dh_1}{dz_1},$$

where $$\frac{dc}{dy'} - \frac{db}{dz'} = 4\pi\left(\frac{df}{dt'} - v\frac{df}{dx'}\right)$$

and also $$\frac{df_1}{dt_1} = \frac{df}{dt'};$$

hence $\frac{df}{dx'} + \frac{dg}{dy'} + \frac{dh}{dz'} - \frac{v}{C^2}\left(\frac{df}{dt'} - v\frac{df}{dx'}\right)$ is equal to

$$\varepsilon\frac{df_1}{dx_1} + \frac{dg_1}{dy_1} + \frac{dh_1}{dz_1} - \frac{v}{C^2}\varepsilon\frac{df}{dt'},$$

so that, up to the order of (v/C^2) inclusive,

$$\frac{df}{dx'} + \frac{dg}{dy'} + \frac{dh}{dz'} = \frac{df_1}{dx_1} + \frac{dg_1}{dy_1} + \frac{dh_1}{dz_1}.$$

Thus the conclusions as to the corresponding positions of the electrons of the two systems, which had been previously established up to the first order of v/C, are true up to the second order when the dimensions of the moving system are contracted in comparison with the fixed system in the ratio $\varepsilon^{-\frac{1}{2}}$, or $1 - \frac{1}{2}v^2/C^2$, along the direction of its motion.

111. The ratio of the strengths of corresponding electrons in the two systems may now be deduced just as it was previously when the discussion was confined to the first order of v/C. For the case of a single electron in uniform motion the comparison is with a single electron at rest, near which (a_1, b_1, c_2) vanishes so far as it depends on that electron: now we have in the general correlation

$$g = g_1 + \frac{v}{4\pi C^2}\left(c_1 + 4\pi v g\right),$$

hence in this particular case

$$(g, h) = \varepsilon\left(g_1, h_1\right), \text{ while } f = \varepsilon^{\frac{1}{2}} f_1 .$$

But the strength of the electron in the moving system is the value of the integral $\int\int\left(f dy' dz' + g dz' dx' + h dx' dy'\right)$ extended over any surface closely surrounding its nucleus; that is here $\varepsilon^{\frac{1}{2}}\int\int\left(f_1 dy_1 dz_1 + g_1 dz_1 dx_1 + h_1 dx_1 dy_1\right)$, so that the strength of each moving electron is $\varepsilon^{\frac{1}{2}}$ times that of the correlative fixed electron. As before, no matter what other electrons are present, this argument still applies if the surface be taken to surround the electron under consideration very closely, because then the wholly preponderating part of each vector is that which belongs to the adjacent electron [*Footnote:* This result follows more immediately from § 110, which shows that corresponding densities of electrification are equal, while corresponding volumes are as $\varepsilon^{\frac{1}{2}}$ to unity.].

112. We require however to construct a correlative system devoid of the translatory motion in which the strengths of the electrons shall be equal instead of proportional, since motion of a material system containing electrons cannot alter their strengths. The principle of dynamical similarity will effect this.

We have in fact to reduce the scale of the electric charges, and therefore of $\frac{df}{dx} + \frac{dg}{dy} + \frac{dh}{dz}$, in a system at rest in the ratio $\varepsilon^{-\frac{1}{2}}$. Apply therefore a transformation

$$(x, y, z) = k\left(x_1, y_1, z_1\right), \quad t = l t_1,$$
$$(a, b, c) = \mathfrak{v}\left(a_1, b_1, c_1\right), \ (f, g, h) = \varepsilon^{-\frac{1}{2}} k\left(f_1, g_1, h_1\right);$$

and the form of the fundamental circuital aethereal relations will not be changed provided $k = l$ and $\mathfrak{v} = \varepsilon^{-\frac{1}{2}} k$. Thus we may have k and l both unity and $\mathfrak{v} = \varepsilon^{-\frac{1}{2}}$; so that no further change of scale in space and time is required, but only a diminution of (a, b, c) in the ratio $\varepsilon^{-\frac{1}{2}}$.

We derive the result, correct to the second order, that if the internal forces

of a material system arise wholly from electrodynamic actions between the systems of electrons which constitute the atoms, then an effect of imparting to a steady material system a uniform velocity of translation is to produce a uniform contraction of the system in the direction of the motion, of amount $\varepsilon^{-\frac{1}{2}}$ or $1 - \frac{1}{2} v^2/C^2$. The electrons will occupy corresponding positions in this contracted system, but the aethereal displacements in the space around them will not correspond: if (f, g, h) and (a, b, c) are those of the moving system, then the electric and magnetic displacements at corresponding points of the fixed systems will be the values that the vectors

$$\varepsilon^{\frac{1}{2}} \left(\varepsilon^{-\frac{1}{2}} f, \; g - \frac{v}{4\pi C^2} c, \; h + \frac{v}{4\pi C^2} b \right)$$

and $$\varepsilon^{\frac{1}{2}} \left(\varepsilon^{-\frac{1}{2}} a, \; b + 4\pi v h, \; c - 4\pi v g \right)$$

had at a time const. $+ vx/C^2$ before the instant considered when the scale of time is enlarged in the ratio $\varepsilon^{\frac{1}{2}}$.

As both the electric and magnetic vectors of radiation lie in the wave-front, it follows that in the two correlated systems, fixed and moving, the relative wave-fronts of radiation correspond, as also do the rays which are the paths of the radiant energy relative to the systems. The change of the time variable, in the comparison of radiations in the fixed and moving systems, involves the Doppler effect on the wave-length."

In 1899, Hendrik Antoon Lorentz published his transformation in near modern form.[2265] In 1904, Hendrik Antoon Lorentz published the following transformation,

"§ 4. We shall further transform these formulae by a change of variables. Putting

$$\frac{c^2}{c^2 - w^2} = k^2, \tag{3}$$

and understanding by l another numerical quantity, to be determined further on, I take as new independent variables

$$x' = klx, \quad y' = ly, \quad z' = lz, \tag{4}$$

$$t' = \frac{l}{k} t - kl \frac{w}{c^2} x, \tag{5}"$$

In 1905, before the Einsteins, Poincaré published the following transformation and noted that it, together with all rotations of space, forms a group,

> "The essential point, established by Lorentz, is that the equations of the electromagnetic field are not altered by a certain transformation (which I will call by the name of Lorentz) of the form:
>
> $$x' = kl(x+\varepsilon t),\ y' = ly,\ z' = lz,\quad t' = kl(t+\varepsilon x), \tag{1}$$
>
> where x, y, z are the coordinates and t the time before the transformation and x, y, z' and t' after the transformation. Here ε is a constant which defines the transformation,
>
> $$k = \frac{1}{\sqrt{1-\varepsilon^2}},$$
>
> and l is an arbitrary function of ε. One sees that in this transformation the *x*-axis plays an essential role, but one can evidently construct a transformation in which this role would be played by any arbitrary line passing through the origin. The ensemble of all these transformations together with all rotations of space, should form a group; but for this it is necessary that $l = 1$. One is thus forced to take $l = 1$, and this is a conclusion to which Lorentz was led by a different way."[2266]

Prof. Anatoly Alexeivich Logunov has stressed the fact that Poincaré selflessly attributed to Lorentz, that which Poincaré had accomplished. Lorentz, alternately, and depending upon the audience, credited Poincaré and Einstein for the same innovations. Poincaré's priority is established by the dates of publication. Prof. Logunov has also stressed that many have failed to understand the significance of Poincaré's statements, wrongfully attributing priority to Einstein, which rightfully belongs to Poincaré. Prof. Logunov states, *inter alia*,

> "Poincare writes: .«The idea of Lorentz», but Lorentz never wrote such words before Poincare. [***] We see that invariance of the equations of the electromagnetic field under transformations of the Lorentz group results in the relativity principle being fulfilled in electromagnetic phenomena. In other words, the relativity principle for electromagnetic phenomena follows from the Maxwell-Lorentz equations in the form of a rigorous mathematical truth. [***] It must be underlined that, by having established the group nature of the set of all purely spatial transformations together with the Lorentz transformations, that leave the equations of electrodynamics invariant, Poincare thus discovered the existence in physics of an essentially new type of symmetry related to the group of linear space-time transformations, which

he called the Lorentz group. [***] Poincare thus introduces the physical concept of gravitational waves, the exchange of which generates gravitational forces, and supplies and estimation of the contribution of relativistic corrections to Newton's law of gravity. For example, he shows that the terms of first order in υ/c cancel out exactly and so the relativistic corrections to Newton's law are quantities of the order of $(\upsilon/c)^2$. [***] It is here that such concepts as the following first appeared: the Lorentz group, invariance of the equations of the electromagnetic field with respect to the Lorentz transformations, the transformation laws for charge and current, the addition formulae of velocities, the transformation laws of force. Here, also, Poincare extends the transformation laws to all the forces of Nature, whatever their origin might be."[2267]

In 1905, without reference to prior authors, Mileva and Albert Einstein wrote,

"It follows from this relation and the one previously found that $\varphi(v) = 1$, so that the transformation equations which have been found become

$$\begin{aligned} \tau &= \beta\left(t - vx/c^2\right), \\ \xi &= \beta(x - vt), \\ \eta &= y, \\ \zeta &= z, \end{aligned}$$

where $\beta = 1\Big/\sqrt{1 - v^2/c^2}$."[2268]

Given the facts that Galileo popularized the concept of the principle of relativity, Lange took from it absolute space and absolute time, Voigt introduced the relativistic transformation, and Poincaré first demonstrated relative simultaneity; why is the concept popularly referred to as "Einstein's special theory of relativity"? Einstein contributed next to nothing to the special principle of relativity. Why are the popular misconceptions of Einstein, and his supposed discoveries; which misconceptions are fed by the scientific community and the media; and the factual historic record, itself, at odds? Is exposing the truth counter-productive, if it means the downfall of a hero and the death of a religion?

Contrary to the view of some Einstein advocates that Einstein worked in near complete isolation from both the scientific literature and the physics community, many have pointed out that Einstein had easy access to the literature at the Swiss Patent Office and was heavily immersed in the most recent physics literature of the day as a prolific reviewer of that literature for the *Beiblätter zu den Annalen der Physik*. Jules Leveugle has stressed the fact that Einstein and Planck were exposed to the recent writings of Poincaré and Lorentz through many sources including the *Beiblätter zu den Annalen der Physik* and *Fortschritte der Physik*. Einstein published 21 reviews in the *Beiblätter* in 1905.[2269] Jules Leveugle points out in his book *Poincaré et la Relativité : Question sur la Science*, that the *Beiblätter* published the

following review of Lorentz' 1904 paper by Richard Gans, in Volume 29, Number 4, (February, 1905), pp. 168-170:

"15. ***H. A. Lorentz.*** *Elektromagnetische Vorgänge in einem Systeme, das sich mit einer willkürlichen Geschwindigkeit (kleiner als die des Lichtes) bewegt* (Versl. K. Ak. van Wet. **12,** S. 986-1009. 1904). — Durch die ursprüngliche Lorentzsche Elektronentheorie ist nicht erklärt: 1. Daß die Erdbewegung auf die Interferenz des Lichtes keinen Einfluß hat (Michelson und Morley). 2. Daß auf einen geladenen Plattenkondensator kein Drehmoment wirkt (Trouton und Noble).

Die erste Tatsache ist durch eine neue Hypothese von FitzGerald und Lorentz erklärt worden, nämlich dadurch, daß die Dimensionen fester Körper in Richtung der Erdbewegung ein wenig kleiner werden.

3. Diese Hypothese verlangt eine Doppelbrechung des Lichtes in isotropen Körpern infolge der Erdbewegung; die Versuche ergaben ein negatives Resultat (Lord Rayleigh, Brace).

Um diese Widersprüche zu beseitigen, stellt der Verf. folgende Betrachtungen an:

Erfährt das elektromagnetische System eine konstante Geschwindigkeit w in Richtung der $x-$Achse, und ist die Lichtgeschwindigkeit c, setzen wir ferner

$$\frac{c^2}{c^2 - w^2} = k^2,$$

und bilden den Raum ab durch die Transformation $x' = kx$, $y' = y$, $z' = z$ und führen anstatt der Zeit t die „Ortszeit"

$$t' = \frac{t}{k} - \frac{kwx}{c^2}$$

ein, so erhalten wir, wenn wir anstatt der elektrischen und und magnetischen Feldstärke $\mathfrak{d}$ bez. $\mathfrak{h}$ etwas andere Vektoren $\mathfrak{d}'$ und $\mathfrak{h}'$ einführen, Gleichungen im bewegten, durch die Abbildung transformierten System, welche genau so gebildet sind, wie die Lorentzschen Gleichungen im ursprünglichen ruhenden System. Es folgt daraus, daß das Feld ($\mathfrak{d}'$, $\mathfrak{h}'$) in aller Strenge dem Felde im ruhenden System an entsprechenden Punkten gleich ist, d. h. im elektrostatischen oder optischen *Felde* ist kein Einfluß irgend einer Ordnung der Bewegung zu konstatieren. Die ponderomotorischen *Kräfte* auf die Volumeinheit dagegen erleiden eine kleine Änderung entsprechend der Volumänderung, es ist

$$f'_x = f_x \qquad f'_y = \frac{f_y}{k} \qquad f'_z = \frac{f_z}{k},$$

wo die gestrichenen Buchstaben im bewegten System gelten.

Diese Umformung gibt die Hypothese an die Hand, daß die Dimensionen der Elektronen durch die Bewegung in derselben Weise verändert werden wie der Raum durch die oben angegebene Transformation, daß aber die Ladung entsprechender Volumelemente dieselbe bleibt.

Ferner sollen auch nicht-elektrische (z. B. elastische) Kräfte dieselbe Veränderung durch die Translation erfahren, wie oben die ponderomotorischen Kräfte f elektrischen Ursprungs.

Daraus folgt, daß ein Körper, der durch die Anziehungen und Abstoßungen seiner inneren Kräfte im Gleichgewicht ist, *von selbst* durch die Bewegung seine Dimensionen ändert, denn war im ruhenden System die resultierende Kraft 0 (also Gleichgewicht), so ist sie 0 im bewegten *transformierten* System (also Gleichgewicht).

So erklärt sich der Michelson und Morleysche Interferenzversuch, ferner der von Trouton und Noble über das Drehmoment eines geladenen Plattenkondensators und auch die vergeblichen Doppelbrechungsversuche von Lord Rayleigh und Brace, denn der schon früher vom Verf. (bis auf Größen zweiter Ordnung) aufgestellte Satz, daß Helligkeit, Dunkelheit, Strahl im ruhenden System Helligkeit, Dunkelheit, Strahl im bewegten transformierten entsprechen, gilt bei der jetzigen Transformation streng in Gliedern aller Ordnungen.

Die Formeln für die elektromagnetische Masse ändern sich infolge der Abplattung der Elektronen, aber stellen trotzdem die Kaufmannschen Versuche über Becquerelstrahlen mit befriedigender Genauigkeit dar, wie eingehende Zahlenrechnungen zeigen. Gans."

Gans also published a paper, "Zur Elektrodynamik in bewegten Körpern", *Annalen der Physik*, Series 4, Volume 16, (1905), pp. 516-534.

Emil Cohn published a paper that cited Lorentz' 1904 paper containing the "Lorentz Transformation", with which Cohn paper Einstein was familiar, "Zur Elektrodynamik bewegter Systeme", *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, Sitzung der physikalisch-mathematischen Classe*, (November, 1904), pp. 1294-1303, at 1295. Einstein cited Cohn's paper in his *Jahrbuch* review article of 1907, and a copy of Cohn's 1904 paper is in his preserved collection. *See: The Collected Papers of Albert Einstein*, Volume 2, Note 128, Hardcover, p. 272. Cohn cites the Dutch version of Lorentz' work, "Electromagnetische Verschijnselen in een Stelsel dat zich met Willekeurige Snelheid, Kleiner dan die van het Licht, Beweegt." *Verslagen van de Gewone Vergaderingen der Wis- en Natuurkundige Afdeeling, Koninklijke Akademie van Wetenschappen te Amsterdam* , Volume 12, (23 April 1904), pp. 986-1009. Einstein cites Cohn in the direct context of Lorentz' 1904 paper in: A. Einstein, "Über das

Relativitätsprinzip und die aus demselben gezogenen Folgerung", *Jahrbuch der Radioaktivität und Elektronik*, Volume 4, (1907), pp. 411-462, at 413.

Jules Leveugle notes that Felix Klein annotated Lorentz' article "Weiterbildung der Maxwellschen Theorie. Elektronentheorie", in Volume 2, Part 2, Chapter 14, pp. 145-280, of the *Encyklopädie der Mathematischen Wissenschaften*, with note 113:

> "113) *Lorentz*, Amsterdam Zittungsverslag Akad. v. Wet 12, 1904 (Amsterdam Proceedings, 1903-1904)."

and that Max Abraham also referred his readers to Lorentz' 1904 paper, in Abraham's "Die Grundhypothesen der Elektronentheorie", *Physikalische Zeitschrift*, Volume 5, (1904), pp. 576-579:

> "2) H. A. Lorentz, K. Akad. van Wetensch. te Amsterdam 1899, S. 507 und 1904, S. 809."

and that Sommerfeld cited Lorentz' 1904 paper in his paper, "Simplified Deduction of the Field and Forces of an Electron, Moving in Any Given Way" in the Koninklijke Akademie van Wetenschappen te Amsterdam Proceedings of the Meeting of Saturday, November 26, 1904, p. 346:

> "1) K. Akademie van Wetenschappen te Amsterdam Mei 1904. Proceedings p. 809."

and that Grimm wrote of Lorentz' work in *Die Fortschritte der Physik*, (1905), p. 29:

> "**H. A. Lorentz.** Electrodynamic phenomena in a system moving with any velocity smaller than that of light. Proc. Amsterdam **6.** 809-831, 1904. Versl. Amsterdam **12,** 986-1009, 1904.
>
> Nachdem neuerdings eine Reihe neuer Versuche gemacht worden sind, die sämtlich das Resultat hatten, daß auch ein Einfluß zweiter Ordnung der Erdbewegung nicht zu konstatieren ist, hat Verf. es als notwendig gefunden, seiner und FITZGERALDS Hypothese, daß die Dimensionen der Körper durch ihre Bewegung geändert würden, eine allgemeinere Grundlage zu geben. Er stellt zunächst die Grundgleichungen der Elektronentheorie auf für ein sich mit einer Geschwindigkeit bewegendes System, die geringer als Lichtgeschwindigkeit ist, und dann transformiert er die Gleichungen auf ein System, das gegen das erste in der Bewegungsrichtung deformiert ist. Er erhält somit Gleichungen, die ihm gestatten, die in einem Felde gegebenen Punkte bzw. Funktionen sofort auch im anderen Felde zu finden. Hiernach führt er nun die Hypothese ein, daß die Elektronen ihre Dimensionen in der Bewegung dieser Deformation entsprechend ändern, während sie in der Ruhe Kugeln sind, und daß die Kräfte, die zwischen ungeladenen Partikeln und zwischen solchen und Elektronen bestehen, in gleicher Weise wie die elektrischen Kräfte in einem elektrostatischen System durch Translation

beeinflußt werden. Es wird nun das elektromagnetische Moment eines einzelnen Elektrons berechnet und für die ABRAHAMsche quasistationäre Bewegung ergibt sich dann eine rein elektromagnetische Masse des Elektrons. Dann wird der Einfluß der Bewegung auf optische Phänomene betrachtet, wobei Verf. zu dem Schlusse kommt, daß in der Deformation (l, l, kl) das $l = const$ sein muß und die Anwendung auf die übrigen neueren Versuche führt zu der allgemeinsten Hypothese, daß „die Massen aller Partikel durch die Bewegung in gleicher Weise beeinflußt werden, wie die elektromagnetischen Massen der Elektronen". Im weiteren wird die Theorie an KAUFMANNS Tabellen geprüft und gibt dabei ungefähr gleich gute Übereinstimmung, wie die KAUFMANNschen Formeln. Zum Schluß wird noch der Versuch von TROUTON diskutiert. *Grm.*"

9.4.5 Einstein's Fudge

As is well known, numerous authors have shown errors in the Einsteins' fallacy of *Petitio Principii*, including, among many others, Essen, Keswani, Miller, Planck, and Guillaume.

9.4.6 Einstein Begged the Question

Albert Einstein's arguments were almost always fallacies of *Petitio Principii*. He argued well-known experimental results as if they were *a priori* first principles. Einstein would then induce, as if deducing, the well-known hypotheses of others, and deduce from these plagiarized hypotheses the same experimental results as conclusions, which he had first stated as premises. This was Einstein's *modus operandi* for plagiarism. In the special theory of relativity, Einstein irrationally argued that light speed invariance, supposedly a well-known experimental result at the time, was an *a priori* first principle, which an empirical measurement cannot be, so that he could then induce through analysis, as if deducing in synthesis, the "Lorentz Transformation" hypotheses. Einstein then used the "Lorentz Transformation", the true set of hypotheses of the special theory of relativity, to deduce light speed invariance as a conclusion, a conclusion which Einstein had already presumed as a premise. Einstein also employed the generalized equivalence of all inertial systems he alleged was observed in the Michelson experiments, as if it were an *a priori* principle, instead of the *a posteriori* empirical observation it was, to then "deduce" from this supposed first principle, the principle itself—Michelson's result.

Einstein employed the same fallacious method in the general theory of relativity. Einstein irrationally asserted the well-known experimental gravitational-inertial mass equivalence of Newton, Bessel and Eötvös as if it were an "*a priori*" postulate, which an experimental result cannot be, only to arrive at it as an ultimate conclusion, a conclusion which was redundant to the premise. The quasi-positivistic analyses Einstein presented by turning the synthetic scientific theories of his predecessors on their heads have been applauded, ridiculed and often misrepresented as if they are

synthetic, which they are not.

Albert Einstein gave a lecture at King's College in June of 1921. *The London Times* reported on 14 June 1921, on page 8,

> "PROFESSOR EINSTEIN said it gave him special pleasure to lecture in the capital of that country from which the most important and fundamental ideas of theoretical physics had spread throughout the world—the theories of motion and gravitation of Newton and the proposition of the electro-magnetic field on which Faraday and Maxwell built up the theories of modern physics. It might well be said that the theory of relativity formed the finishing stone of the elaborate edifice of the ideas of Maxwell and Lorentz by endeavouring to apply physics of 'fields' to all physical phenomena, including the phenomena of gravitation.
>
> Professor Einstein pointed out that the theory of relativity was not of any speculative origin, but had its origin solely in the endeavour to adapt the theory of physics to facts observed. It must not be considered as an arbitrary act, but rather as the result of the observations of facts, that the conceptions of space, time, and motion, hitherto held as fundamental, had now been abandoned.
>
> Two main factors, continued Professor Einstein, have led modern science to regard time as a relative conception in so far as each inertial system had to be coupled with its own peculiar time: the law of constancy of the velocity of light in vacuo, sanctioned by the development of the sciences of electro-dynamics and optics, and in connexion therewith the equivalence of all inertial systems (special principle of relativity) as clearly shown by Michelson's famous experiment. In developing this idea it appeared that hitherto the interconnexion between direct events on the one hand, and the space coordinates and time on the other, had not been thought out with the necessary accuracy.
>
> The theory of relativity endeavours to define more concisely the relationship between general scientific conceptions and facts experienced. In the realm of the special theory of relativity the space coordinates and time are still of an absolute nature in so far as they appear to be measurable by rigid bodies, rods, and by clocks. They are, however, relative in so far as they are dependent upon the motion peculiar to the inertial system that happens to have been chosen. According to the special theory of relativity the four-dimensional *continuum*, formed by the amalgamation of time and space, retains that absolute character which, according to the previous theories, was attributed to space as well as to time, each individually. The interpretation of the spatial coordinates and of time as the result of measurements then leads to the following conclusions: motion (relative to the system of coordinates) influences the shape of bodies and the working of clocks; energy and inertial mass are equivalent.
>
> GRAVITATIONAL FIELDS.
>
> The general theory of relativity owes its origin, continued Professor

Einstein, primarily to the experimental fact of the numerical equivalence of the inertial and gravitational mass of a body; a fundamental fact for which the classical science of mechanics offered no interpretation. Such an interpretation is arrived at by extending the application of the principle of relativity to systems of coordinates accelerated with reference to one another. The introduction of systems of co-ordinates accelerated with reference to inertial systems causes the appearance of gravitational fields relative to the systems of coordinates. That is how the general theory of relativity, based on the equality of inertia and gravity, offers a theory of the gravitational field.

Now that systems of co-ordinates, accelerated with reference to one another, have been introduced as equivalent systems of co-ordinates, based on the identity of inertia and gravity, it follows that the laws governing the position of rigid bodies in the presence of gravitational fields do not conform to the rules of Euclidean geometry. The results as regards the working of clocks is analogous. These conclusions lead to the necessity of once more generalizing the theories of space and time, because it is no longer possible directly to interpret the co-ordinates of space and time by measurements with measuring rods and clocks. This generalization of metrics, which in the sphere of pure mathematics dates back to Gauss and Riemann, is based largely on the fact that the metrics of the special theory of relativity may be considered to apply in certain cases also to the general theory of relativity. In consequence, the co-ordinate system of space and time is no longer a reality in itself. Only by connecting the space and time co-ordinates with those mathematical figures which define the gravitational field can the objects which may be measured by measuring rods and by clocks be determined.

The idea of the general theory of relativity has yet another basis. As Ernst Mach has already emphasized, the Newtonian theory of motion is unsatisfactory in the following point:—if motion is regarded not from the casual but from the purely description point of view it will be found that there exists a relative motion of bodies with reference to each other. But the conception of relative motion does not of itself suffice to formulate the factor of acceleration to be found in Newton's equations of motion. Newton was forced to introduce a fictitious physical space with reference to which an acceleration was supposed to exist. This conception of absolute space introduced by Newton *ad hoc* is unsatisfactory, although it is logically correct. Mach, therefore, endeavoured so to alter the mechanical equations that the inertia of bodies is attributed to their relative motion with reference not to absolute space but with reference to the sum total of all other measurable bodies. Mach was bound to fail considering the state of knowledge at his time. But it is quite reasonable to put the problem as he did. In view of the general theory of relativity this line of thought comes more and more to the fore, because according to the theory of relativity the physical properties of space are influenced by matter.

Professor Einstein said he was of the opinion that the general theory of

> relativity could only solve this problem satisfactorily by regarding the universe as spatially finite and closed. The mathematical results of the theory of relativity forced scientists to this view, if they assumed that the average density of matter within the universe was of finite, if ever so small a value."

In 1905, Mileva Einstein-Marity and Albert Einstein coauthored a paper on the "electrodynamics of moving bodies". Fallacies of begging the question emerge in the very introduction to the work. The Einsteins acknowledge in their introduction, that light speed invariance and the symmetry of electrodynamic phenomena were well-established phenomena. Well-known specific phenomena are not, by definition, "*a priori*" general concepts. However, the Einsteins asked us to abandon reason and assert specific experimental results and empirical observations, as if they were *a priori* general principles. In other words, the Einsteins engaged in an analysis of the problems of invariant light speed, and of the symmetry of electrodynamic phenomena in alleged violation of Maxwell's theory, which problems faced physicists at the end of the Nineteenth Century. The Einsteins irrationally pretended that these two problems were solutions of themselves.

Henry August Rowland stated the two main problems facing the physicists of his day, on 28 October 1899, and I have italicized that which the Einsteins would later erroneously call "two assumptions", or "postulates":

> "And yet, however wonderful [the ether] may be, its laws are far more simple than those of matter. *Every wave in it, whatever its length or intensity, proceeds onwards in it according to well known laws, all with the same speed, unaltered in direction, from its source in electrified matter to the confines of the Universe, unimpaired in energy unless it is disturbed by the presence of matter.* However the waves may cross each other, each proceeds by itself without interference with the others. [***] *To detect something dependent on the relative motion of the ether and matter has been and is the great desire of physicists. But we always find that, with one possible exception, there is always some compensating feature which renders our efforts useless.* This one experiment is the aberration of light, but even here Stokes has shown that it may be explained in either of two ways: first, that the earth moves through the ether of space without disturbing it, and second, if it carries the ether with it by a kind of motion called irrotational. Even here, however, the amount of action probably depends upon relative motion of the luminous source to the recipient telescope. So the principle of Doppler depends also on this relative motion and is independent of the ether. The result of the experiments of Foucault on the passage of light through moving water can no longer be interpreted as due to the partial movement of the ether with the moving water, an inference due to imperfect theory alone. The experiment of Lodge, who attempted to set the ether in motion by a rapidly rotating disc, showed no such result. The experiment of Michelson to detect the ethereal wind, although carried to the extreme of accuracy, also failed to detect any relative motion of the matter and the ether [*Emphasis Added*]."[2270]

The Einsteins turned reason on its head and called these two *a posteriori* problems, *a priori* "postulates". The Einsteins phrased their two "postulates", as follows:

1 (a). "Examples of a similar kind, as well as the failed attempts to find a motion of the earth relative to the 'light medium', lead to the supposition, that the concept of absolute rest corresponds to no characteristic properties of the phenomena not just in mechanics, but also in electrodynamics, on the contrary, for all systems of coordinates, for which the equations of mechanics are valid, the same electrodynamic and optical laws are also valid, as has already been proven for the magnitudes of the first order."

1 (b). "The laws according to which the states of physical systems change do not depend upon to which of two systems of coordinates, in uniform translatory motion relative to each other, this change of state is referred."

2 (a). "[L]ight in empty space always propagates with a determinate velocity c irrespective of the state of motion of the emitting body."

2 (b). "Every ray of light moves in the 'resting' system of coordinates with the determinate velocity c, irrespective of whether this ray of light is emitted from a resting or moving body. Such that

velocity = (path of light) / (interval of time) ,

where 'interval of time' is to be construed in the sense of the definition of § 1."

Note that the first "postulate", the principle of relativity, refers only to "moving systems"; and that the second "postulate", the light "postulate", refers only to a proposed "resting system". Note further, that the light "postulate" refers only to a proposed source independence of light speed, but not to an observer independence, because this "postulate" assumes a prior privileged frame and medium in the 1905 paper, which the Einsteins identify as the "resting system". The expression "resting system" was well understood at the time to refer to "absolute space" and a system of coordinates at rest relative to the "fixed stars". The Einsteins' paper later presumes that $c' = c +/- v$, relative to the "resting system".

Many assert that the Einsteins employed only these two "*a priori* postulates" in their theorization, as opposed to FitzGerald, Larmor, Lorentz, and Poincaré, who required the additional hypotheses of length contraction, time dilatation and an æther *to arrive at the same formulation—long before the Einsteins*. *Ad hoc* hypotheses were frowned upon at the time, due to Newton's admonitions against them, such that

the removal of hypotheses was seen as an improvement. The two postulate myth is substantially and demonstrably false. The two postulates are not postulates, but rather are the deduced conclusions of the theory—summations of the supposedly observed phenomena of the day. The "postulates" are deducible from the more fundamental hypotheses of length contraction, time dilatation, relative simultaneity, inertial motion, an æther, etc.; and these are the actual fundamental hypotheses of the special theory of relativity.

Length contraction is not deduced from invariant light speed *a priori*. It is more fundamental than light speed, which is derived from it, and is logically induced from invariant light speed *a posteriori*. Length contraction is a specific factor which deduces the broad range of all velocity comparisons, not just light speed invariance, which represents but one of these comparisons and a deduced limit. The same is true of time dilatation and relative simultaneity. A wide range of hypotheses which deduce an æther and inertial motion are far more fundamental than the deduced conclusions of light speed source independence and the covariance of the laws of nature in inertial systems. It might be true that no one has yet created a fully fundamental theory to deduce these conclusions, but that does not render empirical observations *a priori*, nor does it mean that the attempt to inductively arrive at a such a set of hypotheses *a posteriori* is futile or detrimental. In addition, the evidence taken to justify the hypotheses which are accepted in the theory of relativity has not been rationally interpreted by the "relativists".

After asserting the two "postulates", the Einsteins raised a straw man argument based a *non sequitur*. They asserted that the two "postulates" appeared irreconcilable with each other. If light speed is constant in the "resting system", then how can it also be isotropic in a "moving system" in motion relative to the "resting system"? This is a manufactured dilemma, because, in some inexplicable way, the Einsteins argue that the first postulate, the principle of relativity, compels that light speed from all sources be isotropic for all systems in uniform inertial motion with each respect to each other. However, this is clearly a *non sequitur*, because the principle of relativity no more compels light speed isotropy for all "moving systems", then the principle of relativity requires that a body resting relative to one "moving system" *k* also rest relative to another "moving system" *K*, which is in motion relative to the first.

The Einsteins also raised the opposing problem. How can light speed be isotropic in the "resting system" and also be isotropic in a "moving system"? Of course, these questions presume the conclusion before it has been proven, the conclusion being that light speed from any given signal is isotropic in the "resting system" and all "moving systems", which are in uniform translatory motion with respect to the "resting system". This conclusion is an alleged empirical observation, which much be deduced from fundamental assertions. It is not an *a priori* fundamental assertion. The Einsteins' "postulates" are in fact the very conclusions which they seek prove. The have manufactured a fallacy of *Petitio Principii*.

To knock down these straw men, the Einsteins turned the "two postulates" into one "postulate", the ultimate conclusion which is sought. The Einsteins asserted that it is the *combination* of the two postulates, not either postulate by itself, which

"deduces" $c' = c$ between the moving system and the resting system, by simply asserting in their paper that $c' = c$, before it has in any way been logically proven (there is a distinction and difference between a logical proof and an empirical observation and the union of the "two postulates" does not constitute a logical proof, but rather discloses the redundancy of the "postulates" to each other—as Louis Essen has stated, they are one alleged empirical fact summarized in two redundant ways):

> "It is easy, with the help of this result, to ascertain the magnitudes ξ, η, ζ, because one expresses by means of these equations, that light (as the principle of the constancy of the velocity of light, in conjunction with the principle of relativity, requires) also propagates with the velocity c as measured in the moving system."

After irrationally presuming this conclusion that $c' = c$, before it has in any way been logically proven, the Einsteins proceeded to pretend that they had not presumed it:

> "Now, we have to prove that every ray of light propagates with the velocity c as measured in the moving system, in case this is, as we have taken for granted, the case in the resting system, because we still have not offered up the proof that the principle of the constancy of the velocity of light is reconcilable with the principle of relativity."

However, unless we presume that the "two postulates" are redundant, the combination of the two postulates results in $c' = c +/- v$, not $c' = c$. If we do not presume that the "two postulates" are redundant, then the principle of relativity applies only to "moving systems" and the principle of the constancy of the velocity of light independent of the speed of the source is an æthereal principle of the "resting system" and only of the "resting system".

In a rational approach to the problem, one must instead take the supposed empirical phenomenon of $c' = c$ as a point of departure for an *a posteriori* inductive analysis, not an *a priori* deductive synthesis, and from there induce a fundamental geometry *a posteriori*, which fundamental geometry then deduces the identity $c' = c$ and the covariance of the laws of physics *a priori*, in a synthetic scientific theory. Albert Einstein never accomplished such a theory and he politically obstructed valid criticisms of his irrationality by calling his critics "anti-Semitic" for daring to questions his fallacies of *Petitio Principii*. Albert Einstein stifled scientific progress with disingenuous "racial" politics and was himself a racist and a segregationist, and therefore a dangerous hypocrite.

The Einsteins averred, before any proof was offered:

> "It is easy, with the help of this result, to ascertain the magnitudes ξ, η, ζ, because one expresses by means of these equations, that light (as the

> principle of the constancy of the velocity of light, in conjunction with the principle of relativity, requires) also propagates with the velocity c as measured in the moving system. For a ray of light emitted in the direction of increasing ξ at the time $\tau = 0$, the following equations are valid: $\xi = c\tau \ldots$"

Note the *non sequitur*, which begs the question: That allegedly if the speed of light is c in the "resting system" the principle of relativity compels that it also be measured to be c in the "moving system"; which, without the prior hypotheses of the Lorentz Transformation, clearly is not a rational conclusion, for if I rest in the resting system, the principle of relativity does not compel that I also rest in the moving system. The detection of an æther frame only violates the principle of relativity *if* we assume that the æther exists and that it is at *absolute rest*, and then only because it would provide a means to detect one's speed relative to that æther which has arbitrarily been identified as being at rest in absolute space, which is another straw man argument because rest relative to a light medium does not constitute of necessity "absolute rest"—without the metaphysical presumption of an æther at absolute rest, there is no special theory of relativity, despite its advocates assertions to the contrary. At any rate, the assertion that the detection of the æther frame would violate the principle of relativity is false and is a straw man argument made to justify the assumption that the æther rests. On the contrary, the only principle the detection of the æther frame would violate is the arbitrary principle that the æther frame cannot be detected, and the means of resolving this principle that the æther cannot be detected is the Lorentz Transformation, not the principle of relativity. It is the Lorentz Transformation which renders the laws of electrodynamics covariant, not the principle of relativity. The Einsteins simply confused their conclusion as an additional premise, which renders the two "postulates" redundant, or renders one postulate deducible from the other, and in no sense a postulate.

There is also a fallacy in the special theory of relativity of defining a violation of the principle of relativity in at least four different and distinct ways and then pretending that those different and distinct definitions are one definition. The principle of relativity is on the one hand defined as the invariance of the laws of nature in inertial frames of reference. It must be borne in mind that this principle of relativity treats of abstract idealizations and not physical reality and that inertial frames of reference do not exist in nature. This first principle is the principle of relativity of classical mechanics, which has the consequence of making it impossible to determine "absolute space" by means dynamic experiments.

Though many have averred that this principle is equivalent to, or the same as, the negative assertion that it is impossible to determine the frame of absolute space by means of the laws of mechanics, or more broadly, by any means; this consequence is not the principle itself, and it might be possible someday to determine a preferred reference frame of space (as is the case with general relativity, or the "fixed stars") without setting aside the principle of relativity. We have identified the classical principle of relativity of mechanics, and a distinct and different consequence of that principle, which is also wrongfully called the principle of relativity.

There is a third distinct and different principle of relativity introduced by Henri Poincaré, which states that the laws of electrodynamics are covariant in inertial frames of reference. This principle depends upon the presupposition of Maxwell's laws of electrodynamics and the preferred reference frame of the æther, which provides an *a priori* basis for an inertial frame of reference and for the source independence of light speed. However, this third principle is not a logical necessity, and defines the identity of the laws of physics in a different way from the classical principle of relativity by means of a different system of velocity addition. According to the classical principle of relativity, the æther ought to be detectable, and it is only rendered undetectable by the Lorentz Transformation, not the principle of relativity.

The fourth distinct and different principle of relativity is the assertion that it is impossible to detect the frame of reference of the æther itself, which is an alleged consequence of the principle of relativity of electrodynamics, not that principle itself. The æther may have properties other than electrodynamic properties which renders its position detectable, and therefore one might be able to detect the frame of the æther without violating the principle of relativity of electrodynamics, as may be the case with "tachyons" or other such proposed phenomena.

The Einsteins, following Poincaré's example, deliberately confused logical consistency between these four different definitions, an artificial consistency obtained through the *ad hoc* Lorentz Transformation; with the assertion, which is false, that logical necessity requires that if one of these principle is true, then the other three must also be true. The only binding agent between these different definitions is the tacit presumption and arbitrary definition that the detection of light speed anisotropy would constitute, of necessity, the detection of an æther at absolute rest, which would, by abstract definition alone, constitute the detection of "absolute space", which, by abstraction definition alone, is in principle not detectible in either definition.

This is a straw man argument and a *non sequitur* in that one can detect the medium of a sound wave without violating the principle of relativity, and the "relativists" have falsely and artificially confused the detection of a light medium with a violation of the "principle of relativity" and the detection of "absolute space". In addition, the "relativists" have falsely assumed that the detection of a preferred frame of reference by any means violates both the principle of relativity of mechanics and the principle of relativity of electrodynamics.

There is complete logical consistency between the detection of light speed anisotropy in a frame of reference moving with respect to the æther, and the principle of relativity of mechanics; and the entirely artificial addition to the principle of relativity of mechanics of the assertion that the principle of relativity of electrodynamics forbids the detection of an æther frame is *ad hoc* and a straw man argument, which presupposes an æther at absolute rest and which cannot exist without the supposition of an an æther at absolute rest, and which depends upon the false assumption that the detection of absolute space violates the principle of relativity of mechanics. The principle of relativity of mechanics only states that the laws of mechanics are the same in all inertial reference frames, which is different from the assertion that "absolute space" is undetectable. If "absolute space" were

detected by a "resting æther" (a definition alone), this in and of itself would not be a violation of the principle of relativity of mechanics nor the principle of relativity of electrodynamics, though it would put an end to the metaphysical myth of "space-time".

Mileva and Albert have wrongly confused the fact that the *ad hoc* Lorentz Transformation renders the undetectability of the æther frame logically consist with the classical principle of relativity when it otherwise would not be, with Henri Poincaré's irrational assertion that the principle of relativity demands of logical necessity that the light medium be undetectable; as if that artificially derived logical consistency were itself a logical necessity, when it is not—quite the contrary, without the *ad hoc* Lorentz Transformation the principle of relativity demands that the æther frame be detectable, or that light speed be source and observer speed dependent. All of these tacit presumptions in the special theory of relativity presume the existence of an æther at absolute rest, and not only has the special theory of relativity not rendered an æther at absolute rest superfluous, the entire theory depends upon the tacit premise of an æther at absolute rest, which is in "principle" undetectable by means of electrodynamics, though it is theoretically detectable by means of superluminal velocities, or other means.

There is a difference between arguing that a set of circumstances renders a physical entity undetectable, and arguing that a set of circumstances renders a physical entity superfluous, and the Einsteins, following Poincaré's example, have deliberately and falsely confused undetectablity with superfluousness, just as they have deliberately and falsely confused logical consistency with logical necessity. The so-called "principle" that the æther at absolute rest is undetectable is in fact a corollary to the tacitly presumed properties of that æther and incorporates the presumption of such an æther at "absolute rest" in the very definition. The "principle" is a deducible conclusion, not a fundamental premise. The fundamental premise is the existence of an æther at "absolute rest"—though even this assertion is deducible from more fundamental elements.

There is also a difference between the assertion that the *resting frame* of an æther arbitrarily defined as at "absolute rest" is *undetecable*, and the assertion that the *æther* as a light medium is *undetecable*. In all of our human observations of physical entities we depend upon our senses and our definitions, and our consciousness of an image is not the actual entity reflected in our images of the physical world. Our knowledge of the æther exists in, among other things, the presumption of the source speed independence of light speed. The *æther* is detectable in the special theory of relativity even though its presumed *resting frame of reference* remains undetectable by means of electrodynamic experiments.

In addition, the entire structure of the Lorentz Transformation is built upon the presumption of light speed anisotropy in moving frames of references, which fact is revealed by the use of the scalar c^2. The Einsteins' assertion of the absolute velocity of light in the "resting system" as a given axiomatic fact is an acknowledgment that the "resting system" is an æther at absolute rest, and this is how the Einsteins' define it in Part 1, Section 1 of their paper. If light speed were not anisotropic in moving frames of reference, the Lorentz Transformation would not work, because light speed

would not then be measured to be c in a moving frame of reference by observers relatively resting in that moving frame—moving with respect to the æther. This has been adequately proven by Guillaume, Jánossy and others.[2271] Prof. Friedwardt Winterberg wrote,

"According to Einstein, two clocks, A and B, are synchronized if

$$t_B = \frac{1}{2}\left(t_A^1 + t_A^2\right) \tag{VII.13}$$

where t_A^1 is the time a light signal is emitted from A to B, reflected at B back to A, arriving at A at the time t_A^2, and where it is assumed that the time t_B at which the reflection at B takes place is equal the arithmetic average of t_A^1 and t_A^2. Only by making this assumption does the velocity of light turn out always to be isotropic and equal to c. From an absolute point of view, the following is rather true: If t_R is the absolute reflection time of the light signal at clock B, one has for the out and return journeys of the light signal from A to B and back to A, if measured by an observer in an absolute system at rest in the distinguished reference system:

$$\begin{aligned} \gamma\left(t_R - t_A^1\right) &= d/c_+, \\ \gamma\left(t_A^2 - t_R\right) &= d/c_- \end{aligned} \tag{VII.14}$$

where d is the distance between both clocks, and where c_+ and c_- are given by

$$c_+ = \sqrt{c^2 - v^2\sin^2\psi} - v\cos\psi$$

$$c_- = \sqrt{c^2 - v^2\sin^2\psi} + v\cos\psi$$

Adding the equations (VII.14) one obtains

$$c\left(t_A^2 - t_A^1\right) = 2\gamma d\sqrt{1 - \left(v^2/c^2\right)\sin^2\psi} \tag{VII.15}$$

If an observer at rest with the clock wants to measure the distance from A to B, he can measure the time it takes a light signal to go from A to B and back to A. If he assumes that the velocity of light is constant and isotropic in all inertial reference systems, including the one he is in, moving together with A and B with the absolute velocity v, this distance is

$$d' = (c/2)\left(t_A^2 - t_A^1\right) \qquad \text{(VII.16)}$$

and because of (VII.15)

$$d' = \gamma\, d \sqrt{1 - \left(v^2/c^2\right)\sin^2\psi} \qquad \text{(VII.17)}$$

Comparing this result with,

$$l' = l\sqrt{1 - \left(v^2/c^2\right)\cos^2\varphi} = \frac{l}{\gamma\sqrt{1 - \left(v^2/c^2\right)\sin^2\psi}}$$

one sees that he would obtain the same distance d', if he uses a contracted rod as a measuring stick, of Einstein's constant light velocity postulate. The velocity of light between A and B by using a rod to measure the distance and the time it takes a light signal in going from A to B and back to A, of course, will turn out to be equal to c, because according to (VII.16)

$$\frac{2d'}{t_A^2 - t_A^1} = c \qquad \text{(VII.18)}$$

Rather than using a reflected light signal to measure the distance d', the observer at A may try to measure the one-way velocity of light by first synchronizing the clock B with A and then measure the time for a light signal to go from A to B. However, since this synchronization procedure also uses reflected light signals, the result is the same. For the velocity he finds

$$\frac{d}{t_B - t_A^1} = \frac{d'}{(1/2)\left(t_A^1 + t_A^2\right) - t_A^1} = \frac{2d'}{t_A^2 - t_A^1} = c \qquad \text{(VII.19)}$$

By subtracting the equations (VII.14) one finds that

$$t_R = t_B + \left(\gamma/c^2\right) v d \cos\psi \qquad \text{(VII.20)}$$

which shows that from an absolute point of view the 'true' reflection time t_R at clock B is only then equal to t_B if $v = 0$. From an absolute point of view the propagation of light is isotropic only in the distinguished reference system, but anisotropic in a reference system in absolute motion against the distinguished reference system. This anisotropy remains hidden due to the

impossibility to measure the one way velocity of light. This impossibility is expressed in the Lorentz transformations themselves, containing the scalar c^2 rather than the vector $\underline{c}$, through which an anisotropic light propagation would have to be expressed."[2272]

The expected anisotropy from which the transformation evolved exhibits itself in the predictions the theory makes for an interferometer constructed and calibrated in an inertial reference system K_0 without rigid attachments, but instead assembled with rockets or automobiles at each of the relevant surfaces, which after being adjusted are then simultaneously and uniformly accelerated with respect to K_0 then allowed to travel in inertial motion in inertial reference system K_1, but which do not suffer a Lorentz contraction due to the lack of rigid attachments between them and the uniform manner in which they are accelerated. The special theory of relativity predicts a shift in the interference fringe pattern on the interferometer, which matches the exact result for which Michelson and Morley originally sought but did not find, and which prediction results from light speed anisotropy in at least one of the two inertial reference systems employed in the experiment.

Lajos Jánossy proved this argument,

"§7. Im vorigen Abschnitt haben wir gezeigt, wie man ein materialles Bezugssystem K_1 konstruieren kann, das eine vollkommene G a l i l e i sche Transformation des Systems K_0 ist. Das System K_1 ist jedoch ein sehr unbequemes Bezugssystem. Wir finden nämlich, daß 1. das Licht sich in K_1 nicht isotrop ausbreitet, und 2. daß bewegte Uhren Phasenverschiebungen erleiden, auch wenn sie sehr langsam in K_1 bewegt werden; die Phasenverschiebung verschwindet auch im Grenzfall der verschwindenden Verschiebungsgeschwindigkeit nicht.

Wir zeigen zunächst, daß diese erwähnte, unbequeme Eigenschaft in K_1 tatsächlich auftritt.

1. Daß Licht sich in K_0 isotrop ausbreitet, kann durch den M i c h e l s o n - M o r l e y-Versuch gezeigt werden. Betrachten wir nun ein Interferometer in K_0, das aus vier unzusammenhängenden Teilen besteht (s. Abb. 2 [*Figure deleted*]): Eine halbversilberte Platte P, zwei Spiegel M_1 and M_2 und ein Fernohr T. Wenn wir das System drehen, so daß die relativen Entfernungen von M_1, M_2, P und T unverändert bleiben, dann wird auch das Streifensystem in T unverändert bleiben. Wenn wir nun die vier Teile des Systems unabhängig, aber gleichzeitig beschleunigen, dann bringen wir das Interferometer in des System K_1. Diese Beschleunigung wird aber das Streifensystem, das man in T sieht, beeinflussen. Diese Beschleunigung würde in der Tat eine Streifenverschiebung hervorrufen, die in Lichtzeit

ausgedrückt folgenden Wert besitzt.

$$\Delta T = l\left(\frac{4}{c} - \frac{2}{\sqrt{c^2 - v^2}} - \frac{1}{c - v} - \frac{1}{c + v}\right) = -\frac{lv^2}{c^2} + \cdots . \quad (13)$$

Der obige wert der Verschiebung ist nämlich genau der, den seinerzeit M i c h e l s o n und M o r l e y erwartet hatten, aber nicht fanden. Der Unterschied zwischen dem hier beschriebenen Experiment und dem wirklichen M i c h e l s o n - M o r l e y-Experiment ist nämlich der, daß das wirkliche Interferometer nicht aus unabhängigen Bestandteilen „zusammengesetzt‘‘ ist, sondern ein festes System bildete. Wenn die Teile unseres gedachten Interferometers durch materielle Stäbe verbunden wären, dann würden die einzelnen Teile nach Vollzug der Beschleunigung durch die in den Stäben auftretenden, elastischen Kräfte verschoben werden. Wenn wir also den elastischen Kräften freies Spiel gewähren würden, dann würden sie das Interferometer im Vergleich zum System K_1 in einer solchen Weise verzerren, daß die Verzerrung die Phasenverschiebung (13) genau kompensieren würde.

Um dies ganz klar zu machen, betrachten wir schematisch ein Interferometer, dessen vier Bestandteile auf vier Autos montiert sind. Setzen wir nun voraus, daß diese Autos gleichzeitig in der in §6 beschriebenen Weise losfahren. (Wir setzen voraus, daß die Autos so glatt fahren, daß die Interferenzstreifen während der Fahrt bestehen bleiben.) Das Interferometer, das auf diese Weise in Bewegung gesetzt worden ist, wird sicher eine Phasenverschiebung zeigen. Wir haben in §6/1 darauf hingewiesen, daß elastische Bänder, die zwischen Autos gespannt sind, in Spannung geraten, wenn die Autos sich in Bewegung setzen, weil nämlich diese Bänder sich zusammenzuziehen versuchen, aber daran verhindert werden durch die Autos. Wenn wir jetzt die Autos sich einander soweit nähern lassen, daß die elastische Spannung aufhört, dann verschieben wir damit die Spiegel genau in der richtigen Weise, um die nach der Beschleunigung aufgetretene Phasenverschiebung rückgängig zu machen. Zusammenfassend sehen wir, daß die Lichtfortpflanzung in K_1 nicht der isotrop erfolgt. Dieses Resultat setzt natürlich voraus, daß wir mit der Methode der Konstruktion von K_1, wie sie in §6 beschreiben wurde, einverstanden sind.”[2273]

Metaphysical four-dimensional expositions, which would obfuscate these facts with the obvious fiction of a false *ad hoc* fourth dimension, are not science and depend upon an imaginary dimension to perform the mutations of physical bodies which must have a physical basis if they in fact occur.

As Einstein, himself, avowed, “the real basis of the special relativity theory” is not the deduced conclusion of light speed invariance and the covariance of the laws of electrodynamics in Ludwig Lange’s “inertial systems”. As Albert Einstein later

admitted, the real set of *a priori* postulates is the *ad hoc* "Lorentz Transformation", replete with its dreaded *ad hoc* hypotheses of length contraction and time dilatation. The Lorentz Transformation deduces all velocity comparisons, not just invariant light speed, which is a specific speed, and a derived unit,[2274] not a general and fundamental geometry. Therefore, the Lorentz Transformation is more fundamental than light speed invariance and the principle of relativity.

In the modern metaphysical theory of special relativity first developed by Henri Poincaré through the use of his pseudo-Euclidean geometry, it is space-time which is fundamental, and which provides the basis to deduce the quadri-dimensionality of numerous non-physical quantities.[2275] Space-time is not the principle of relativity, nor is it the principle of light speed invariance. Space-time is more fundamental than either and both are deducible from space-time. But it must be borne in mind that when speaking of space-time one is dealing in metaphysical quantities and qualities, not physical and measurable ones. In other words, one is pretending in lieu of a formulating a rational physical theory.

Later formulations of the special theory of relativity change the 1905 light postulate, from the Einsteins' constant speed of light exclusively in the "resting system", into the invariance of light speed in all of Lange's inertial systems. But this renders the principle of relativity redundant to, or deducible from, the light "postulate", and, therefore, not a "postulate", *per se*, because the light "postulate" then asserts the identity of Lange's inertial systems as light speed invariance, and the principle of relativity is already proven in the light "postulate". On the other hand, if we pretend that the principle of relativity is the covariance of the laws of physics embracing Maxwell's theory of the æther, given the "Lorentz Transformation" as a premise, then the second "postulate" is already incorporated in the first "postulate".

If we are to assume that the Einsteins, in their 1905 paper, deduced, not induced, the Lorentz Transformation from invariant light speed; we would further have to fallaciously assume that empirically observed Lorentz Transformation metrics provoked the Einsteins to induce an unobserved invariant light speed and the unobserved symmetry of electrodynamic phenomena, as self-evident general truths induced *a posteriori* from empirically observed and reciprocally measured: length contraction, time dilatation, relative simultaneity and inertial relative motion between two systems devoid of any net force. Such is obviously not what happened, and such is not what is argued in the 1905 paper.

On the contrary, supposedly observed invariant light speed and the supposedly observed symmetry of electrodynamic phenomena led Voigt, FitzGerald and Larmor to scientifically induce, *a posteriori*, the general geometry of the (misnamed) "Lorentz Transformation", which general set of hypotheses supposedly deduced all "known" phenomena in non-existent hypothetical "inertial systems". The Einsteins pseudo-Metaphysics, their ontology of redundancy, simply disguised the more scientific, though likewise irrational, work of their predecessors, in a way which attempted to make it appear that the Einsteins had deduced that which must be induced, and had avoided hypotheses, which they had not avoided, but rather attempted to induce, through fallacies of *Petitio Principii*.

Most of the post-1905 statements of the special theory of relativity substitute a

completely different proposition for the "two postulates". Einstein, himself, substituted one light theorem in 1907 for the "two postulates" of 1905:

> "the 'principle of the constancy of the velocity of light' [***] for a system of coordinates in a definite state of motion [as opposed to solely in the 'resting system' as in 1905.]"[2276]

which presumes the Lorentz Transformation from which this supposed "postulate" is deduced, and which presumes the tacit hypotheses of an isotropic and homogenous absolute space[2277] and "a definite state of motion" relative to that absolute space. This new light "postulate" represents, therefore, not a postulate, but a deduction, a theorem, and a phenomenon.

Einstein admitted in 1907 that this "postulate" could not be *a priori*, but must instead be *a posteriori*:

> "That the supposition made here, which we want to call the 'principle of the constancy of the velocity of light', is actually met in Nature, is by no means self-evident, nevertheless, it is—at least for a system of coordinates in a definite state of motion—rendered probable through its verification, which Lorentz' theory based upon an absolutely resting aether has ascertained through experiment."[2278]

The so-called "postulates" are simply a restatement of supposed experimental facts, and are not postulates, but empirical facts generalized as "laws" and "theorems". As Robert Daniel Carmichael stated:

> "The experiments which we have described (and others related to them) are fundamental in the theory of relativity. The postulates in the next chapter are based on them. These postulates are in the nature of generalizations of the facts established by experiment. [***] In the next chapter we shall begin the systematic development of the theory of relativity. It will be seen that its fundamental postulates, or laws, are based on the experiments of which we have given a brief account and on others related to them. [***] The postulates, as we shall see, are simply generalizations of experimental facts; and, unless an experiment can be devised to show that these generalizations are not legitimate, it is natural and in accordance with the usual procedure in science to accept them as 'laws of nature.'"[2279]

There is an obnoxious pun in Carmichael's argument related to the use of the word "generalization". The generalization expressed is that: what happens in experiment *A* must happen in experiment *B*, given like conditions; and *not* that the like results of experiments *A* and *B* are general principles, *per se*. The "laws of nature" incorporate general principles to deduce the generalized experimental results, and there is an absolute distinction between the general principles and the generalization of experimental results, which the general principles must deduce. Carmichael blurs

the distinction with a pun.

Hendrik Antoon Lorentz questioned Albert Einstein's "method" of pretending that induction is deduction:

> "Einstein simply postulates what we have deduced, with some difficulty and not altogether satisfactorily, from the fundamental equations of the electromagnetic field. [***] I have not availed myself of his substitutions, only because the formulae are rather complicated and look somewhat artificial".[2280]

We soon discover in the introduction of the Einsteins' 1905 paper a clear statement of the fallacious objective of their entire paper:

> "These two assumptions are sufficient in order to arrive at a simple and consistent electrodynamics of moving bodies, taking as a basis Maxwell's theory for resting bodies."

Is Maxwell's theory for resting bodies a third postulate? One of the "two assumptions", the first "postulate", is that the laws electrodynamics of moving bodies be consistent among systems of reference in uniform translatory motion with respect to the "resting system". Of course, the reasoning presented is circular, first assuming via the first "postulate" that the laws of electrodynamics are consistent, then arguing that this mandated consistency, as a premise, deduces consistency as a conclusion. It is the first of many circular arguments found in the Einsteins' 1905 paper. How are we to determine that which constitutes an "inertial system", other than circularly, as in: An inertial system is one in which there is no net force acting on the system; *i. e.* there is no net force acting on a system, when it is in inertial motion?

Maxwell's theory for resting bodies is Maxwell's theory of the medium, a privileged frame, the æther. However, the Einsteins alleged that the aether was "superfluous" to their theory. The Einsteins irrationally wrote with the same pen that the æther was superfluous, while assuming it and its laws and properties as a basis for "their" theory.

In the introduction to the 1905 paper, we are being primed to venture forth from Maxwell's theorems for bodies resting in the æther, so that we can return to them, *Petitio Principii*, as the covariant laws of moving bodies, while being asked to pretend that the æther is superfluous, so that we aren't too shocked when simultaneity is claimed to be relative, again, *Petitio Principii*, via an impossible light signal clock synchronization operation which is itself based on the unproven assumption of light speed invariance, or $c' = c$, which premise of light speed invariance is also the conclusion of the theory. The unproven conclusion is redundant to the unproven premise. The Lorentz Transformations are then plagiarized as if from nowhere to save the day and provide the proof which otherwise does not exist, and which begins from the true postulates of length contraction, time dilatation, relative simultaneity, inertial motion, the æther, etc.

For example, Albert Einstein stated in 1949:

> "[T]he following postulate is [***] sufficient for a solution [***] *L[ight]-principle holds for all inertial systems* (application of the special principle of relativity to the L[ight]-principle) [***] With the help of the Lorentz transformations the special principle of relativity can be expressed thus: The laws of nature are invariant with respect to Lorentz-transformations".[2281]

Compare Albert Einstein's later statement to Willem de Sitter's statement of 1911:

> "The principle of relativity can be enunciated as the postulate that the transformations, with respect to which the laws of nature shall be invariant, are 'Lorentz-transformations.'*"[2282]

Einstein, ever the plagiarist, stated in 1952:

> "The whole content of the special theory of relativity is included in the postulate: The laws of Nature are invariant with respect to the Lorentz transformations."[2283]

Einstein disclosed his *modus operandi* for manipulating credit for the synthetic scientific theories of others, when he stated in 1936:

> "There is no inductive method which could lead to the fundamental concepts of physics. Failure to understand this fact constituted the basic philosophical error of so many investigators of the nineteenth century. [***] Logical thinking is necessarily deductive; it is based upon hypothetical concepts and axioms. How can we expect to choose the latter so that we might hope for a confirmation of the consequences derived from them? The most satisfactory situation is evidently to be found in cases where the new fundamental hypotheses are suggested by the world of experience itself."[2284]

This is a clear statement by Einstein that he would have science deduce a thing from itself, taking the world of experience as a hypothesis, only to deduce the world of experience as an effect, of itself. Albert Einstein avowed that,

> "[A]ll knowledge of reality starts from experience and ends in it. [***] [E]xperience is the alpha and omega of all our knowledge of reality."[2285]

Of course, Mileva and Albert were forced to present the real hypotheses, which they stuck in the middle of their arguments by way of induction, or an attempt at induction, which analyses they attempted to disguise as deductions from *a priori* principles, but which "*a priori* principles" were well-known summations of physical

phenomena.

Einstein wanted people to believe that it is irrelevant that his predecessors induced the theories he later copied, because Einstein just invented them, *sua sponte*, irrationally, after he had read them, and therefore deserved credit for them. Einstein stated,

> "Invention is not the product of logical thought, even though the final product is tied to a logical structure."[2286]

Einstein stated, together with Infeld:

> "Physical concepts are free creations of the human mind, and are not, however it may seem, uniquely determined by the external world."[2287]

This was a philosophy they took over from Henri Poincaré.[2288]

Certainly, the two "postulates" of the theory of relativity were not, "free creations of the human mind," but were, instead, summations of the empirical observations of the well-known phenomena of the day framed with the familiar concepts of the day. What Infeld and Einstein meant by "free" is difficult to fathom, and it is simply repetitive to say that creations of the mind are creations of the mind. Einstein's vague notions are perhaps the result of his plagiarizing Newton, Mach, Pearson, and others, on the principle of logical economy and watering down what they had written with Einstein's simplistic and naïve talk. If "free" is to mean unrestricted in any sense, no human mind is "free". We are limited in our concepts, experience, and scope, and we are socialized, indoctrinated and inculcated into certain beliefs.

Despite Einstein's assertions to the contrary, there is no mutual exclusion between being creative and being logical. A true scientist can create logical hypotheses through creative induction, even though Albert Einstein lacked the talent needed to do it for himself.

It is the Lorentz Transformation which is the product of creative inductive logic, with its hypotheses of length contraction, time dilatation and relative simultaneity, and which is the fundamental postulation of the special theory of relativity. Invariant light speed and the covariance of the laws of physics, were observed, not induced, and are deducible from the Lorentz Transformation, the laws of physics, and the definition of inertial motion, which are more fundamental in the special theory of relativity than invariant light speed. Speed must be composed of the more fundamental elements of distance and duration. Speed is a derived unit. Therefore, the synthesis of the special theory of relativity comes in deducing invariant light speed from the hypotheses of an isotropic and homogenous space, Maxwell's theory of the medium, the theory of inertial motion, and the hypotheses of length contraction, time dilation and relative simultaneity. This is precisely the conclusion Einstein was obliged to admit in 1935:

> "The special theory of relativity grew out of the Maxwell electromagnetic equations. So it came about that even in the derivation of the mechanical

> concepts and their relations the consideration of those of the electromagnetic field has played an essential role. The question as to the independence of those relations is a natural one because the Lorentz transformation, the real basis of the special relativity theory[. . .]"[2289]

To argue, as the Einsteins did argue in 1905, that invariant light speed and the mandated identity of Lange's inertial systems deduces invariant light speed and the mandated identity of Lange's inertial systems, is to argue in fallacies of *Petitio Principii*, which is precisely what the Einsteins did do, in an attempt to hide their plagiarism of the induced hypotheses of Boscovich, Voigt, FitzGerald and Larmor.

9.5 The "Two Postulates"

The two postulates, are not in fact postulates, but are instead summations of well-known empirical facts; which are deducible from more fundamental principles, and even from each other. Henry August Rowland stated the two "postulates" on October 28th, 1899,

> "And yet, however wonderful [the ether] may be, its laws are far more simple than those of matter. *Every wave in it, whatever its length or intensity, proceeds onwards in it according to well known laws, all with the same speed, unaltered in direction, from its source in electrified matter to the confines of the Universe, unimpaired in energy unless it is disturbed by the presence of matter.* However the waves may cross each other, each proceeds by itself without interference with the others. [***] *To detect something dependent on the relative motion of the ether and matter has been and is the great desire of physicists. But we always find that, with one possible exception, there is always some compensating feature which renders our efforts useless.* This one experiment is the aberration of light, but even here Stokes has shown that it may be explained in either of two ways: first, that the earth moves through the ether of space without disturbing it, and second, if it carries the ether with it by a kind of motion called irrotational. Even here, however, the amount of action probably depends upon relative motion of the luminous source to the recipient telescope. So the principle of Doppler depends also on this relative motion and is independent of the ether. The result of the experiments of Foucault on the passage of light through moving water can no longer be interpreted as due to the partial movement of the ether with the moving water, an inference due to imperfect theory alone. The experiment of Lodge, who attempted to set the ether in motion by a rapidly rotating disc, showed no such result. The experiment of Michelson to detect the ethereal wind, although carried to the extreme of accuracy, also failed to detect any relative motion of the matter and the ether [*Emphasis Added*]."[2290]

9.5.1 The "Principle of Relativity"

Boscovich wrote of length contraction, time dilatation, relative simultaneity, and the "Principle of Invariance" resulting from these long ago in the 1700's.[2291] Stallo, Streintz, Everett and Lange stressed the principle of relativity. The term "principle of relativity" was not original to the Einsteins. It was, in fact, a common term long before they entered the scene. It was found in German in: Lange,[2292] Stallo,[2293] Violle,[2294] Poincaré,[2295] and the German translation, with notes by Felix Hausdorff,[2296] of Huyghens' Seventeenth Century seminal paper on relativity theory, "Über die Bewegung der Körper durch den Stoss / Über die Centrifugalkraft"; all before 1905. The term also appeared in many other languages, and was used by many other authors prior to 1905. Poincaré frequently iterated his electrodynamics-based "principle of relativity" long before the Einsteins repeated the same principle. Rowland had expressed it by 1900 and Maxwell in 1872.

Though it was an ancient notion, Galileo Galilei made the principle of relativity of mechanics famous,

> "When you have observed all these things carefully (though there is no doubt that when the ship is standing still everything must happen in this way), have the ship proceed with any speed you like, so long as the motion is uniform and not fluctuating this way and that. You will discover not the least change in all the effects named, nor could you tell from any of them whether the ship was moving or standing still."[2297]

Boscovich argued in 1763 in the second supplement to his *Natural Philosophy,*

> "§ II
>
> *Of Space & Time, as we know them*
>
> 18. We have spoken, in the preceding Supplement, of Space & Time, as they are in themselves; it remains for us to say a few words on matters that pertain to them, in so far as they come within our knowledge. We can in no direct way obtain a knowledge through the senses of those real modes of existence, nor can we discern one of them from another. We do indeed perceive, by a difference of ideas excited in the mind by means of the senses, a determinate relation of distance & position, such as arises from any two local modes of existence; but the same idea may be produced by innumerable pairs of modes or real points of position; these induce the relations of equal distances & like positions, both amongst themselves & with regard to our organs, & to the rest of the circumjacent bodies. For, two points of matter, which anywhere have a given distance & position induced by some two modes of existence, may somewhere else on account of two other modes of existence have a relation of equal distance & like position, for instance if the distances exist parallel to one another. If those points, we, & all the circumjacent bodies change their real positions, & yet do so in such a manner that all the distances remain equal & parallel to what they were at the start, we shall get exactly the same ideas. Nay, we shall get the same ideas, if, while the magnitudes of the distances remain the same, all their directions are

turned through any the same angle, & thus make the same angles with one another as before. Even if all these distances were diminished, while the angles remained constant, & the ratio of the distances to one another also remained constant, but the forces did not change owing to that change of distance; then if the scale of forces is correctly altered, that is to say, that curved line, whose ordinates express the forces; then there would be no change in our ideas.

19. Hence it follows that, if the whole Universe within our sight were moved by a parallel motion in any direction, & at the same time rotated through any angle, we could never be aware of the motion or the rotation. Similarly, if the whole region containing the room in which we are, the plains & the hills, were simultaneously turned round by some approximately common motion of the Earth, we should not be aware of such a motion; for practically the same ideas would be excited in the mind. Moreover, it might be the case that the whole Universe within our sight should daily contract or expand, while the scale of forces contracted or expanded in the same ratio; if such a thing did happen, there would be no change of ideas in our mind, & so we should have no feeling that such a change was taking place.

20. When either objects external to us, or our organs change their modes of existence in such a way that that first equality or similitude does not remain constant, then indeed the ideas are altered, & there is a feeling of change; but the ideas are the same exactly, whether the external objects suffer the change, or our organs, or both of them unequally. In every case our ideas refer to the difference between the new state & the old, & not to the absolute change, which does not come within the scope of our senses. Thus, whether the stars move round the Earth, or the Earth & ourselves move in the opposite direction round them, the ideas are the same, & there is the same sensation. We can never perceive absolute changes; we can only perceive the difference from the former configuration that has arisen. Further, when there is nothing at hand to warn us as to the change of our organs, then indeed we shall count ourselves to have been unmoved, owing to a general prejudice for counting as nothing those things that are nothing in our mind; for we cannot know of this change, & we attribute the whole of the change to objects situated outside of ourselves. In such manner any one would be mistaken in thinking, when on board ship, that he himself was motionless, while the shore, the hills & even the sea were in motion."[2298]

Newton stated, in the fifth corollary to his *Principia*,

"C o r o l l a r y V.

"*The motions of bodies included in a given space are the same among themselves, whether that space is at rest, or moves uniformly forwards in a right line without any circular motion.*

For the differences of the motions tending towards the same parts, and

> the sums of those that tend towards contrary parts, are at first (by supposition) in both cases the same; and it is from those sums and differences that the collisions and impulses do arise with which the bodies mutually impinge one upon another. Wherefore (by Law 2.) the effects of those collisions will be equal in both cases; and therefore the mutual motions of the bodies among themselves in the one case will remain equal to the mutual motions of the bodies among themselves in the other. A clear proof of which we have from the experiment of a ship: where all motions happen after the same manner, whether the ship is at rest, or is carried uniformly forwards in a right line."[2299]

J. D. Everett expressly stated the principle of relativity at least as early as 1883, in anticipation of Lange,

> "We cannot even assert that there is any such thing as absolute rest, or that there is any difference between absolute rest and uniform straight movement of translation."[2300]

and, in 1895, Everett asserted the principle of relativity as a negative assertion,

> "[T]here is no test by which we can distinguish between absolute rest and uniform velocity of translation".[2301]

As Joseph Larmor noted in 1898, and as G. H. Keswani and C. W. Kilmister clarified,[2302] James Clerk Maxwell stated the principle of relativity of electromagnetism in 1873 in his *Treatise on Electricity and Magnetism* §§ 600, 601,

> "*On the Modification of the Equations of Electromotive Intensity when the Axes to which they are referred are moving in Space.*
>
> 600.] Let x', y', z' be the coordinates of a point referred to a system of rectangular axes moving in space, and let x, y, z be the coordinates of the same point referred to fixed axes.
>
> Let the components of the velocity of the origin of the moving system be u, v, w and those of its angular velocity $\omega_1, \omega_2, \omega_3$ referred to the fixed system of axes, and let us choose the fixed axes so as to coincide at the given instant with the moving ones, then the only quantities which will be different for the two systems of axes will be those differentiated with respect to the time. If $\frac{\delta x}{\delta t}$ denotes a component velocity at a point moving in rigid connexion with the moving axes, and $\frac{dx}{dt}$ and $\frac{dx'}{dt}$ those of any moving point, having the same instantaneous position, referred to the fixed and the moving axes respectively, then

$$\frac{dx}{dt} = \frac{\delta x}{\delta t} + \frac{dx'}{dt}, \tag{1}$$

with similar equations for the other components.

By the theory of the motion of a body of invariable form,

$$\left.\begin{aligned} \frac{\delta x}{\delta t} &= u + \omega_2 z - \omega_3 y, \\ \frac{\delta y}{\delta t} &= v + \omega_3 x - \omega_1 z, \\ \frac{\delta z}{\delta t} &= w + \omega_1 y - \omega_2 x. \end{aligned}\right\} \tag{2}$$

Since F is a component of a directed quantity parallel to x, if $\frac{dF'}{dt}$ be the value of $\frac{dF}{dt}$ referred to the moving axes, it may be shewn that

$$\frac{dF'}{dt} = \frac{dF}{dx}\frac{\delta x}{\delta t} + \frac{dF}{dy}\frac{\delta y}{\delta t} + \frac{dF}{dz}\frac{\delta z}{\delta t} + G\omega_3 - H\omega_2 + \frac{dF}{dt}. \tag{3}$$

Substituting for $\frac{dF}{dy}$ and $\frac{dF}{dz}$ their values as deduced from the equations (A) of magnetic induction, and remembering that, by (2),

$$\frac{d}{dx}\frac{\delta x}{\delta t} = 0, \quad \frac{d}{dx}\frac{\delta y}{\delta t} = \omega_3, \quad \frac{d}{dx}\frac{\delta z}{\delta t} = -\omega_2, \tag{4}$$

we find

$$\frac{dF'}{dt} = \frac{dF}{dx}\frac{\delta x}{\delta t} + F\frac{d}{dx}\frac{\delta x}{\delta t} + \frac{dG}{dx}\frac{\delta y}{\delta t} + G\frac{d}{dx}\frac{\delta y}{\delta t} + \frac{dH}{dx}\frac{\delta z}{\delta t} + H\frac{d}{dx}\frac{\delta z}{\delta t} - c\frac{\delta y}{\delta t} + b\frac{\delta z}{\delta t} + \frac{dF}{dt}. \tag{5}$$

If we now put

$$-\Psi' = F\frac{\delta x}{\delta t} + G\frac{\delta y}{\delta t} + H\frac{\delta z}{\delta t}, \tag{6}$$

$$\frac{dF'}{dt} = -\frac{d\Psi'}{dx} - c\frac{\delta y}{\delta t} + b\frac{\delta z}{\delta t} + \frac{dF}{dt}. \qquad (7)$$

The equation for P, the component of the electromotive intensity parallel to x, is, by (B),

$$P = c\frac{dy}{dt} - b\frac{dz}{dt} - \frac{dF}{dt} - \frac{d\Psi}{dx}, \qquad (8)$$

referred to the fixed axes. Substituting the values of the quantities as referred to the moving axes, we have

$$P' = c\frac{dy'}{dt} - b\frac{dz'}{dt} - \frac{dF'}{dt} - \frac{d(\Psi + \Psi')}{dx}, \qquad (9)$$

for the value of P referred to the moving axes.

601.] It appears from this that the electromotive intensity is expressed by a formula of the same type, whether the motions of the conductors be referred to fixed axes or to axes moving in space, the only difference between the formulæ being that in the case of moving axes the electric potential Ψ must be changed into $\Psi + \Psi'$.

In all cases in which a current is produced in a conducting circuit, the electromotive force is the line-integral

$$E = \int \left(P\frac{dx}{ds} + Q\frac{dy}{ds} + R\frac{dz}{ds} \right) ds, \qquad (10)$$

taken round the curve. The value of Ψ disappears from this integral, so that the introduction of Ψ' has no influence on its value. In all phenomena, therefore, relating to closed circuits and the currents in them, it is indifferent whether the axes to which we refer the system be at rest or in motion. See Art. 668."

Maxwell wrote in his *Matter and Motion*,

"18. ABSOLUTE SPACE

Absolute space is conceived as remaining always similar to itself and immovable. The arrangement of the parts of space can no more be altered than the order of the portions of time. To conceive them to move from their places is to conceive a place to move away from itself.

But as there is nothing to distinguish one portion of time from another except the different events which occur in them, so there is nothing to distinguish one part of space from another except its relation to the place of

material bodies. We cannot describe the time of an event except by reference to some other event, or the place of a body except by reference to some other body. All our knowledge, both of time and place, is essentially relative. When a man has acquired the habit of putting words together, without troubling himself to form the thoughts which ought to correspond to them, it is easy for him to frame an antithesis between this relative knowledge and a so-called absolute knowledge, and to point out our ignorance of the absolute position of a point as an instance of the limitation of our faculties. Anyone, however, who will try to imagine the state of a mind conscious of knowing the absolute position of a point will ever after be content with our relative knowledge.

[***]

102. RELATIVITY OF DYNAMICAL KNOWLEDGE

Our whole progress up to this point may be described as a gradual development of the doctrine of relativity of all physical phenomena. Position we must evidently acknowledge to be relative, for we cannot describe the position of a body in any terms which do not express relation. The ordinary language about motion and rest does not so completely exclude the notion of their being measured absolutely, but the reason of this is, that in our ordinary language we tacitly assume that the earth is at rest.

As our ideas of space and motion become clearer, we come to see how the whole body of dynamical doctrine hangs together in one consistent system.

Our primitive notion may have been that to know absolutely where we are, and in what direction we are going, are essential elements of our knowledge as conscious beings.

But this notion, though undoubtedly held by many wise men in ancient times, has been gradually dispelled from the minds of students of physics.

There are no landmarks in space; one portion of space is exactly like every other portion, so that we cannot tell where we are. We are, as it were, on an unruffled sea, without stars, compass, soundings, wind, or tide, and we cannot tell in what direction we are going. We have no log which we can cast out to take a dead reckoning by; we may compute our rate of motion with respect to the neighbouring bodies, but we do not know how these bodies may be moving in space."

Poincaré stated the principle of relativity of electrodynamics in 1895,

"Experience reveals an abundance of facts, which can be summed up in the following formula: it is impossible to make manifest the absolute motion of matter, or, more correctly, the relative motion of ponderable matter with reference to the æther; the only thing which can be observed is the motion of ponderable matter with reference to ponderable matter."

"L'expérience a révélé une foule de faits qui peuvent se résumer dans la

formule suivante: il est impossible de rendre manifeste le mouvement absolu de la matière, ou mieux le mouvement relatif de la matière pondérable par rapport à l'éther; tout ce qu'on peut mettre en évidence, c'est le mouvement de la matière pondérable par rapport à la matière pondérable."[2303]

In 1899, Poincaré declared the principle of relativity to be rigorously valid,

"This strange property would appear to be a veritable '*fudging factor*' given by nature to prevent the detection of the absolute movement of the Earth by optical phenomena. I find that unsatisfactory, and I feel a duty to express my feelings: I look upon it as very probable that the optical phenomena depend only on the relative movements of the material source of light, related bodies or optical apparatus; and *then not only with the quantities close to the order of the square or the cube of aberration, but rigorously*. As the experiments become more exact, this principle will be checked with greater precision. [***] a well made theory should enable us to demonstrate the principle in one fell swoop in all its rigor."

"Cette étrange propriété semblerait un véritable «*coup de pouce*» donné par la nature pour éviter que le mouvement absolu de la terre puisse être révélé par les phénomènes optiques. Cela ne saurait me satisfaire et je crois devoir dire ici mon sentiment: je regarde comme très probable que les phénomènes optiques ne dépendent que des mouvements relatifs des corps matériels en présence, sources lumineuses ou appareils optiques et *cela non pas aux quantités près de l'ordre du carré ou du cube de l'aberration, mais rigoureusement*. A mesure que les expériences deviendront plus exactes, ce principe sera vérifie avec plus de précision. [***] une théorie bien faite devrait permette de démontrer le principe d'un seul coup dans toute sa rigueur."[2304]

In 1900, Poincaré declared,

"I do not believe, in spite of Lorentz, that more exact observations will ever make evident anything else but the relative displacements of material bodies. [***] No; the same explanation must be found for the two cases, and everything tends to show that this explanation would serve equally well for the terms of the higher order, and that the mutual destruction of these terms will be rigorous and absolute."[2305]

Poincaré reiterated the principle of relativity in 1902 in his book *La Science et l'Hypothèse*, E. Flammarion, Paris, (1902); and we know from Solovine's accounts[2306] that Einstein had read Poincaré's book,

"*The Principle of Relative Motion*.—Sometimes endeavours have been made to connect the law of acceleration with a more general principle. The

movement of any system whatever ought to obey the same laws, whether it is referred to fixed axes or to the movable axes which are implied in uniform motion in a straight line. This is the principle of relative motion; it is imposed upon us for two reasons: the commonest experiment confirms it; the consideration of the contrary hypothesis is singularly repugnant to the mind."[2307]

Poincaré's 1904 principle of relativity states, and we know from Solovine's accounts[2308] that Einstein had read this lecture, which was reprinted as Chapters 7 and 8 of Poincaré's book *La Valeur de la Science*, E. Flammarion, Paris, (1904),

"The principle of relativity, according to which the laws of physical phenomena should be the same, whether for an observer fixed, or for an observer carried along in a uniform movement of translation; so that we have not and could not have any means of discerning whether or not we are carried along in such a motion."[2309]

Poincaré stated, in 1905, before the Einsteins,

"It appears at first sight that the aberration of light and other related optical phenomena would furnish us a means of determining the absolute motion of the earth, that is, its motion relative to ether rather than relative to the stars; there are no such phenomena. The experiments in which one takes account only of the first power of aberration have been unsuccessful, and one knows the reasons for that. But Michelson, having thought of an experiment in which one could measure effects depending on the second power of aberration, was equally unsuccessful. It appears that this impossibility of demonstrating the absolute motion of the earth is a general law of nature."[2310]

In 1908, Poincaré reaffirmed the principle of relativity,

"*The Principle of Relativity* [***] Whatever be the means employed there will never be disclosed anything but relative velocities; I mean the velocities of certain material bodies with reference to other material bodies. [***] We have seen above the reasons which impel us to regard the principle of relativity as a general law of nature."[2311]

It was Lorentz, who properly phrased the *corollary of relativity* in 1904,

"It would be more satisfactory, if it were possible to show, by means of certain fundamental assumptions, and without neglecting terms of one order of magnitude or another, that many electromagnetic actions are entirely independent of the motion of the system."

The Einsteins wrote, in 1905, without reference to previous authors,

> "Examples of a similar kind, as well as the failed attempts to find a motion of the earth relative to the 'light medium', lead to the supposition, that the concept of absolute rest corresponds to no characteristic properties of the phenomena not just in mechanics, but also in electrodynamics, on the contrary, for all systems of coordinates, for which the equations of mechanics are valid, the same electrodynamic and optical laws are also valid, as has already been proven for the magnitudes of the first order."

and,

> "The laws according to which the states of physical systems change do not depend upon to which of two systems of coordinates, in uniform translatory motion relative to each other, this change of state is referred."

9.5.2 The "Light Postulate"

The Einsteins asserted the "light postulate", in 1905, without reference to previous authors,

> "[L]ight in empty space always propagates with a determinate velocity *c* irrespective of the state of motion of the emitting body."

> "Every ray of light moves in the 'resting' system of coordinates with the determinate velocity *c*, irrespective of whether this ray of light is emitted from a resting or moving body. Such that
>
> velocity = (path of light) / (interval of time) ,
>
> where 'interval of time' is to be construed in the sense of the definition of § 1."

The references in Lorentz' and Poincaré's works to this velocity are too numerous to repeat. In the Einsteins' 1905 paper, this velocity is the absolute velocity of light in its medium, absolute space. Einstein stated in 1912,

> "To fill this gap, I introduced the principle of the constancy of the velocity of light, which I borrowed from H. A. Lorentz's theory of the stationary luminiferous ether, and which, like the principle of relativity, contains a physical assumption that seemed to be justified only by the relevant experiments (experiments by Fizeau, Rowland, etc.)."[2312]

We know that Einstein believed in absolute space, the "reference frame of the vacuum", the "resting system",

> "Then I tried to discuss the Fizeau experiment on the assumption that the

> Lorentz equations for electrons should hold in the frame of reference of the moving body as well as in the frame of reference of the vacuum as originally discussed by Lorentz."[2313]

Lorentz pointed out in 1913,

> "The latter is, by the way, up to a certain degree a quarrel over words: it makes no great difference, whether one speaks of the vacuum or of the æther."
>
> "Letzteres ist übrigens bis zu einem gewissen Grade ein Streit über Worte: es macht keinen großen Untershied, ob man vom Vakuum oder vom Äther spricht."[2314]

Lorentz, who knew the Einsteins' theory well, would not have alleged that it made no difference to speak of vacuum as opposed to æther, if Einstein had discounted absolute space, a "resting system" in which light propagates independently of the speed of the source. Both Sommerfeld and Pauli also recognized that the "resting system" of the Einsteins' 1905 paper was simply another appellation for Lorentz' æther, with absolute *celeritas* being an æther concept. Einstein described the light postulate as an æthereal idea to Peter A. Bucky.[2315] Pauli stated, regarding *celeritas* in absolute space, that,

> "There is no question of a *universal* constancy of the velocity of light in vacuo, if only because it has the constant value *c* only in Galilean systems of reference. On the other hand its independence of the state of motion of the light source obtains equally in the general theory of relativity. It proves to be the true essence of the old aether point of view."[2316]

And Sommerfeld held it up as,

> "The only valid remnant of the ether concept"[2317]

We discover in "Part I" of the Einsteins' 1905 paper, that the "resting system" of the light postulate signifies absolute space, the "reference frame of the vacuum" a. k. a. the "æther", as Albrecht Fölsing has noted,

> "To that end he proceeds from a 'system at rest,' the customary three-dimensional Euclidean space with Cartesian coordinates, in which the movement of a body is described by its coordinates as a function of time. This is so conventional that many readers must have asked themselves why it was even mentioned. [***] For the 'system at rest' for which these observations were initially made, it may be stated 'in accordance with experience'—i. e., in line with Maxwell-Lorentz theory—that the velocity of light in a vacuum is a universal constant. [***] To be sure, Einstein is using

> almost 'prerelativist' terminology by referring, throughout this section, to a system 'at rest' in which the rod, either at rest or in motion, is observed. While this formulation lets the background of Lorentzian theory—a motionless ether—shine through, it also leads to complications in which even an attentive reader can lose the thread."[2318]

Philipp Frank makes clear that Einstein effectively adopted Lorentz' æther, and certainly adopted Lorentz' light postulate of the "resting system",

> "This law [***] may be called the *relativity principle of mechanistic physics*. It is a deduction from the Newtonian laws of motion and deals only with relative motions and not, as Newton's laws proper, with absolute motion. In this form it is a positive assertion, but it can also be formulated in a negative way, thus: It is impossible by means of experiments such as those described above to differentiate one inertial system from another. [***] Besides this 'principle of relativity,' Einstein needed a second principle dealing with the interaction of light and motion. He investigated the influence of the motion of the source of light on the velocity of light emitted by it. From the standpoint of the ether theory, it is self-evident that it makes no difference whether or not the source of light moves; light considered as mechanical vibration in the ether is propagated with a constant velocity with respect to the ether. [***] Dropping the ether theory of light, Einstein had to reformulate this law into a statement about observable facts. There is one system of reference, *F* (the fundamental system), with respect to which light is propagated with a specific speed, *c*. No matter with what velocity the light source moves with respect to the fundamental system (*F*), the light emitted is propagated with the same specific velocity (*c*) relative to *F*. This statement is usually called the 'principal [*sic*] of the of the constancy of the speed of light.'"[2319]

Immanuel Kant and Carl Neumann reawoke an interest in the Newtonian concept of absolute space, and Hobbes had suggested that the æther far from major bodies is quiescent—a belief that held sway among many at least as late as Lorentz, Larmor and Volkmann. Thomas Young argued that the aether rests.[2320] Neumann argued that absolute space is definable through a body, which is taken to be at absolute rest, the so-called "body Alpha". Fresnel[2321] proposed that the æther only participates in the motion of bodies to a limited degree and rests outside of ponderable bodies. Many like Larmor, Lorentz, Volkmann, Maxwell, Heaviside, Hertz, Volterra and Drude believed that Young and Fresnel's resting æther signified Neumann's "body Alpha", an absolute space endowed with special properties, as opposed to an absolute space of true vacuum, and they used the same nomenclature of "resting system" and "moving system" which the Einsteins used without distinctions and to mean absolute space and motion relative to it.[2322] Michelson set out to find the relative motion of the Earth in the supposedly still sea of æther, but wrecked on the static shores of his interferometer.

The Einsteins again and again refer to a "Resting System" with "resting" rods, clocks and observers and an empirically observed absolute speed of light and an absolute time in the "resting system"; and they asserted $c \pm v$ in the "moving system". The nomenclature of the day, which stemmed from Newton, Maxwell, Larmor and Lorentz, among many others, was clearly that the "resting system" was a system of coordinates at rest with respect to the fixed stars, and *not* any and all inertial systems. Einstein wrote to Mach on 25 June 1913, "relative to the fixed stars ('Restsystem')",[2323] which confirms Frank's analysis of Einstein's thought process.

In 1911, Albert Einstein again confirmed that it was his essential belief that the "resting system" is Lorentz' æther at rest with respect to itself and with respect to the "fixed stars", as expressed ontologically as "absolute space",

> "[W]e will extract from Lorentz's theory of the stationary luminiferous ether the following aspects most essential to us. What is the physical meaning of the statement that there exists a stationary luminiferous ether? The most important content of this hypothesis can be expressed as follows: There exists a reference system (called in Lorentz's theory 'a system at rest relative to the ether') with respect to which every light ray propagates in a vacuum with the universal velocity *c*. This ought to hold independently of whether the light-emitting body is in motion or at rest."[2324]

The detection of an æther frame in no sense violates the principle of relativity unless the æther is defined to be at absolute rest—whatever that "absolute rest" should ultimately be interpreted to mean.

Max Abraham wrote in 1904,

> "The electromagnetic theory addresses the absolute motion of light, which light issues forth in every direction with the same velocity (*c*)"
>
> "Die elektromagnetische Theorie spricht von einer absoluten Bewegung des Lichtes, die nach jeder Richtung hin mit derselben Geschwindigkeit (*c*) erfolgt"[2325]

The absolute velocity of light was stated numerous times in history, for example, as an observed empirical result, by Cassini and Roemer (ca. 1676) and Bradley (ca. 1729).

Maxwell created his theorem of the velocity of light as a dynamic process in its medium. W. Stanley Jevons wrote in the 1870's,

> "In a first subclass we may place the velocity of light or heat undulations, the numbers expressing the relation between the lengths of undulations, and the rapidity of the undulations, these numbers depending only on the properties of the ethereal medium, and being probably the same in all parts of the universe."[2326]

Willem de Sitter stated in his famous paper of 1911,

> "The principle of relativity can be enunciated as the postulate that the transformations, with respect to which the laws of nature shall be invariant, are 'Lorentz-transformations.'*"[2327]

Einstein, ever the plagiarist, stated in 1952:

> "The whole content of the special theory of relativity is included in the postulate: The laws of Nature are invariant with respect to the Lorentz transformations."[2328]

The Einsteins argued, in 1905, that the æther is "superfluous", without reference to prior authors,

> "The introduction of a 'luminiferous ether' will prove to be superfluous inasmuch as the view here to be developed will not require an 'absolutely stationary space' provided with special properties".

Johann Heinrich Ziegler gave widely-discussed lectures in Switzerland, in which he sought to abolish the concept of the æther. Ziegler directly accused Einstein of plagiarism. Ziegler wrote, in 1902,

> "Und doch ist diese Annahme nichts anderes als ein greifbarer Unsinn. Der den Raum oder die Stofflosigkeit überall erfüllende stofflose Stoff, genannt Weltäther, ist ein unbegreiflicher Begriff, und alle Lehren, welche auf ihm beruhen, sind genau ebenso unvollkommen und trügerisch, wie die Grundlage. Keine der Wellenbewegungen, die man jenem wesenlosen Ding andichtet, um die Fortpflanzung des Lichtes zu erklären, ist wirklich vorhanden. Es sind dies bloß mathematische Fiktionen, die ausschließlich in der Einbildung der Physiker vorhanden sind, gerade wie jener phantomhafte Stoff selbst, der bald dem bewegten Wasser, bald einem geschlagenen, gespannten Seil ähnliche Schwingungen ausführen soll."[2329]

Lorentz stated in 1895,

> "It does not suit my purpose to examine more thoroughly such speculations, or to express presumptions about the nature of the æther. I merely wish, as far as possible, to free myself of all preconceived notions regarding this substance and not to ascribe to it, for example, any of the qualities of ordinary liquids and gasses. Should it be shown, that a description of the phenomena is best arrived at through the assumption of absolute permeability, then one must surely in the meantime adopt this sort of hypothesis, and leave it to further research, if possible, to open up a deeper understanding to us.

It stands to reason, that there can be no question of the *absolute* rest of the æther; the phrase would not even have made sense. When I concisely state, the æther rests, it is only meant that one part of this medium does not displace the other, and that all perceptible motions of the heavenly bodies are relative motions in reference to the æther."

"Es liegt nicht in meiner Absicht, auf derartige Speculationen näher einzugehen oder Vermuthungen über die Natur des Aethers auszusprechen. Ich wünsche nur, mich von vorgefassten Meinungen über diesen Stoff möglichst frei zu halten und demselben z. B. keine von den Eigenschaften der gewöhnlichen Flüssigkeiten und Gase zuzuschreiben. Sollte es sich ergeben, dass eine Darstellung der Erscheinungen am besten unter der Voraussetzung absoluter Durchdringlichkeit gelänge, dann müsste man sich zu einer solchen Annahme einstweilen schon verstehen und es der weiteren Forschung überlassen, uns, womöglich, ein tieferes Verständniss zu erschliessen.

Dass von *absoluter* Ruhe des Aethers nicht die Rede sein kann, versteht sich wohl von selbst; der Ausdruck würde sogar nicht einmal Sinn haben. Wenn ich der Kürze wegen sage, der Aether ruhe, so ist damit nur gemeint, dass sich der eine Theil dieses Mediums nicht gegen den anderen verschiebe und dass alle wahrnehmbaren Bewegungen der Himmelskörper relative Bewegungen in Bezug auf den Aether seien."[2330]

Joseph Larmor wrote, in 1900,

"At the same time all that is known (or perhaps need be known) of the aether itself may be formulated as a scheme of differential equations defining the properties of a *continuum* in space, which it would be gratuitous to further explain by any complication of structure; though we can with great advantage employ our stock of ordinary dynamical concepts in describing the succession of different states thereby defined."[2331]

In 1900, Paul Drude stated,

"*The velocity of light in space* [***] independent of what is understood by a light vector. [***] The conception of an ether absolutely at rest is the most simple and the most natural,—at least if the ether is conceived to be not a substance but merely space endowed with certain physical properties."[2332]

Poincaré asserted in 1900,

"Does our ether actually exist? We know the origin of our belief in the ether. If light takes several years to reach us from a distant star, it is no longer on the star, nor is it on the earth. It must be somewhere, and supported, so to speak, by some material agency.

The same idea may be expressed in a more mathematical and more abstract form."[2333]

Maxwell stated,

"These are some of the already discovered properties of that which has often been called vacuum, or nothing at all. They enable us to resolve several kinds of action at a distance into actions between contiguous parts of a contiguous substance. Whether this resolution is of the nature of explication or complication, I must leave to the metaphysicians."[2334]

Poincaré also asserted in 1889 that,

"Whether the ether exists or not matters little—let us leave that to the metaphysicians; what is essential for us is, that everything happens as if it existed, and that this hypothesis is found to be suitable for the explanation of phenomena. After all, have we any other reason for believing in the existence of material objects? That, too, is only a convenient hypothesis; only, it will never cease to be so, while some day, no doubt, the ether will be thrown aside as useless."[2335]

Poincaré likened the æther to "Shinola",

"What is meant by the ether? In France or in Germany, it is little more than a system of differential equations; provided that these equations are internally consistent and account for the observed facts, one won't worry if the picture which they suggest is more or less strange or unprecedented. On the other hand, W. Thomson immediately tries to carve out the figure of a familiar substance which has a greater likeness to the æther, it appears that it is *scotch shoe wax*, which is to say, a very tough species of shoemaker's wax."

"Que dire de l'éther? En France ou en Allemagne, ce n'est guère qu'un système d'équations différentielles; pourvu que ces équations n'impliquent pas contradiction et rendent compte des faits observés, on ne s'inquiétera pas si l'image qu'elles suggèrent est plus ou moins étrange ou insolite. W. Thomson, au contraire, cherche tout de suite quelle est la matière connue qui ressemble le plus à l'éther; il paraît que c'est le *scotch shoe wax*, c'est-à-dire une espèce de poix très dure."[2336]

Poincaré stated,

"[If the ether] is able to explain everything, this is because it does not enable us to foresee anything; it does not enable us to decide between the different possible hypotheses, since it explains everything beforehand. It therefore

becomes useless."[2337]

In 1901, Cohn averred,

"Like Maxwell and Hertz we address a chemically and physically homogenous medium as an entity, which is also completely characterized at all points electromagnetically by the same value of some constants. This type of medium fills each element of our space; it is perhaps a certain ponderable substance, or it may also be the vacuum. In light of this, we will avoid continuing to speak of an 'æther'."

"Wie Maxwell und Hertz behandeln wir ein chemisch und physikalisch homogenes Medium als ein Gebilde, welches auch elektromagnetisch in allen Punkten durch die gleichen Werte einiger Constanten vollständig charakterisiert ist. *Ein* solches Medium erfüllt jedes Element unseres Raumes; es kann eine bestimmte ponderable Substanz oder auch das Vacuum sein. Daneben noch von einem „Aether" zu sprechen, werden wir vermeiden."[2338]

Faraday argued, in April of 1846,

"The point intended to be set forth for consideration of the hearers was, whether it was not possible that the vibrations which in a certain theory are assumed to account for radiation and radiant phænomena may not occur in the lines of force which connect particles, and consequently masses of matter together; a notion which as far as it is admitted, will dispense with the æther, which, in another view, is supposed to be the medium in which these vibrations take place.

You are aware of the speculation[2] which I some time since uttered respecting that view of the nature of matter which considers its ultimate atoms as centres of force, and not as so many little bodies surrounded by forces, the bodies being considered in the abstract as independent of the forces and capable of existing without them. In the latter view, these little particles have a definite form and a certain limited size; in the former view such is not the case, for that which represents size may be considered as extending to any distance to which the lines of force of the particle extend: the particle indeed is supposed to exist only by these forces, and where they are it is. The consideration of matter under this view gradually led me to look at the lines of force as being perhaps the seat of the vibrations of radiant phænomena.

[***]

The view which I am so bold as to put forth considers, therefore, radiation as a high species of vibration in the lines of force which are known

> to connect particles and also masses of matter together. It endeavours to dismiss the æther, but not the vibration. The kind of vibration which, I believe, can alone account for the wonderful, varied, and beautiful phænomena of polarization, is not the same as that which occurs on the surface of disturbed water, or the waves of sound in gases or liquids, for the vibrations in these cases are direct, or to and from the centre of action, whereas the former are lateral. It seems to me, that the resultant of two or more lines of force is in an apt condition for that action which may be considered as equivalent to a *lateral* vibration; whereas a uniform medium, like the æther, does not appear apt, or more apt than air or water.
>
> The occurrence of a change at one end of a line of force easily suggests a consequent change at the other. The propagation of light, and therefore probably of all radiant action, occupies *time*; and, that a vibration of the line of force should account for the phænomena of radiation, it is necessary that such vibration should occupy time also. I am not aware whether there are any data by which it has been, or could be ascertained whether such a power as gravitation acts without occupying time, or whether lines of force being already in existence, such a lateral disturbance of them at one end as I have suggested above, would require time, or must of necessity be felt instantly at the other end.
>
> As to that condition of the lines of force which represents the assumed high elasticity of the æther, it cannot in this respect be deficient: the question here seems rather to be, whether the lines are sluggish enough in their action to render them equivalent to the æther in respect of the time known experimentally to be occupied in the transmission of radiant force.
>
> The æther is assumed as pervading all bodies as well as space: in the view now set forth, it is the forces of the atomic centres which pervade (and make) all bodies, and also penetrate all space. As regards space, the difference is, that the æther presents successive parts or centres of action, and the present supposition only lines of action; as regards matter, the difference is, that the æther lies between the particles and so carries on the vibrations, whilst as respects the supposition, it is by the lines of force between the centres of the particles that the vibration is continued."[2339]

Faraday's ideas were very influential. William Kingdon Clifford speculated in the year of his death and of Einstein's birth, 1879, that light may be naught but flickering "space",

> "In order to explain the phenomena of light, it is not necessary to assume anything more than a periodical oscillation between two states at any given point of space."[2340]

Karl Pearson noted, as second editor and annotator of Clifford's *The Common Sense of the Exact Sciences* in 1884-1885,

> "The most notable physical quantities which vary with position and time are heat, light, and electro-magnetism. It is these that we ought peculiarly to consider when seeking for any physical changes, which may be due to changes in the curvature of space. If we suppose the boundary of any arbitrary figure in space to be distorted by the variation of space-curvature, there would, by analogy from one and two dimensions, be no change in the volume of the figure arising from such distortion. Further, if we *assume* as an axiom that space resists curvature with a resistance proportional to the change, we find that waves of 'space-displacement' are precisely similar to those of the elastic medium which we suppose to propagate light and heat. We also find that 'space-twist' is a quantity exactly corresponding to magnetic induction, and satisfying relations similar to those which hold for the magnetic field. It is a question whether physicists might not find it simpler to assume that space is capable of a varying curvature, and of a resistance to that variation, than to suppose the existence of a subtle medium pervading an invariable homaloidal space."[2341]

In 1934, Einstein repeated Clifford's idea without an attribution, which idea appeared before Lorentz' theory appeared,

> "Then came H. A. Lorentz's great discovery. All the phenomena of electromagnetism then known could be explained on the basis of two assumptions: that the ether is firmly fixed in space—that is to say, unable to move at all, and that electricity is firmly lodged in the mobile elementary particles. Today his discoveries may be expressed as follows: physical space and the ether are only different terms for the same thing; fields are physical states of space."[2342]

9.6 Relative Simultaneity

The concept of relative simultaneity appears repeatedly in the Nineteenth Century as a French conception, inspired perhaps by Fizeau and Flammarion, furthered by Bergson in his *Time and Free Will, an Essay on the Immediate Data of Consciousness* and by Guyau and Fouillée in *Genèse de l'idée de Temps*, and brought to fruition in Poincaré's *The Measurement of Time* of 1898, and *La Théorie de Lorentz at le Principe de Réaction* of 1900, and *Science and Hypothesis* of 1902, and his 1904 St. Louis lecture, *The Principles of Mathematical Physics*—all of which Albert Einstein is known to have read. However, it was the Croatian Jesuit Boscovich who had the profoundest, and prior, insight regarding relative simultaneity.[2343]

Einstein claimed that he arose from bed once and wondered if events were absolutely simultaneous.[2344] Was Einstein reading Poincaré, who had already expressly written that events are not absolutely simultaneous, in bed, before Einstein fell asleep? We know that Einstein had read Poincaré's work on relative simultaneity before allegedly dreaming about it. Einstein also told an Eureka-like story of his

enlightenment of the special theory of relativity—a story which is suspiciously similar to Archimedes' story.[2345] He was compelled to invent these childish fairy tales of his divine inspiration, as if they accounted for his "research", because there is no record of his having developed the theory, while there is a substantial record of others having published it before him.

9.6.1 Isotropic Light Speed

The equating of light speed to length and time was placed in the consciousness of physicists by Roemer, whose calculations of light's finite speed underpin the definition of simultaneity in modern physics. Fizeau defined space as isotropic with respect to light speed and assumed that:

$$c = (2AB) \div (t'_A - t_A),$$

where c = *celeritas*, the wave speed of light, AB is the length of the path of light from point A to point B, and $(t'_A - t_A)$ is the time interval of the round trip path of light moving from A to B and reflected back to A.

Fizeau thereby presented a new circular definition of time. Poincaré demonstrated that, since c was supposedly a universal constant between systems in relative motion to each other, this new circular definition of time rendered simultaneity relative and that the presumption of an isotropic light speed was the presumption of a measurement of time. Time was previously defined by the circular definition[2346] of uniform motion supplied by Galileo, where equal *spaces* are defined to be traversed in equal *times*. It is interesting to note that Gotthold Ephraim Lessing contrasted painting, sculpture and poetry in terms of events and time.[2347]

9.6.2 The "Aarau Question"

James Clerk Maxwell inspired Albert Abraham Michelson's experiments.[2348] Maxwell wrote an article on "Ether" in the *Encyclopædia Britannica* in 1878 and published a thought experiment Einstein later repeated as if a novel idea,

> "If we consider what is going on at different points in the axis of a beam of light at the same instant, we shall find that if the distance between the points is a multiple of a wave-length the same process is going on at the two points at the same instant, but if the distance is an odd multiple of half a wave-length the process going on at one point is the exact opposite of the process going on at the other.
>
> Now, light is known to be propagated with a certain velocity $(3{\cdot}004 \times 10^{10}$ centimetres per second in vacuum, according to Cornu). If, therefore, we suppose a movable point to travel along the ray with this velocity, we shall find the same process going on at every point of the ray as the moving point reaches it. If, lastly, we consider a fixed point in the axis of the beam, we shall observe a rapid alternation of these opposite processes, the interval of time between similar processes being the time light takes to travel a wave-length."[2349]

Einstein, late in life, told a story of his supposed fantasy in 1895 of traveling at light speed, the so-called "Aarau Question". This story is used as an example of Einstein's supposed independence from Lorentz.[2350] It was one of Einstein's many "Eureka!" stories. Einstein, however, began to study Lorentz in 1895, and his work in 1905 was not independent of Lorentz', but instead did little more than reiterate it.[2351] Albert Einstein stated,

> "After ten years of reflection such a principle resulted from a paradox upon which I had already hit at the age of sixteen: If I pursue a beam of light with the velocity *c* (velocity of light in a vacuum), I should observe such a beam of light as a spatially oscillatory electromagnetic field at rest. [***] One sees that in this paradox the germ of the special theory of relativity is already contained."[2352]

However, this fantasy was the subject of the novel *Lumen*, which was popular among physicists of Einstein's day,[2353] and with which Einstein was intimately familiar long before he fabricated his "Eureka!" story. One might even say that Einstein was an expert on the story of *Lumen*. Mr. Tobinkin noted that Einstein was an avid reader of fiction,

> "After such a period of concentration, Einstein often rests himself by reading fiction."[2354]

Alexander Moszkowski recounted a conservation he had with Einstein, in which Einstein essentially agreed with Lenard's objections to the general principle of relativity and Oskar Kraus' objections to the special theory of relativity, which Einstein publicly condemned, and Moszkowski reveals that Einstein knew Flammarion's story of *Lumen* very well before he fabricated the Aarau myth in an attempt to take credit for Lorentz' theory,

> "A CONVERSATION held during April 1920 destroyed an illusion which had become dear to me.
>
> It concerned the fantastic figure, 'Lumen,' conceived as an actual human being, imagined as endowed with an extraordinary power of motion and keenness of sight. Mr. Lumen is supposed to be the invention of the astronomer Flammarion, who produced him in the retort of fancy, as Faust produced Homunculus, to use him to prove the possibility of very remarkable happenings, in particular, the reversal of Time.
>
> Einstein declared outright 'Firstly, Lumen is not due to Flammarion, who has derived him from other sources; and secondly, Lumen can in no way be used as a means of proving things.'
>
> MOSZKOWSKI: 'It is at least very interesting to operate with him. Lumen is supposed to have a velocity greater than that of light. Let us assume this as given, then the rest follows quite logically. If, for example, he leaves the earth on the day of a great event, such as the battle of Waterloo, and— May

I trace out this example, at the risk of tiring you?

EINSTEIN: Do repeat it, and act as if you were telling something entirely new. It is clear that the Lumen-story gives you great amusement, so please talk quite freely. But I cannot forgo the privilege of showing later how the whole adventure and its consequences must be demolished.

M.: Well then, the person, Lumen, sets off at the end of the battle of Waterloo to make an excursion into space with a speed of 250,000 miles per second. He thus catches up all the light-rays that left the field of battle and moved in his direction. After an hour he will already have attained a lead of about twenty minutes. This lead will be gradually increased, so that at the end of the second day he will no longer be seeing the end of the battle, but the beginning. What has Lumen been seeing in the meantime? Clearly he has been observing events happening in the reverse direction, as in the case of a cinematograph which is exhibiting pictures backwards. He saw the projectiles leaving the objects they had struck, and returning into the mouths of the cannon. He saw the dead come to life, arise, and arrange themselves into battalion order. He would thus arrive at an exactly opposite view of the passing of time, for what he observes is as much his experience as what we observe is ours. If he had seen all the battles of history and, in fact, all events happening in the reverse order, then in his mind 'before' and 'after' would be interchanged. That is, he would experience time backwards; what are causes to us would be effects to him, and our effects would be his causes; antecedents and consequents would change places, and he would arrive at a causality diametrically opposite to our own. He would be quite as justified in adopting his view of the happening of things, according to his experiences, and of the causal nexus as it appears to him, as we are justified in adopting ours.

EINSTEIN: And the whole story is mere humbug, absurd, and based on false premises, leading to entirely false conclusions.

M.: But it is only to be taken as an imaginary experiment that plays with fantastic impossibilities to direct our ideas on to the relativity of time by a striking illustration. Did not Henri Poincaré adduce this extreme example to discuss the 'reversal' of time?

EINSTEIN: You may rest assured that Poincaré, even if he used this example as an entertaining digression in his lectures, took the same view of Lumen as I do. It is not an imaginary experiment: it is a farce, or, to express it more bluntly, it is a mere swindle! These experiences and topsy-turvy perceptions have just as little to do with the relativity of time, such as it is taught by the new machanics, as have the personal sensations of a man, to whom time seems long or short according as he experiences pain or pleasure, amusement or boredom. For, in this case, at least the subjective sensation is a reality, whereas Lumen cannot have reality because his existence is based on nonsense. Lumen is to have a speed greater than that of light. This is not only an impossible, but a foolish assumption, because the theory of relativity has shown that the velocity of light cannot be exceeded. However great the

accelerating force may be, and for however long it may act, it cannot cause this limit to be transcended. Lumen is supposed to be equipped with the organ of sight, that is, he is supposed to have a corporal existence. But the mass of a body becomes infinitely great when it reaches the velocity of light, so that it is quite absurd to go beyond this stage. It is admissible to operate with impossibilities in imagination, that is, with things that contradict our practical experience, but not with absolute nonsense. That is why the other adventure of Lumen, in which he jumps to the moon, is also an absurdity. In this, he is supposed to leap with a speed greater than light, and, when he reaches the moon, to turn round instantaneously, with the result that he sees himself jumping from the moon to the earth backwards! This jump is logically meaningless; and if we try to make deductions of an optical nature from such a nonsensical assumption, we deceive ourselves.

M.: Nevertheless, I should claim extenuating circumstances for this case on the ground that I am enlisting the help of the conception of impossibility. A journey even at a speed of only 1000 miles per second is impossible for a man or a homunculus.

EINSTEIN: Yes, according to our experience, if we measure it against facts. We cannot state definitely that a journey into the universe at an enormous yet limited velocity is absolutely impossible. Within the indicated bounds every play of thought that is argued correctly is allowable.

M.: Now, suppose that I strip Lumen of all bodily organs and take him as being a pure creature of thought, entirely without substance. A velocity greater than that of light can be imagined, even if it cannot he realized physically. If, for example, we think of a lighthouse with a revolving light, and consider a beam of light about 600 miles long, which rotates 200 times per second. Then we could represent to ourselves that the light at the circumference of this beam travels with a speed of nearly 760,000 miles per second.

EINSTEIN: As for that, I can give you a much better example of the same thing. We need only imagine that the earth is poised in space, motionless, and non-rotating. This is physically admissible. Then the most distant stars, as judged by us, would describe their paths with almost unlimited velocities. But this projects us right out of the world of reality into a pure fiction of thought, which, if followed to its conclusion, leads to the most degenerate form of imagination, namely, to pathological individualism. It is in these realms of thought that such perversities as the reversal of time and causality occur.

M.: Dreams, too, are confined to the individual. Reality constrains all human beings to exist in one and the same world, whereas, in dreams, each one has his own world with a different kind of causality. Nevertheless, dreams are a positive experience, and signify a reality for the dreamer. Even for waking reality it would be easy to construct cases in which the causal relationship is shattered. Suppose a person who has grown up in a confined retreat, such as Kaspar Hauser, looks in a mirror for the first time in his life.

As he knows nothing of the phenomena of optical reflexion, he sees in it a new, objective world that gives a shock to, or even subverts, his own idea of causality in so far as it may have become developed in him. Lumen sees himself jump backwards, whereas Kaspar Hauser sees himself performing gestures on the wrong side of his body; should it not be possible to draw a reasonable parallel between these two cases?

EINSTEIN: Quite impossible. However you set about it, your Lumen will inevitably come to grief on the conception of time. Time, denoted in physical expressions by the symbol 't,' may, indeed, be given a negative value in these equations so that an event may be calculated in the reverse direction. But then we are dealing with pure matters of calculation, and in this case we must not allow ourselves to be drawn into the erroneous belief that time itself may travel negatively that is, retrogressively. This is the root of the misapprehension: that what is allowable and indeed necessary in calculations is confused with what may be thought possible in Reality. [*Footnote:* Perhaps an analogy will serve to make this clear. Suppose that a certain quantity of some foodstuff is consumed by $\frac{1}{10}$ head of population. The false inference would be that a population is possible which has $\frac{1}{10}$ heads! In the same way the statistics may be quite correct in arriving at the figure $\frac{1}{5}$ suicides, but if we leave the realms of calculation, then the $\frac{1}{5}$ suicide loses its meaning entirely.] Whoever seeks to derive new knowledge from the excursions of a creature like Lumen into space, confuses the time of an experience with the time of the objective event; but the former can have a definite meaning only if it is founded on a proper causal relation of space and time. In the above imaginary experiment the order of the experiences in time is the reverse of that of the events. And as far as causality is concerned, it is a scientific conception that relates only to events ordered in space and time, and not to experiences. In brief, the experiments with Lumen are swindles.

M.: I must resign myself to giving up these illusions. I must frankly confess that I do so with a certain sadness, for such bold flights of constructive fancy exert a powerful attraction on me. At one time I was near outdoing Lumen by assuming a Super-Lumen, who was to traverse all worlds at once with infinite velocity. He would then be in a position to take a survey of the whole of universal history at a single glance. From the nearest star, Alpha Centauri, he would see the earth as it was four years ago; from the Pole Star, as it was forty years ago; and from the boundary of the Milky Way, as it was four thousand years ago. At the same moment he could choose a point of observation that would enable him to see the First Crusade, the Siege of Troy, the Flood, and also the events of the present day simultaneously.

EINSTEIN: And this flight of thought, which, by the way, has been indulged in repeatedly by others too, has much more sense in it than the

> former one, because you may make an abstraction which disregards speed altogether. It is only a limiting case of reflection."[2355]

Moszkowski had written in 1911,

> "Am humansten verfährt eigentlich noch Henri Poincaré, und unter den Büchern mit sieben Siegeln, die er sonst zu schreiben pflegt, ist seine Schrift über „Die neue Mechanik" noch das offenste. Anstatt von vornherein mit dem Geschütz unheimlicher Differentialgleichungen vorzurücken, vermenschlicht er die Aufgabe durch Einführung jenes Beobachters „Lumen", der uns zuerst von Camille Flammarion vorgestellt worden ist. Mit diesem Lumen, „wie ich ihn sehe" wollen wir uns zunächst ein wenig beschäftigen."[2356]

and then proceeded to explore his view of the story's relevance to the problem of relativity.

Contrary to hypothesis that Einstein only required thought experiments to deduce the theory of relativity and that his work was independent of Lorentz', Einstein himself admitted in 1921,

> "'There has been a false opinion widely spread among the general public,' [Einstein] said, 'that the theory of relativity is to be taken as differing radically from the previous developments in physics from the time of Galileo and Newton—that it is violently opposed to their deductions. The contrary is true. Without the discoveries of every one of the great men of physics, those who laid down preceding laws, relativity would have been impossible to conceive and there would have been no basis for it. Psychologically, it is impossible to come to such a theory at once without the work which must be done before. The four men who laid the foundations of physics on which I have been able to construct my theory are Galileo, Newton, Maxwell, and Lorenz.'"[2357]

Moszkowski again wrote of his fascination with Lumen in 1916 and 1917.[2358] As Moszkowski correctly pointed out, Poincaré not only knew Flammarion's story of *Lumen*, he used it in his lectures. In Poincaré's lecture on "chance", which was, *in all probability*, the inspiration for Einstein's statement that "God does not play dice," Poincaré stated:

> "So we have, then, the reverse of what we found in the preceding examples, great differences in the cause and small differences in the effect. Flammarion once imagined an observer moving away from the earth at a velocity greater than that of light. For him time would have its sign changed, history would be reversed, and Waterloo would come before Austerlitz. Well, for this observer effects and causes would be inverted, unstable equilibrium would no longer be the exception; on account of the universal

irreversibility, everything would seem to him to come out of a kind of chaos in unstable equilibrium, and the whole of nature would appear to him to be given up to chance. [***] But we have not come to the end of paradoxes. I recalled just above Flammarion's fiction of the man who travels faster than light, for whom time has its sign changed. I said that for him all phenomena would seem to be due to chance. This is true from a certain point of view, and yet, at any given moment, all these phenomena would not be distributed in conformity with the laws of chance, since they would be just as they are for us, who, seeing them unfolded harmoniously and not emerging from a primitive chaos, do not look upon them as governed by chance.

What does this mean? For Flammarion's imaginary Lumen, small causes seem to produce great effects; why, then, do things not happen as they do for us when we think we see great effects due to small causes? Is not the same reasoning applicable to his case?

Let us return to this reasoning. When small differences in the causes produce great differences in the effects, why are the effects distributed according to the laws of chance? Suppose a difference of an inch in the cause produces a difference of a mile in the effect. If I am to win in case the effect corresponds with a mile bearing an even number, my probability of winning will be $\frac{1}{2}$. Why is this? Because, in order that it should be so, the cause must correspond with an inch bearing an even number. Now, according to all appearance, the probability that the cause will vary between certain limits is proportional to the distance of those limits, provided that distance is very small. If this hypothesis be not admitted, there would no longer be any means of representing the probability by a continuous function.

Now what will happen when great causes produce small effects? This is the case in which we shall not attribute the phenomenon to chance, and in which Lumen, on the contrary, would attribute it to chance. A difference of a mile in the cause corresponds to a difference of an inch in the effect. Will the probability that the cause will be comprised between two limits *n* miles apart still be proportional to *n*? We have no reason to suppose it, since this distance of *n* miles is great. But the probability that the effect will be comprised between two limits *n* inches apart will be precisely the same, and accordingly it will not be proportional to *n*, and that notwithstanding the fact that this distance of *n* inches is small. There is, then, no means of representing the law of probability of the effects by a continuous curve. I do not mean to say that the curve may not remain continuous in the *analytical* sense of the word. To *infinitely small* variations of the abscissa there will correspond infinitely small variations of the ordinate. But *practically* it would not be continuous, since to *very small* variations of the abscissa there would not correspond very small variations of the ordinate. It would become impossible to trace the curve with an ordinary pencil: that is what I mean.

What conclusion are we then to draw? Lumen has no right to say that the probability of the cause (that of *his* cause, which is our effect) must

necessarily be represented by a continuous function. But if that be so, why have we the right? It is because that state of unstable equilibrium that I spoke of just now as initial, is itself only the termination of a long anterior history. In the course of this history complex causes have been at work, and they have been at work for a long time. They have contributed to bring about the mixture of the elements, and they have tended to make everything uniform, at least in a small space. They have rounded off the corners, levelled the mountains, and filled up the valleys. However capricious and irregular the original curve they have been given, they have worked so much to regularize it that they will finally give us a continuous curve, and that is why we can quite confidently admit its continuity.

Lumen would not have the same reasons for drawing this conclusion. For him complex causes would not appear as agents of regularity and of levelling; on the contrary, they would only create differentiation and inequality. He would see a more and more varied world emerge from a sort of primitive chaos. The changes he would observe would be for him unforeseen and impossible to foresee. They would seem to him due to some caprice, but that caprice would not be at all the same as our chance, since it would not be amenable to any law, while our chance has its own laws. All these points would require a much longer development, which would help us perhaps to a better comprehension of the irreversibility of the universe."[2359]

The story of *Lumen*, written by the famous astronomer Camille Flammarion, is filled with the positivistic dogma Einstein would later promote throughout his career. It was first published many decades before Einstein claimed credit for the story, before Einstein was even born, and discusses not only travel at luminal and superluminal velocities, but the complete relativity of simultaneity, time and space, and the use of light speed as a measurement of relative distance, time and simultaneity.

As a small example from *Lumen*,

"{The magnifying power of time. [*Notes in* "{}" *are margin notes found in the original.*]} It is this: If you set out from the Earth at the moment that a flash of lightning bursts forth, and if you travelled for an hour or more with the light, you would see lightning as long as you continued to look at it. This fact is established by the foregoing principles. But if, instead of travelling *exactly* with the velocity of light, you were to travel with a little less velocity; note the observation that you might make. I will suppose that this voyage away from the Earth, during which you look at the lightning, lasts a minute. I will suppose also, that the lightning lasts a thousandth part of a second. You will continue to see the lightning during 60,000 times its duration. In our first supposition this voyage is identical with that of light. Light has occupied 60,000 tenths of seconds to go from the Earth to the point in space where you are. Your voyage and that of light have co-existed. Now if instead of flying with just the same velocity as light, you had flown a little less quickly, and

if you had employed a thousandth part of a second more to arrive at the same point, instead of always seeing *the same moment of the lightning*, you would have seen, successively, the different moments which consulted the total duration of the lightning, equal to 1000 parts of a second. In this whole minute you would have had time to see first the beginning of the flash of lightning, and could analyse the development of it, the successive phases of it, to the very end. You may imagine what strange discoveries one could make in the secret nature of lightning, increased 60,000 times in the order of its duration, what frightful battles you would have time to discover in the flames! what pandemonium! what unlucky atoms! what a world hidden by its volatile nature from the imperfect eyes of mortals!

{Vision of the analysing eye.}

If you could see by your imagination sufficiently, to separate and count the atoms which constitute the body of a man, that body would disappear before you, for it consists of thousands of millions of atoms in motion, and to the analysing eye it would be a nebula animated by the forces of gravitation. Did not Swedenborg imagine that the universe by which he was surrounded, seen as a whole, was in the form of an immense man? That was anthropomorphism. But there are analogies everywhere. What we know most certainly is, that things *are not* what they appear to be, either in space or in time. But let us return to the delayed flash of lightning.

When you travel with the velocity of light, you see constantly the scene which was in existence at the moment of your departure. If you were carried away for a year, at the same rate, you would have before your eyes the same event for that time. But if, in order to see more distinctly an event which would have taken only a few seconds, such as the fall of a mountain, an avalanche, or an earthquake, you were to delay, to see the commencement of the catastrophe (in slackening a little, your steps on those of light), you would see the progress of the catastrophe, its first moment, its second, and so on successively, in thus nearly following the light, you would only see the end after an hour of observation. The event would last for you an hour instead of a few seconds. You would see the rocks, or the stones suspended in the air, and could thus ascertain the mode of production of the phenomenon, and its incidental delays. Already your terrestrial scientific knowledge enables you to take instantaneous photographs of the successive aspects of rapid phenomena, such as lightning, a meteor, the waves of the sea, a volcanic eruption, the fall of a building, and to make them pass before you graduated in accordance with their effect on the retina. Similarly you can, on the contrary, photograph the pollen of a flower, through each stage of expansion to its completion in the fruit, or the development of a child from its birth to maturity, and project these phases upon a screen, depicting in a few seconds the life of a man, or a tree."[2360]

Somewhat similar stories to the story of *Lumen* are told by Comte Didier de Chousy, *Ignis*; Aaron Bernstein, *Naturwissenschaftliche Volksbücher*, (*confer:* F.

Gregory, "The Mysteries and Wonders of Natural Science: Bernstein's *Naturwissenschaftliche Volksbücher* and the Adolescent Einstein", in J. Stachel and D. Howard, Editors, *Einstein: The Formative Years 1879-1909*, Birkhäuser, Boston, (2000), pp. 23-41); John Venn, "Our Control of Space and Time", *Mind*, Volume 6, Number 21, (January, 1881), pp. 18-31; and Hudson Maxim, *confer:* "Hudson Maxim's Anticipations of Einstein", *Current Opinion*, Volume 71, (November, 1921), pp. 636-638. The story of Dr. Faustus of the 1500's, as translated into English by P. F. Gent in 1592, also tells of travel through the heavens at the speed of thought, presents a Copernican view of the solar system, anticipates satellite images of the weather, etc. The book of *Enoch* also contains somewhat similar stories, as do stories of Mohammed's flight with the angel Gabriel.

Johann Christoph Friedrich von Schiller wrote, in the Eighteenth Century:

Die Große der Welt

Die der schaffende Geist einst aus dem Chaos schlug,
Durch die schwebende Welt flieg' ich des Windes Flug,
    Bis am Strande
    Ihrer Wogen ich lande,
Anker werf', wo kein Hauch mehr weht
Und der Markstein der Schöpfung steht.
Sterne sah ich bereits jugendlich auferstehn,
Tausendjährigen Gangs durchs Firmament zu gehn,
    Sah sie spielen
    Nach den lockenden Zielen;
Irrend suchte mein Blick umher,
Sah die Räume schon—sternenleer.
Anzufeuern den Flug weiter zum Reich des Nichts,
Steur' ich muthiger fort, nehme den Flug des Lichts,
    Neblicht trüber
    Himmel an mir vorüber,
Weltsysteme, Fluthen im Bach,
Strudeln dem Sonnenwandrer nach.
Sieh, den einsamen Pfad wandelt ein Pilger mir
Rasch entgegen—»Halt an! Waller, was suchst du hier?«
    »»Zum Gestade
    Seiner Welt meine Pfade!
Segle hin, wo kein Hauch mehr weht
Und der Markstein der Schöpfung steht!««
»Steh! du segelst umsonst—vor dir Unendlichkeit!«
»»Steh! du segelst umsonst—Pilger, auch hinter mir!—
    Senke nieder,
    Adlergedank', dein Gefieder!
Kühne Seglerin, Phantasie,
Wirf ein muthloses Anker hie.««

9.6.3 Light Signals and Clock Synchronization

There is a common misconception enunciated in numerous histories, that Albert Einstein was the first person to propose the relativity of simultaneity. It is often alleged that the paper, "Zur Elektrodynamik bewegter Körper", *Annalen der Physik*, Series 4, Volume 17, (1905), pp. 891-921, at 892-895, contained the first proposal of a clock synchronization method employing observers and light signals. Given the absence of references in Einstein's work, it has been further assumed by some that the revised thought-experiment regarding a midpoint and relative simultaneity, which appeared in Einstein's 1916 work, "Die Relativität der Gleichzeitigkeit", *Über die spezielle und die allgemeine Relativitätstheorie*, Chapter 9, Friedr. Vieweg & Sohn, Braunschweig, (1917), pp. 16-19, was also an original idea. The historic record proves otherwise. Einstein's thought experiments related to the relativity of simultaneity were first stated by Henri Poincaré, Daniel F. Comstock and Robert Daniel Carmichael.

Of course, Einstein's parroting of Poincaré's ideas did not go completely unnoticed. Poincaré, who was a very gracious person—he even allegedly wrote an undeserving Einstein a recommendation,[2361] *never* mentioned Einstein in the context of the theory of relativity in a positive way. In 1922, Stjepan Mohorovičić acknowledged what Einstein did not,

> "I must point out what is little known, that the French physicist H. Poincaré had already called attention to the fact that the Lorentz Transformations form a group, he had already shown in 1900 (therefore 5 years before Einstein) [*Footnote:* See the book, which is cited in note 22 {M. Abraham, *Theorie der Elektrizität*, Volume 2, Fourth Edition, Leipzig, Berlin, 1920}, S. 359. It appears that Poincaré did not mention Einstien even once in his lecture '*The New Mechanics*' (Leipzig, Berlin, 1911) for this reason.], how one can set clocks by means of light signals to Lorentz' local time. [***] Therefore we must understand the method of signaling (which, as we have stressed, H. Poincaré had already applied in 1900) only as an interpretation of Lorentz' formulas."
>
> "Ich muß darauf hinweisen, was weniger bekannt ist, daß schon der französische Physiker H. Poincaré darauf aufmerksam gemacht hat, *daß die Lorentzschen Transformationen eine Gruppe bilden*; er hat schon 1900 (also 5 Jahre vor Einstein) gezeigt [*Footnote:* Siehe das Buch, welches in Anmerkung 22 zitiert ist {M. Abraham, *Theorie der Elektrizität*. II. Bd. 4. Aufl. Leizig-Berlin 1920}, S. 359. Es scheint, daß deswegen Poincaré in seinem Vortrage »*Die neue Mechanik*« (Leipzig-Berlin 1911) Einstein nicht einmal erwähnt.], wie man die Uhren mittels der Lichtsignale auf die Lorentzsche Ortszeit richten kann. [***] [D]eswegen müssen wir die Methode der Signalisierung (welche — wie wir betont haben — schon H. Poincaré 1900 aufgebracht hat), nur als eine Interpretation der Lorentzschen Formeln auffassen[29]).":[2362]

Stjepan Mohorovičić acknowledged Poincaré's priority for realizing that the Lorentz Transformations form a group. Mohorovičić cites Max Abraham's acknowledgment of Poincaré's priority for the clock synchronization method with light signals,[2363] and asserts that Poincaré did not mention Einstein even once in his lecture *Die neue Mechanik* (*La mécanique nouvelle = The New Mechanics*),[2364] because Einstein had plagiarized Poincaré's method of synchronizing clocks with light signals, which method is but an interpretation of Lorentz' "Ortszeit", and Einstein had plagiarized Poincaré's assertion of the group properties of the Lorentz Transformation.[2365]

Felix Klein had made similar statements in a private letter to Wolfgang Pauli on 8 March 1921, that Poincaré first recognized that the Lorentz Transformations form a group and that Poincaré felt an animosity towards Einstein, and this was the only explanation for the fact that Poincaré did not mention Einstein in Poincaré's Göttingen lecture on the new mechanics. Klein wrote,

> "Es ist nun doch einmal so, daß Poincarés erste Note in den Comptes Rendus 140 vor Einstein liegt und er im Anschluß daran (in den Rendiconti di Palermo) zuerst zeigte, daß es sich bei Lorentz um eine *Gruppe* von Transformationen handele. Von da aus ein Gegensatz, der allein es verständlich macht, daß P[oincaré] 1911 in seinem Göttinger Vortrag ,,sur la nouvelle mécanique'' den Namen Einstein überhaupt nicht nennt."[2366]

Poincaré's silence also caught the attention of Max Born, who stated,

> "One of these series of lectures was given by Henri Poincare, April 22nd-28th 1909[.] The sixth lecture had the title 'La mécanique nouvelle.' It is a popular account of the theory of relativity without any formulae and with very few quotations. EINSTEIN and MINKOWSKI are not mentioned at all, only MICHELSON, ABRAHAM and LORENTZ. But the reasoning used by POINCARÉ was just that, which EINSTEIN introduced in his first paper of 1905, of which I shall speak presently. Does this mean that POINCARÉ knew all this before EINSTEIN? It is possible, but the strange thing is that this lecture definitely gives you the impression that he is recording LORENTZ' work."[2367]

Arvid Reuterdahl also was aware that Poincaré resented Einstein,

> "Professor Henri Poincaré, the famous French physicist and mathematician, advisedly ignores the name of Einstein in his lectures on 'Relativity'."[2368]

And Johannes Riem reiterated the fact,

> "Neben dieser Aufklärung durch die Presse ging dann eine wissenschaftliche Bekämpfung Einsteins, vor allem durch den Mathematiker und Ingenieur *Reuterdahl* am St. Thomas College, der selbst schon *vor* Einstein über Relativität gearbeitet und Einstein zu einer öffentlichen Aussprache

aufgefordert hat, bei der dieser das Richterscheinen vorzog. Reuterdahl hat eine kleine leicht lesbare Broschüre im Journal seines College erscheinen lassen „Einstein und die neue Wissenschaft‘‘. Hierin untersucht er physikalisch die Grundlagen der neuen Lehre. Er zeigt seinen Landsleuten, wie schon lange vor Einstein zahlreiche Gelehrte das Richtige der Relativitätstheorie gefunden und diesem als Quelle gedient haben, ohne daß dieser auf diese seine Vorgänger hinwiese, so daß es ganz falsch ist, die Relativitätstheorie immer auf Einstein zurückzuführen, wie dies meist geschieht. Es ist dies so wenig berechtigt, daß z. B. Poincaré in seinen Vorlesungen über Relativität Einstein überhaupt nicht erwähnt. Quellenmäßig wird dann von Reuterdahl gezeigt, wie bedeutende Gelehrte die Einsteinsche Fassung der Relativitätstheorie als falsch bekämpfen und ganz andere Ueberlegungen and die Stelle setzen, wie *Lenard*, *Gehrcke*, *Fricke*, *Mewes* es tun. Endlich untersucht er das Einsteinsche Gebäude selbst auf seine Zusammensetzung, seine Grundlagen und Haltbarkeit, und findet, daß es ein Spiel mit Worten und Begriffen ist, denen in der Physik nichts tatsächliches entspricht. Es wäre sehr lohnend, die kleine Schrift von 26 Seiten zu übersetzen.”[2369]

Charles Nordmann stated, in 1921,

“The only time of which we have any idea apart from all objects is the psychological time so luminously studied by M. Bergson: a time which has nothing except the name in common with the time of physicists, of science.

It is really to Henri Poincaré, the great Frenchman whose death has left a void that will never be filled, that we must accord the merit of having first proved, with the greatest lucidity and the most prudent audacity, that time and space, as we know them, can only be relative. A few quotations from his works will not be out of place. They will show that the credit for most of the things which are currently attributed to Einstein is, in reality, due to Poincaré. [***] I venture to sum up all this in a sentence which will at first sight seem a paradox: in the opinion of the Relativists it is the measuring rods which create space, the clocks which create time. All this was maintained by Poincaré and others long before the time of Einstein, and one does injustice to truth in ascribing the discovery to him.”[2370]

Wolfgang Pauli wrote, in 1921,

“The formal gaps left by Lorentz’s work were filled by Poincaré. He stated the relativity principle to be generally and rigourously valid. Since he, in common with the previously discussed authors, assumed Maxwell’s equations to hold for the vacuum, this amounted to the requirement that all laws of nature must be covariant with respect to the ‘Lorentz transformation’ [*Footnote:* The terms ‘Lorentz transformation’ and ‘Lorentz group’ occurred for the first time in this paper by Poincaré.]. The invariance of the transverse

dimensions during the motion is derived in a natural way from the postulate that the transformations which affect the transition from a stationary to a uniformly moving system must form a group which contains as a subgroup the ordinary displacements of the coordinate system. Poincaré further corrected Lorentz's formulae for the transformations of charge density and current and so derived the complete covariance of the field equations of electron theory. We shall discuss his treatment of the gravitational problem, and his use of the imaginary coordinate *ict*, at a later stage (see §§ 50 and 7)."[2371]

In 1927, Hans Thirring wrote,

"H. Poincaré had already completely solved the problem of time several years before the appearance of Einstein's first work (1905). Beginning with an article in Revue de Métaphysique et de Morale which appeared in 1898 (later reprinted in his book 'The Value of Science' as a chapter on the concept of time), Poincaré settled the general problem of time from the physical standpoint and had already there referred to the fact that the principle of the constancy of the velocity of light serves as a basis for a definition of time. Poincaré, in his work 'La Théorie de Lorentz et le Principe de Réaction'(Arch. Néerland. (2) Vol. 5. 1900, Lorentz-Festschrift), then defined Lorentz' local time (Fig. 23) as time, which time is to be measured with clocks synchronized by light signals."

"Die Klärung des Zeitproblems war schon mehrere Jahre vor dem Erscheinen von EINSTEINS grundlegender Arbeit (1905) durch H. POINCARÉ weitgehend vorbereitet worden. Dieser hatte zunächst in einem im Jahre 1898 in der Revue de Métaphysique et de Morale erscheinenen (später als Kapitel über den Begriff der Zeit in seinem Buche „Der Wert der Wissenschaft" abgedruckten) Artikel das allgemeine Zeitproblem vom physikalischen Standpunkt aus behandelt und hatte dort schon erwähnt, daß sich auf den Satz von der Konstanz der Lichtgeschwindigkeit eine Zeitdefinition gründen läßt. Er hat dann in einer Arbeit „La Théorie de LORENTZ et le principe de réaction" (Arch. Néerland. (2) Bd. 5. 1900, Lorentz-Festschrift) die LORENTZsche Ortszeit (Ziff. 23) als die Zeit definiert, die durch mit Lichtsignalen synchronisierte Uhren gemessen wird."[2372]

Herbert Spencer argued that time, space and simultaneity are purely relative, at least as early as the 1860's,

"§ 93. But now what are we to say about the pure relations of Co-existence, of Sequence, and of Difference; considered apart from amounts of Space, of Time, and of Contrast? Can we say that the relation of Co-existence, conceived simply as implying two terms that exist at the same time, but are not specified in their relative positions, has anything answering to it beyond

consciousness? Can we say that out of ourselves there is such a thing as Succession, corresponding to the conception we have of one thing coming after another, without reference to the time between them? And can we say that what we know as Difference, apart from any particular degree of it, has objective unlikeness as its cause?

The reply is that we cannot frame ideas of Co-existence, of Sequence, and of Difference, without there entering into them ideas of quantity. Though we have examined apart the compound relations of these orders, into which consciousness of quantity avowedly enters; and though, in above defining the simple relations of these orders, the avowed contemplation of quantity is excluded; yet, on looking closely into the matter, we find that a tacit recognition of quantity is always present. Co-existence cannot be thought of without some amount of space. Sequence cannot be thought of without some interval of time. Difference cannot be thought of without some degree of contrast. Hence what has been said above respecting these relations in their definitely-compound forms, applies to them under those forms which, by a fiction, we regard as simple. All the proofs of relativity that held where the conceived quantities were large, hold however small the conceived quantities become. And as the conceived quantities cannot disappear from consciousness without the relations themselves disappearing, it follows inevitably that the relativities hold of the relations themselves in their ultimate elements. We are thus forced to the conclusion that the relations of Co-existence, of Sequence, and of Difference, as we know them, do not obtain beyond consciousness.

Let us simplify the matter by reducing derivative relations to the fundamental relation; and we shall then see more clearly the truth of this apparently-incredible proposition.

Every particular relation of Co-existence involves a cognition of some difference in the positions of the things co-existing; resolvable, ultimately, into differences of relative position towards self. And differences of relative position can be known only through differences between the states of consciousness accompanying the disclosure of the positions. But while positions in Space, and co-existing objects occupying them, are known through relations of Difference between the feelings accompanying disclosure of them; they are known through relations of Likeness, in respect of their order of presentation. The relation of Co-existence, which is that out of which all Space-conceptions are built, is one in which neither term is first or last: the terms exhibit equality in their order—no difference in their order.

Phenomena occurring in succession, like those occurring simultaneously, are known as occupying different positions in consciousness. Intervals between them are distinguished by differences in the feelings that arise in passing over the intervals; and where the intervals are alike, they are so classed from the absence of such differences. But while the relations among phenomena in Time are known as such or such through conceptions of Difference and No-difference yielded by comparisons of them, they are

known as alike in this, that their terms are unequal in order of presentation—differ in their order.

Thus all Space-relations and Time-relations—all relations of Co-existence and Sequence, are known through relations of Difference and No-difference. Sequence is Difference of order; Co-existence is No-difference of order. Hence we have at last to deal with the relations of Difference and No-difference. And our entire consciousness being built up of feelings which present these relations, both in themselves and in the secondary feelings constituting consciousness of their order, the whole question of the relativity of relations among feelings is reducible to the question of the relativity of the relation of Difference. This is readily demonstrable.

The sole elements, and the indissoluble elements, of the relation are these:—A feeling of some kind; a feeling coming next to it, which, being distinguishable as another feeling, proves itself to be not homogeneous with the first; a feeling of shock, more or less decided, accompanying the transition. This shock, which arises from the difference of the two feelings, becomes the measure of that difference—constitutes by its occurrence the consciousness of a relation of difference, and by its degree the consciousness of the amount of difference. That is, the relation of Difference as present in consciousness is nothing more than a change in consciousness. How, then, can it resemble, or be in any way akin to, its source beyond consciousness? Here are two colours which we call unlike. As they exist objectively, the two colours are quite independent—there is nothing between them answering to the change which results in us from contemplating first one and then the other. Apart from our consciousness they are not linked as are the two feelings they produce in us. Their relation as we think it, being nothing else than a change of our state, cannot possibly be parallel to anything between them, when they have both remained unchanged."[2373]

Poincaré later spoke in very similar terms to Spencer's arguments.

Wilhelm Bölsche wrote, in 1896,

"Noch einmal aber selbst nach diesem zwingt uns die einfache Thatsachenreihe, die mit jener Spekulation durchaus nichts weiter zu thun hat, zu einer letzten, allerungeheurlichsten Erweiterung des Zeithorizontes: wenn wir nämlich von der Erde als einem anfänglich selbstleuchtenden Stern zu den glühenden Gebilden des Weltraums, den Sonnen und Nebelflecken, übergehen. Die Fülle der Analogien ist so zwingend, daß wir es müssen. Ein eigentümliches Verhältnis kommt uns auf dieser äusersten Stufe entgegen. Durch eine seltsame Verkettung nämlich vermischt sich hier räumliche Entfernung mit exakten Zeitangaben. Die vermittelnde Bewegung, die unseren Sinnen die deutlichste Kunde giebt von der Existenz außerirdischer Weltkörper, das licht, wird von selbst zum Meßapparat für gewisse Zeiträume in der Existenz jener Körper. Das Licht pflanzt sich im Raume fort mit einer Geschwindigkeit von 40,000 Meilen in der Sekunde. Nun handelt

es sich aber bei den Sonnen und Nebeln außerhalb der Erde um Entfernungen von dieser Erde selbst, in denen jene nicht allzu hohe Ziffer von 40,000 Meilen sehr oft und in immer steigendem Maße aufgeht. Die Sekunden, die der Lichtstrahl braucht, mehren sich entsprechend. Von der Sonne zu uns verbraucht der Strahl bereits 8 ganze Minuten und einige Sekunden (die 20 Millionen Meilen Entfernung des Sonnenballs vom Erdball), so daß die Lichtpost stets um diese Zeitspanne verspätet eintrifft; ein jähes Verlöschen der Sonne würde erst nach Ablauf 8 Minuten von uns bemerkt werden. Nun aber ist der wahrscheinlich nächste Fixstern, der Stern a im Sternbild des Centauren (vorausgesetzt, daß die in solchen Entfernungsbestimmungen noch außerordentlich schwankenden Resultate der Rechnung einigermaßen stimmen), schon einige Billionen Meilen von uns entfernt und sein Licht entsprechend erst nach mehreren Jahren bei uns. Vom Sirius kommt die Lichtpost bereits mit einer Verspätung von 14 Jahren, von Stern Capella (bei sehr unsicherer Berechnung) mit etwa 42 Jahren Rückstand. Der fernsten Lichtäußerung von der Grenze unseres Fixsternsystems glaubte Herschel wenigstens zweitausend Jahre zugeben zu müssen. Jenseits der gedrängten Fixsternmasse, der unsere Sonne noch angehört, tauchen aber im öderen Raum jene geheinisvollen, vielgestaltigen Stoffmassen auf, die man Nebelflecke nennt und deren chemische Zusammensetzung die Spektralanalyse zum Teil erfolgreich zu ergründen begonnen hat. Die Entfernung wachsen hier ins Ungemessene; und mit den Entfernungen datiert sich im Banne jener Lichtstrahlverzögerung die Geschichte jener Gebilde ins gleichfalls Unermeßliche zurück: was wir heute gewahren, sind Vorgänge und Formen, die in Wahrheit wahrscheinlich lange vor dem Anfang menschlicher Kultur, vielleicht vor Beginn der ältesten geologischen Epochen, vielleicht gar vor der Entstehung oder Isolierung des ursprünglichen irdischen Glutballs existiert haben. Der Nebelflecke ist für unser Suchen bis jetzt kein Ende. Und so auch kein Ende dieser zeitlichen Verschiebung nach rückwärts. Auch hier wieder stoßen wir auf die Million, bloß daß sie uns noch sinnlich anschaulicher entgegentritt als in der Urgeschichte der Erde selbst — innig verknüpft mit der Gegenwart, mit der Sekunde, da das milde Licht irgend einer solchen einsam schwebenden Nebelinsel fernster Himmelszone nach unermeßlicher Wanderung anspruchslos, wie ein eben aufglimmendes irdisches Lichtwölkchen, in das kunstvolle Teleskop unserer Sternwarte fällt, um uns, nach Humboldts schönem Wort, vielleicht „das älteste sinnliche Zeugnis von dem Dasein der Materie“ zu übermitteln.”[2374]

In 1874, Richard A. Proctor wrote,

“We learn by view of the heavens that twenty years ago Sirius was shining with such and such brightness; that a hundred years ago some other star was shining with its degree of luster, and so on; but the star depths are never revealed to us exactly as they are at the moment, or exactly as they were at

> any moment. Yet this is merely due to the imperfection of our senses. We judge by the light of these objects, and this light travels at such and such a rate. It is conceivable that creatures might have a sense enabling them to judge by some other form of action, exerted by the stars, as for instance by the action of gravity. If gravity were the action thus effective, the information conveyed respecting the universe would be far more nearly contemporaneous, since the action of gravity certainly travels many times faster than light, even if it does not travel with infinite velocity as some philosophers suppose."[2375]

This was a view that would later lead to lingering doubts about the special theory of relativity with respect to the speed of gravity[2376] and with respect to "tachyons". Rudolf Lämmel posed the critical question to Einstein in 1911 and Einstein responded,

> "If gravitation were to propagate with a (universal) superluminal velocity, this would suffice to bring down the principle of relativity once and for all. If it propagated infinitely fast, this would provide us with a means to determine the absolute time."[2377]

Poincaré returned to Proctor's Sirius, seriously attacking the notions of absolute space, time and simultaneity. Poincaré wrote, and notice that he provides cause with an alibi for effect,

> "[I]t is possible to say that a ray of light is also one of our instruments. [***] One event takes place on Earth, another on Sirius; how shall we know whether the first occurs before, at the same time, or after the second? This can be so only as the result of a convention. [***] In this new mechanics there is no effect which is transmitted instantaneously; the maximum speed of transmission is that of light. Under these conditions it can happen that event *A* (as a consequence of the mere consideration of space and time) could be neither the effect nor the cause of event *B* if the distance between the places where they take place is such that light cannot travel in sufficient time from place *B* to place *A* nor from place *A* to place *B*."[2378]

James Thomson stated the principle of relativity and pointed out the difficulty of "ascertaining simultaneity of occurrences in distant places" in 1884, which difficulty we attempt to resolve with light signals,

> "There is no distinction known to men, among states of existence of a body which can give reason for any one state being regarded as a state of absolute rest in space, and any other being regarded as a state of uniform rectilinear motion. Men have no means of knowing, nor even of imagining, any one length rather than any other, as being the distance between the place occupied by the centre of a ball at present, and the place that was occupied

by that centre at any past instant; nor of knowing or imagining any one direction, rather than any other, as being the direction of the straight line from the former place to the new place, if the ball is supposed to have been moving in space. The point of space that was occupied by the centre of the hall at any specified past moment is utterly lost to us as soon as that moment is past, or as soon as the centre has moved out of that point, having left no trace recognisable by us of its past place in the universe of space.

There is then an essential difficulty as to our forming a distinct conception either of rest or of rectilinear motion through unmarked space.

We have besides no preliminary knowledge of any principle of chronometry, and for this additional reason we are under an essential preliminary difficulty as to attaching any clear meaning to the words *uniform rectilinear motion* as commonly employed, the uniformity being that of equality of spaces passed over in equal times.

If two balls are altering their distance apart, we cannot suppose that they are both at rest. One, at least, must be in motion.

Men have very good means of knowing in some cases, and of imagining in other cases, the distance between the points of space simultaneously occupied by the centres of two balls; if, at least, we be content to waive the difficulty as to imperfection of our means of ascertaining or specifying, or clearly idealising, simultaneity at distant places. For this we do commonly use signals by sound, by light, by electricity, by connecting wires or bars, and by various other means. The time required in the transmission of the signal involves an imperfection in human powers of ascertaining simultaneity of occurrences in distant places. It seems, however, probably not to involve any difficulty of idealising or imagining the existence of simultaneity. Probably it may not be felt to involve any difficulty comparable to that of attempting to form a distinct notion of identity of place at successive times in unmarked space."[2379]

In 1885 in a Mach-like argument, Edmund Montgomery set the stage for Poincaré's notion of relative simultaneity,

"An unsophisticated mind would think it obvious beyond controversy that, in spite of the lapse in time of all our feelings, there consciously appears within our mental presence, ready-made and persistently enduring, an unmistakably extended universe with all its parts simultaneously subsisting. [***] But how to consolidate by memory or otherwise into simultaneous extension and actual presence successive moments of ever-fleeting time, irretrievably dwindled away into the past—this is a task which transcends all thinkable possibility. [***] Time has to be somehow metamorphosed into space, inwardness into outwardness. From a lapsing succession of sensations, forming a series of unextended feelings, the permanent and simultaneous expanse of the outer world has to be constructed."[2380]

G. Windred gave a brief history of theories of time and space, "The History of Mathematical Time: II", *Isis*, Volume 20, Number 1, (November, 1933), pp. 192-219; which highlights some of the important contributions of Challis, Herschel, Whewell, Shadworth H. Hodgson, Airy, and others, towards Poincaré's notion of relative simultaneity. Windred quotes Hodsgon's statement, "Time has one dimension—length[,]"[2381] and quotes astronomers to show that they recognized the need to correctly position events relative to time, given that we depend upon signals with a finite speed to observe these events.

In 1887, Woldemar Voigt[2382] published the following relativistic transformation of space-time coordinates:

$$x' = x - v\,t, \quad y' = \frac{y}{\gamma}, \quad z' = \frac{z}{\gamma}, \quad t' = t - \frac{v\,x}{c^2}$$

$$\text{where } \gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Poincaré asserted that Lorentz' (Voigt's) "position time" was "time" and that simultaneity is relative, in 1898, and we know from Solovine's accounts[2383] that Einstein had read this paper, which was reprinted as Chapter 2 of Poincaré's book *La Valeur de la Science*, E. Flammarion, Paris, (1904); and which was referred to in Poincaré's book *La Science et l'Hypothèse*, E. Flammarion, Paris, (1902);

"XII

But let us pass to examples less artificial; to understand the definition implicitly supposed by the savants, let us watch them at work and look for the rules by which they investigate simultaneity.

I will take two simple examples, the measurement of the velocity of light and the determination of longitude.

When an astronomer tells me that some stellar phenomenon, which his telescope reveals to him at this moment, happened nevertheless fifty years ago, I seek his meaning, and to that end I shall ask him first how he knows it, that is, how he has measured the velocity of light.

He has begun by *supposing* that light has a constant velocity, and in particular that its velocity is the same in all directions. That is a postulate without which no measurement of this velocity could be attempted. This postulate could never be verified directly by experiment; it might be contradicted by it if the results of different measurements were not concordant. We should think ourselves fortunate that this contradiction has not happened and that the slight discordances which may happen can be readily explained.

The postulate, at all events, resembling the principle of sufficient reason, has been accepted by everybody; what I wish to emphasize is that it furnishes

us with a new rule for the investigation of simultaneity, entirely different from that which we have enunciated above.

This postulate assumed, let us see how the velocity of light has been measured. You know that Roemer used eclipses of the satellites of Jupiter, and sought how much the event fell behind its prediction. But how is this prediction made? It is by the aid of astronomic laws, for instance Newton's law.

Could not the observed facts be just as well explained if we attributed to the velocity of light a little different value from that adopted, and supposed Newton's law only approximate? Only this would lead to replacing Newton's law by another more complicated. So for the velocity of light a value is adopted, such that the astronomic laws compatible with this value may be as simple as possible. When navigators or geographers determine a longitude, they have to solve just the problem we are discussing; they must, without being at Paris, calculate Paris time. How do they accomplish it? They carry a chronometer set for Paris. The qualitative problem of simultaneity is made to depend upon the quantitative problem of the measurement of time. I need not take up the difficulties relative to this latter problem, since above I have emphasized them at length.

Or else they observe an astronomic phenomenon, such as an eclipse of the moon, and they suppose that this phenomenon is perceived simultaneously from all points of the earth. That is not altogether true, since the propagation of light is not instantaneous; if absolute exactitude were desired, there would be a correction to make according to a complicated rule.

Or else finally they use the telegraph. It is clear first that the reception of the signal at Berlin, for instance, is after the sending of this same signal from Paris. This is the rule of cause and effect analyzed above. But how much after? In general, the duration of the transmission is neglected and the two events are regarded as simultaneous. But, to be rigorous, a little correction would still have to be made by a complicated calculation; in practise it is not made, because it would be well within the errors of observation; its theoretic necessity is none the less from our point of view, which is that of a rigorous definition. From this discussion, I wish to emphasize two things: (1) The rules applied are exceedingly various. (2) It is difficult to separate the qualitative problem of simultaneity from the quantitative problem of the measurement of time; no matter whether a chronometer is used, or whether account must be taken of a velocity of transmission, as that of light, because such a velocity could not be measured without *measuring* a time.

XIII

To conclude: We have not a direct intuition of simultaneity, nor of the equality of two durations. If we think we have this intuition, this is an illusion. We replace it by the aid of certain rules which we apply almost always without taking count of them.

But what is the nature of these rules? No general rule, no rigorous rule;

a multitude of little rules applicable to each particular case.

These rules are not imposed upon us and we might amuse ourselves in inventing others; but they could not be cast aside without greatly complicating the enunciation of the laws of physics, mechanics and astronomy.

We therefore choose these rules, not because they are true, but because they are the most convenient, and we may recapitulate them as follows: 'The simultaneity of two events, or the order of their succession, the equality of two durations, are to be so defined that the enunciation of the natural laws may be as simple as possible. In other words, all these rules, all these definitions are only the fruit of an unconscious opportunism."[2384]

Circa 1899, Poincaré clarified the fact that he saw no distinction between "time" and "local time",

"Allow me a couple of remarks regarding the new variable t': it is what Lorentz calls *the local time*. At a given point t and t' will not defer but by a constant, t' will, therefore, always represent the time, but the origin of the times being different for the different points serves as justification for his designation."

"Disons deux mots sur la nouvelle variable t': c'est ce que Lorentz appelle *le temps locale*. En un point donné t et t' ne différeront que par une constante, t' représentera donc toujours le temps mais l'origine des temps étant différente aux différents points: cela justifie sa dénomination."[2385]

In his article on "Ether" for the *Encyclopædia Britannica*, Maxwell proposed thought experiments which may have inspired Poincaré's definition of relative simultaneity,

"*Relative motion of the æther*.—We must therefore consider the æther within dense bodies as somewhat loosely connected with the dense bodies, and we have next to inquire whether, when these dense bodies are in motion through the great ocean of æther, they carry along with them the æther they contain, or whether the æther passes through them as the water of the sea passes through the meshes of a net when it is towed along by a boat. If it were possible to determine the velocity of light by observing the time it takes to travel between one station and another on the earth's surface, we might, by comparing the observed velocities in opposite directions, determine the velocity of the æther with respect to these terrestrial stations. All methods, however, by which it is practicable to determine the velocity of light from terrestrial experiments depend on the measurement of the time required for the double journey from one station to the other and back again, and the increase of this time on account of a relative velocity of the aether equal to

that of the earth in its orbit would be only about one hundred millionth part of the whole time of transmission, and would therefore be quite insensible."[2386]

In 1900, Poincaré stated,

"In order for the compensation to occur, the phenomena must correspond, not to the true time t, but to some determined *local time* t' defined in the following way.

I suppose that observers located at different points synchronize their watches with the aid of light signals; which they attempt to adjust to the time of the transmission of these signals, but these observers are unaware of their movement of translation and they consequently believe that the signals travel at the same speed in both directions, they restrict themselves to crossing the observations, sending a signal from *A* to *B*, then another from *B* to *A*. The local time t' is the time determined by watches synchronized in this manner.

If in such a case $V = \frac{1}{\sqrt{K_0}}$ is the speed of light, and *v* the translation of the Earth, that I imagine to be parallel to the positive *x* axis, one will have:

$$t' = t - \frac{vx}{V^2}."$$

"Pour que la compensation se fasse, il faut rapporter les phénomènes, non pas au temps vrai t, mais à un certain *temps local* t' défini de la façon suivante.

Je suppose que des observateurs placés en différents points, règlent leurs montres à l'aide de signaux lumineux; qu'ils cherchent à corriger ces signaux du temps de la transmission, mais qu'ignorant le mouvement de translation dont ils sont animés et croyant par conséquent que les signaux se transmettent également vite dans les deux sens, ils se bornent à croiser les observations, en envoyant un signal de *A* en *B*, puis un autre de *B* en *A*. Le temps local t' est le temps marqué par les montres ainsi réglées.

Si alors $V = \frac{1}{\sqrt{K_0}}$ est la vitesse de la lumière, et *v* la translation de la Terre que je suppose parallèle à l'axe des *x* positifs, on aura:

$$t' = t - \frac{vx}{V^2}."[2387]$$

We know that Einstein had read this paper.[2388]

In 1902 in his book *La Science et l'Hypothèse*, E. Flammarion, Paris, (1902); Poincaré asserted, and we know, from Solovine's accounts,[2389] that Einstein had read this work of Poincaré's,

"1. There is no absolute space, and we only conceive of relative motion; and yet in most cases mechanical facts are enunciated as if there is an absolute space to which they can be referred.

2. There is no absolute time. When we say that two periods are equal, the statement has no meaning, and can only acquire a meaning by a convention.

3. Not only have we no direct intuition of the equality of two periods, but we have not even direct intuition of the simultaneity of two events occurring in two different places. I have explained this in an article entitled 'Mesure du Temps.' [*Footnote: Revue de Métaphysique et de Morale*, t. vi., pp. 1-13, January, 1898.]"[2390]

Philipp Frank stressed the influence Poincaré had on Einstein.[2391] Einstein once stated,

"The reading of Hume, along with Poincaré and Mach, had some influence on my development."[2392]

In Lisbeth and Ferdinand Lindemann's German translation; *Wissenschaft und Hypothese*, B. G. Teubner, Leipzig, (1904), pp. 286-289; of Poincarés 1902 work, *La Science et l'Hypothèse*; the Lindemanns included the following notation:

"43) S. 92. In der citierten Abhandlung ["la Mesure du temps", *Revue de Métaphysique et de Morale*, t. VI, p. 1-13 (janvier 1898).] kommt P o i n c a r é zu folgenden Schlüssen:

„Wir haben keine direkte Anschauung von der Gleichzeitigkeit zweier Zeitdauern, ebensowenig von der Gleichheit. — Wir behelfen uns mit gewissen Regeln, die wir beständig anwenden, ohne uns davon Rechenschaft zu geben. — Es handelt sich dabei um eine Menge kleiner Regeln, die jedem einzelnen Falle angepaßt sind, nicht um eine allgemeine und strenge Regel. — Man könnte dieselben auch durch andere ersetzen, aber man würde dadurch das Aussprechen der Gesetze in der Physik, Mechanik und Astronomie außerordentlich umständlich machen. — Wir wählen also diese Regeln nicht, weil sie wahr, sondern weil sie bequem sind, und wir können sie in folgendem Satze zusammenfassen: Die Gleichzeitigkeit zweier Ereignisse oder die Ordnung ihrer Aufeinanderfolge und die Gleichheit zweier Zeitdauern müssen so definiert werden, daß der Ausspruch der Naturgesetze möglichst einfach wird; mit anderen Worten: Alle diese Regeln und Definitionen sind nur die Frucht eines unbewußten Opportunismus."

N e w t o n (dessen Anschauung man z. B. bei M a c h reproduziert findet: Die Mechanik in ihrer Entwicklung, 2. Anfl., Leipzig 1889, S. 207) setzte die Existenz einer „absoluten Zeit" voraus; d ' A l e m b e r t , L o c k e u. a. hoben den relativen Charakter aller Zeitmaße hervor; vgl. die historischen Angaben bei A . V o ß in dem Artikel über die Prinzipien der rationellen Mechanik (Enzyklopädie der math. Wissenschaften, IV, 1). Nach d e T i l l y s Angabe (Sur divers points de la philosophie des sciences

mathématiques; Classe des sciences de l'Académie R. de Belgique, 1901) definiert z. B. L o b a t s c h e w s k y die Zeit als eine „Bewegung, welche geeignet ist, die anderen Bewegungen zu messen". Auch eine solche Definition setzt voraus, daß es e i n e Bewegung gibt, die zum Messen der (also aller) anderen Bewegungen geeignet ist; und wann ist eine Bewegung „geeignet", als Maß anderer zu dienen? Vielleicht kann die folgende analytische Erörterung hier zur Klärung beitragen.

Wir betrachten z. B. das Fallgesetz eines schweren Punktes auf der Erdoberfläche; dasselbe ist bekanntlich durch die Differentialgleichung:

$$\frac{d^2 z}{dt^2} = -g \tag{1}$$

vollständig dargestellt, wenn z eine vertikal nach oben gemessene Koordinate, t die Zeit, g die Beschleunigung der Schwere bedeutet. Führen wir nun ein anderes Zeitmaß τ ein, so wird τ eine Funktion von t sein:

$$\tau = \varphi(t), \quad t = \Phi(\tau),$$

und die Gleichung (1) nimmt, wenn wir τ einführen, folgende Gestalt an:

$$\left[\frac{1}{\Phi'(\tau)}\right]^2 \left(\frac{d^2 z}{d\tau^2} - \frac{dz}{d\tau}\,\Phi''(\tau)\right) = -g, \tag{2}$$

wo Φ' und Φ'' den ersten und zweiten Differentialquotienten der Funktion $\Phi(\tau)$ nach τ bezeichnen. Die einfache Form der Gleichung (1) beruht also wesentlich auf der Wahl eines für die Gesetze des Falles „geeigneten" Zeitmaßes; jede andere Art der Zeitmessung würde zu wesentlich komplizierterem Ansatze führen; dadurch ist die Zeit t vor der Zeit τ ausgezeichnet. Dieses Zeitmaß wird praktisch durch eine Uhr, etwa eine Pendeluhr, gegeben; die Bewegung des Pendels wird selbst wieder durch die Fallgesetze bedingt; wir messen also in (1) eine Fallerscheinung durch eine andere Fallerscheinung, und deshalb ist die Einfachheit des Resultates nicht auffällig. Anders ist es, wenn wir eine durch eine Feder getriebene Uhr anwenden; hier ist es eine nicht selbstverständliche Tatsache, daß das Zeitmaß für das Ablaufen der Feder zur Beobachtung des freien Falles geeignet ist; immerhin wird der richtige und gleichmäßige Gang der Federuhr nur durch Vergleichung mit einer Pendeluhr reguliert, und dadurch wird dieses Zeitmaß auf das vorhergehende reduziert. Auf die gewählte Zeiteinheit, die der Rotation der Erde um ihre Achse entlehnt ist, kommt es hierbei nicht an; wir bestimmen allerdings die Länge des Sekundenpendels nach dieser Einheit, könnten aber auch mit gleichem Erfolge umgekehrt eine beliebig gewählte Pendellänge zur Definition der Einheit verwenden. Anders

ist es, wenn man zu kosmischen Problemen übergeht. Die Bewegung eines Planeten (x, y) um die im Anfangspunkte stehende Sonne mit der Masse m' wird durch die Gleichungen

$$(3) \qquad \frac{d^2x}{dt^2} = -\frac{m'x}{r^3}, \quad \frac{d^2y}{dt^2} = -\frac{m'y}{r^3}$$

definiert, welche das Newtonische Gravitationsgesetz darstellen $\left(r = \sqrt{x^2 + y^2}\right)$. Erfahrungsmäßig genügt auch hier dasselbe Zeitmaß, das beim freien Falle eingeführt wurde; denn alle aus den Gleichungen (3) zu ziehenden Folgerungen stimmen (auch wenn man die Störungen der anderen Planeten berücksichtigt) hinreichend mit den Beobachtungen überein, so daß man keine Veranlassung hat, eine andere Zeit τ einzuführen und die obige Transformation anzuwenden. Analog verhält es sich mit allen bekannten Erscheinungen; es genügt immer, die Komponenten der Beschleunigung durch die Ausdrücke $\frac{d^2x}{dt^2}, \frac{d^2y}{dt^2}, \frac{d^2z}{dt^2}$ zu messen, und es ist überflüssig, die allgemeineren Ausdrücke

$$\left(\frac{d^2x}{d\tau^2} - \frac{dx}{d\tau}\,\Phi''(\tau)\right)\frac{1}{\Phi'(\tau)^2}, \text{ etc.}$$

statt dessen einzuführen. In diesem Sinne kann man erfahrungsmäßig von einer absoluten Zeit sprechen, d. h. einer Zeit, die zur Beschreibung aller bisher beobachteten Erscheinungen gleichmäßig bequem ist, allerdings mit dem Vorbehalte, diese Vorstellung der absoluten Zeit sofort aufzugeben, wenn nun Tatsachen oder feinere Beobachtung alter Tatsachen dazu führen sollten, für irgendeine Erscheinung durch eine Funktion $\Phi(\tau)$ ein neues Zeitmaß τ einzuführen, so daß für diese Erscheinung die Beschleunigung durch $\frac{d^2s}{d\tau^2}$ statt durch $\frac{d^2s}{dt^2}$ dargestellt wird (d. h. das Produkt aus Masse und Beschleunigungskomponente $\frac{d^2x}{dt^2}$ sich als Funktion des Ortes des bewegten Punktes und anderer fester oder bewegter Punkte darstellen läßt). Aber auch dann würde man wohl versuchen, die entstehende Schwierigkeit durch Modifikation der anderen Annahmen, eventuell durch Hinzufügung weiterer fingierter Punkte und Kräfte (vgl. weiterhin die analogen Erörterungen auf S. 95 ff. beim Trägheitsgesetz) zu beseitigen, ehe man sich entschließt, bei verschiedenen Erscheinungen verschiedene Zeitmaße anzuwenden. Durch diese Überlegung kommt man zu wesentlich derselben

> Auffassung, welche P o i n c a r é a. a. O. mit dem Worte Opportunismus charakterisiert."

Again, in 1904, Poincaré asserted that simultaneity is relative, and elaborated on the light synchronization thought experiment Einstein copied in 1905 without citation to Poincaré's prior works. We know from Solovine's accounts[2393] that Einstein had read Poincaré's paper, which was reprinted as Chapters 7 and 8 of Poincaré's book *La Valeur de la Science*, E. Flammarion, Paris, (1904). Poincaré stated in 1904,

> "We come to the principle of relativity: this not only is confirmed by daily experience, not only is it a necessary consequence of the hypothesis of central forces, but it is imposed in an irresistible way upon our good sense, and yet it also is battered.
>
> Consider two electrified bodies; though they seem to us at rest, they are both carried along by the motion of the earth; an electric charge in motion, Rowland has taught us, is equivalent to a current; these two charged bodies are, therefore, equivalent to two parallel currents of the same sense and these two currents should attract each other. In measuring this attraction, we measure the velocity of the earth; not its velocity in relation to the sun or the fixed stars, but its absolute velocity.
>
> I well know what one will say, it is not its absolute velocity that is measured, it is its velocity in relation to the ether. How unsatisfactory that is! Is it not evident that from the principle so understood we could no longer get anything? It could no longer tell us anything just because it would no longer fear any contradiction.
>
> If we succeed in measuring anything, we would always be free to say that this is not the absolute velocity in relation to the ether, it might always be the velocity in relation to some new unknown fluid with which we might fill space.
>
> Indeed, experience has taken on itself to ruin this interpretation of the principle of relativity; all attempts to measure the velocity of the earth in relation to the ether have led to negative results. This time experimental physics has been more faithful to the principle than mathematical physics; the theorists, to put in accord their other general views, would not have spared it; but experiment has been stubborn in confirming it.
>
> The means have been varied in a thousand ways and finally Michelson has pushed precision to its last limits; nothing has come of it. It is precisely to explain this obstinacy that the mathematicians are forced to-day to employ all their ingenuity.
>
> Their task was not easy, and if Lorentz has gotten through it, it is only by accumulating hypotheses. The most ingenious idea has been that of local time.
>
> Imagine two observers who wish to adjust their watches by optical signals; they exchange signals, but as they know that the transmission of light

is not instantaneous, they take care to cross them.

When the station B perceives the signal from the station A, its clock should not mark the same hour as that of the station A at the moment of sending the signal, but this hour augmented by a constant representing the duration of the transmission. Suppose, for example, that the station A sends its signal when its clock marks the hour 0, and that the station B perceives it when its clock marks the hour *t*. The clocks are adjusted if the slowness equal to *t* represents the duration of the transmission, and to verify it, the station B sends in its turn a signal when its clock marks 0; then the station A should perceive it when its clock marks *t*. The time-pieces are then adjusted. And in fact, they mark the same hour at the same physical instant, but on one condition, which is that the two stations are fixed. In the contrary case the duration of the transmission will not be the same in the two senses, since the station A, for example, moves forward to meet the optical perturbation emanating from B, while the station B flies away before the perturbation emanating from A. The watches adjusted in that manner do not mark, therefore, the true time, they mark what one may call the *local time*, so that one of them goes slow on the other. It matters little since we have no means of perceiving it. All the phenomena which happen at A, for example, will be late, but all will be equally so, and the observer who ascertains them will not perceive it since his watch is slow; so as the principle of relativity would have it, he will have no means of knowing whether he is at rest or in absolute motion."[2394]

Einstein reiterated Poincaré's clock synchronization procedures, without acknowledging that Poincaré had stated them first. From Mileva and Albert Einstein's 1905 co-authored paper,

"**I. KINEMATICAL PART**

§ 1. Definition of Simultaneity

Consider a system of coordinates, in which the Newtonian mechanical equations are valid. In order to put the contradistinction from the [*moving*] systems of coordinates to be introduced later into words, and for the exact definition of the conceptualization, we call this system of coordinates the 'resting system'.

If a material point is at rest relatively to this system of co-ordinates, its position can be defined relatively thereto by the employment of rigid standards of measurement and the methods of Euclidean geometry, and can be expressed in Cartesian co-ordinates.

If we wish to describe the *motion* of a material point, we give the values of its co-ordinates as functions of the time. Now we must bear carefully in mind that a mathematical description of this kind has no physical meaning unless we are quite clear as to what we understand by 'time.' We have to take into account that all our judgments in which time plays a part are always judgments of *simultaneous events*. If, for instance, I say, 'That train arrives

here at 7 o'clock,' I mean something like this: 'The pointing of the small hand of my watch to 7 and the arrival of the train are simultaneous events.' [*Footnote:* We shall not here discuss the inexactitude which lurks in the concept of simultaneity of two events at approximately the same place, which can only be removed by an abstraction.]

It might appear possible to overcome all the difficulties attending the definition of 'time' by substituting 'the position of the small hand of my watch' for 'time.' And in fact such a definition is satisfactory when we are concerned with defining a time exclusively for the place where the watch is located; but it is no longer satisfactory when we have to connect in time series of events occurring at different places, or—what comes to the same thing—to evaluate the times of events occurring at places remote from the watch.

We might, of course, content ourselves with time values determined by an observer stationed together with the watch at the origin of the co-ordinates, and co-ordinating the corresponding positions of the hands with light signals, given out by every event to be timed, and reaching him through empty space. But this co-ordination has the disadvantage that it is not independent of the standpoint of the observer with the watch or clock, as we know from experience. We arrive at a much more practical determination along the following line of thought.

If at the point A of space there is a clock, an observer at A can determine the time values of events in the immediate proximity of A by finding the positions of the hands which are simultaneous with these events. If there is at the point B of space another clock in all respects resembling the one at A, it is possible for an observer at B to determine the time values of events in the immediate neighbourhood of B. But it is not possible without further assumption to compare, in respect of time, an event at A with an event at B. We have so far defined only an 'A time' and a 'B time.' We have not defined a common 'time' for A and B, for the latter cannot be defined at all unless we establish *by definition* that the 'time' required by light to travel from A to B equals the 'time' it requires to travel from B to A. Let a ray of light start at the 'A time' t_A from A towards B, let it at the 'B time' t_B be reflected at B in the direction of A, and arrive again at A at the 'A time' t'_A.

In accordance with definition the two clocks synchronize if

$$t_B - t_A = t'_A - t_B .$$

We assume that this definition of synchronism is free from contradictions, and possible for any number of points; and that the following relations are universally valid:—

1. If the clock at B synchronizes with the clock at A, the clock at A synchronizes with the clock at B.

2. If the clock at A synchronizes with the clock at B and also with the

clock at C, the clocks at B and C also synchronize with each other.

Thus with the help of certain imaginary physical experiments we have settled what is to be understood by synchronous resting clocks located at different places, and have evidently obtained a definition of 'simultaneous,' or 'synchronous,' and of 'time.' The 'time' of an event is that which is given simultaneously with the event by a resting clock located at the place of the event, this clock being synchronous, and indeed synchronous for all time determinations, with a specified stationary clock.

We set forth, according to present experience, that the magnitude

$$\frac{2\,AB}{t'_A - t_A} = c,$$

is a universal constant (the velocity of light in empty space).

It is essential to have time defined by means of resting clocks in the resting system, and the time now defined being appropriate to the resting system we call it 'the time of the resting system.'"[2395]

Albert Einstein believed he had a right to plagiarize, if he could put a new spin on an old idea. He asserted this "privilege" in 1907,

"It appears to me that it is the nature of the business that what follows has already been partly solved by other authors. Despite that fact, since the issues of concern are here addressed from a new point of view, I believe I am entitled to leave out what would be for me a thoroughly pedantic survey of the literature, all the more so because it is hoped that these gaps will yet be filled by other authors, as has already happened with my first work on the principle of relativity through the commendable efforts of Mr. *Planck* and Mr. *Kaufmann*."[2396]

Daniel F. Comstock proposed a new approach to Poincaré's idea of "relative simultaneity", in 1910, in his popular exposition on the theory of relativity, which was cited by Robert Daniel Carmichael and Paul Carus,[2397] before Einstein manipulated credit for Comstock's idea,

"The whole principle of relativity may be based on an answer to the question: When are two events which happen at some distance from each other to be considered simultaneous? The answer, 'When they happen at the same time,' only shifts the problem. The question is, how can we make two events happen at the same time when there is a considerable distance between them.

Most people will, I think, agree that one of the very best practical and simple ways would be to send a signal to each point from a point half-way between them. The velocity with which signals travel through space is of course the characteristic 'space velocity,' the velocity of light.

Two clocks, one at *A* and the other at *B*, can therefore be set running in unison by means of a light signal sent to each from a place midway between them.

Now suppose both clock *A* and clock *B* are on a kind of sidewalk or platform moving uniformly past us with velocity *v*. In Fig. 1 (2) is the moving platform and (1) is the fixed one, on which we consider ourselves placed. Since the observer on platform (2) is moving uniformly he can have no reason to consider himself moving at all, and he will use just the method we have indicated to set his two clocks *A* and *B* in unison. He will, that is,

send a light flash from *C*, the point midway between *A* and *B*, and when this flash reaches the two clocks he will start them with the same reading.

To us on the fixed platform, however, it will of course be evident that the clock *B* is really a little behind clock *A*, for, since the whole system is moving in the direction of the arrow, light will take longer to go from *C* to *B* than from *C* to *A*. Thus the clock on the moving platform which leads the other will be behind in time.

Now it is very important to see that the two clocks *are in unison for the observer moving with them* (in the only sense in which the word 'unison' has any meaning for him), for if we adopt the first postulate of relativity, there is no way in which he can know that he is moving. In other words, *he has just as much fundamental right to consider himself stationary as we have to consider ourselves stationary*, and therefore just as much right to apply the midway signal method to set his clocks in unison as we have in the setting of our 'stationary clocks.' 'Stationary' is, therefore, a relative term and anything which we can say about the moving system dependent on its motion, can with absolutely equal right be said by the moving observer about our system.

We are, therefore, forced to the conclusion that, unless we discard one of the two relativity postulates, the simultaneity of two distant events means a different thing to two different observers if they are moving with respect to each other.

The fact that the moving observer disagrees with us as to the reading of his two clocks as well as to the reading of two similar clocks on *our* 'stationary' platform, gives us a complete basis for all other differences due to point of view.

A very simple calculation will show that the difference in time between the two moving clocks is [*Footnote:* The time it takes light to go from *C* to

B is $\frac{1}{2}\Big/(V-v)$ and the time to go from C to A is $\frac{1}{2}\Big/(V+v)$. The difference in these two times is the amount by which the clocks disagree and this difference becomes, on simplification, the expression given {immediately below}.]

$$1/V\ \beta/(1-\beta^2)$$

where

l = distance between clocks A and B;
v = velocity of moving system;
V = velocity of light;
β = v/V.

The way in which this difference of opinion with regard to time between the moving observer and ourselves leads to a difference of opinion with regard to length also may very easily be indicated as follows:

Suppose the moving observer desires to let us know the *distance* between his clocks and says he will have an assistant stationed at each clock and each of these, at a given instant, is to make a black line on our platform. He will, therefore, he says, be able to leave marked on our platform an exact measure of the length between his clocks and we can then compare it at leisure with any standard we choose to apply.

We, however, object to this measure left with us, on the ground that the two assistants *did not make their marks simultaneously* and hence the marks left on our platform do not, we say, represent truly the distance between his clocks. The difference is readily shown in Fig. 2, where M represents the black mark made on our platform at a certain time by the assistant at A, and N that made by the assistant at B at a later time. The latter assistant waited, we say, until his clock read the same as clock A, waited, that is, until B was at B'; and then made the mark N. The moving observer declares, therefore, that the distance MN is equal to the distance AB, while we say that MN is greater than AB.

Again it must be emphasized that, because of the first fundamental postulate, there is no universal standard to be applied in settling such a difference of opinion. Neither the standpoint of the ‘moving’ observer nor our standpoint is wrong. The two merely represent two different sides of reality. Any one could ask: What is the ‘true’ length of a metal rod? Two

observers working at different temperatures come to different conclusions as to the 'true length.' Both are right. It depends on what is meant by 'true.' Again, asking a question which might have been asked centuries ago, is a man walking toward the stern of an east bound ship really moving west? We must answer 'that depends' and we must have knowledge of the questioner's view-point before we can answer yes or no.

A similar distinction emerges from the principle of relativity. What is the distance between the two clocks? Answer: that depends. Are we to consider ourselves with the clock system when we answer, or passing the clocks with a hundredth the velocity of light or passing the clocks with a tenth the velocity of light? The answer in each case must be different, but in each case may be true.

It must be remembered that the results of the principle of relativity are as true and no truer than its postulates. *If future experience bears out these postulates then the length of the body, even of a geometrical line, in fact the very meaning of 'length,' depends on the point of view, that is, on the relative motion of the observer and the object measured.* The reason this conclusion seems at first contrary to common sense is doubtless because we, as a race, have never had occasion to observe directly velocities high enough to make such effects sensible. The velocities which occur in some of the newly investigated domains of physics are just as new and outside our former experience as the fifth dimension."[2398]

Citing Comstock's above quoted work, Robert Daniel Carmichael wrote in 1912,

"§ 9. *Simultaneity of Events Happening at Different Places*.—Let us now assume two systems of reference S and S' moving with a uniform relative velocity *v*. Let an observer on S' undertake to adjust two clocks at different places so that they shall simultaneously indicate the same time. We will suppose that he does this in the following very natural manner: [*Footnote:* Compare Comstock, Science, N. S., 31 (1900): 767-772.] Two stations *A* and *B* are chosen in the line of relative motion of S and S' and at a distance *d* apart. The point *C* midway between these two stations is found by measurement.

The observer is himself stationed at *C* and has assistants at *A* and *B*. A single light signal is flashed from *C* to *A* and to *B*, and as soon as the light ray reaches each station the clock there is set at an hour agreed upon beforehand.

The observer on S' now concludes that his two clocks, the one at *A* and the other at *B*, are simultaneously marking the same hour; for, in his opinion (since he supposes his system to be at rest), the light has taken exactly the same time to travel from *C* to *A* as to travel from *C* to *B*.

Now let us suppose that an observer on the system S has watched the work of regulating these clocks on S'. The distances *CA* and *CB* appear to him to be

$$\tfrac{1}{2} d \sqrt{1 - \beta^2}$$

instead of $\frac{1}{2} d$. Moreover, since the velocity of light is independent of the velocity of the source, it appears to him that the light ray proceeding from *C* to *A* has approached *A* at the velocity $c + v$, where c is the velocity of light, while the light ray going from *C* to *B* has approached *B* at the velocity $c - v$. Thus to him it appears that the light has taken longer to go from *C* to *B* than from *C* to *A* by the amount

$$\frac{\frac{1}{2} d \sqrt{1 - \beta^2}}{c - v} - \frac{\frac{1}{2} d \sqrt{1 - \beta^2}}{c + v} = \frac{v d \sqrt{1 - \beta^2}}{c^2 - v^2}.$$

But since $\beta = v / c$ the last expression is readily found to be equal to

$$\frac{v}{c^2} \cdot \frac{d}{\sqrt{1 - \beta^2}}.$$

Therefore, to an observer on S the clocks on S' appear to mark different times; and the difference is that given by the last expression above.

Thus we have the following conclusion:

THEOREM VII. *Let two systems of reference S and S' have a uniform relative velocity v. Let an observer on S' place two clocks at a distance d apart in the line of relative motion of S and S' and adjust them so that they appear to him to mark simultaneously the same time. Then to an observer on S the clock on S' which is forward in point of motion appears to be behind in point of time by the amount*

$$\frac{v}{c^2} \cdot \frac{d}{\sqrt{1 - \beta^2}},$$

where c is the velocity of light and $\beta = v / c$ (*MVLR*).

It should be emphasized that the clocks on S' are in agreement in the only sense in which they can be in agreement for an observer on that system who supposes (as he naturally will) that his own system is at rest—notwithstanding the fact that to an observer on the other system there appears to be an irreconcilable disagreement depending for its amount directly on the distance apart of the two clocks.

According to the result of the last theorem the notion of simultaneity of events happening at different places is indefinite in meaning until some convention is adopted as to how simultaneity is to be determined. In other words, *there is no such thing as the absolute simultaneity of events happening at different places*."[2399]

Albert Einstein, who sought a "new point of view" from plagiarizing Poincaré's (1900/1904) method of clock synchronization with light signals, instead plagiarized Comstock's (1910) and Carmichael's (1912) work in Einstein's book of 1916,

"THE RELATIVITY OF SIMULTANEITY

Up to now our considerations have been referred to a particular body of reference, which we have styled a 'railway embankment.' We suppose a very long train travelling along the rails with the constant velocity *v* and in the direction indicated in Fig. 1. People travelling in this train will with advantage use the train as a rigid reference-body (co-ordinate system); they regard all events in reference to

the train. Then every event which takes place along the line also takes place at a particular point of the train. Also the definition of simultaneity can be given relative to the train in exactly the same way as with respect to the embankment. As a natural consequence, however, the following question arises:

Are two events (*e. g.* the two strokes of lightning *A* and *B*) which are simultaneous *with reference to the railway embankment* also simultaneous *relatively to the train?* We shall show directly that the answer must be in the negative.

When we say that the lightning strokes *A* and *B* are simultaneous with respect to the embankment, we mean: the rays of light emitted at the places *A* and *B*, where the lightning occurs, meet each other at the mid-point *M* of the length *A→B* of the embankment. But the events *A* and *B* also correspond to positions *A* and *B* on the train. Let M' be the mid-point of the distance *A→B* on the travelling train. Just when the flashes [*Footnote:* As judged from the embankment.] of lightning occur, this point M' naturally coincides with

the point *M*, but it moves towards the right in the diagram with the velocity *v* of the train. If an observer sitting in the position M' in the train did not possess this velocity, then he would remain permanently at *M*, and the light rays emitted by the flashes of lightning *A* and *B* would reach him simultaneously, *i. e.* they would meet just where he is situated. Now in reality (considered with reference to the railway embankment) he is hastening towards the beam of light coming from *B*, whilst he is riding on ahead of the beam of light coming from *A*. Hence the observer will see the beam of light emitted from *B* earlier than he will see that emitted from *A*. Observers who take the railway train as their reference-body must therefore come to the conclusion that the lightning flash *B* took place earlier than the lightning flash *A*. We thus arrive at the important result:

Events which are simultaneous with reference to the embankment are not simultaneous with respect to the train, and *vice versa* (relativity of simultaneity). Every reference-body (co-ordinate system) has its own particular time; unless we are told the reference-body to which the statement of time refers, there is no meaning in a statement of the time of an event.

Now before the advent of the theory of relativity it had always tacitly been assumed in physics that the statement of time had an absolute significance, *i. e.* that it is independent of the state of motion of the body of reference. But we have just seen that this assumption is incompatible with the most natural definition of simultaneity; if we discard this assumption, then the conflict between the law of the propagation of light *in vacuo* and the principle of relativity (developed in Section VII) disappears.

We were led to that conflict by the considerations of Section VI, which are now no longer tenable. In that section we concluded that the man in the carriage, who traverses the distance *w per second* relative to the carriage, traverses the same distance also with respect to the embankment *in each second* of time. But, according to the foregoing considerations, the time required by a particular occurrence with respect to the carriage must not be considered equal to the duration of the same occurrence as judged from the embankment (as reference-body). Hence it cannot be contended that the man in walking travels the distance *w* relative to the railway line in a time which is equal to one second as judged from the embankment.

Moreover, the considerations of Section VI are based on yet a second assumption, which, in the light of a strict consideration, appears to be arbitrary, although it was always tacitly made even before the introduction of the theory of relativity."[2400]

This chapter "by Einstein" has often been criticized as being "absolutist" and "Lorentzian" (as has his 1905 paper on relative simultaneity).[2401] One understands why it was written in the fashion that it was, when one reads the absolutist source material by Carmichael, which Einstein plagiarized to produce it.

Einstein's book *Relativity: The Special and the General Theory* contains many other examples of his plagiarism, among them Appendix One, "Simple Derivation

of the Lorentz Transformation", is suspiciously similar to Lorentz' *Das Relativitätsprinzip: Drei Vorlesungen gehalten in Teylers Stiftung zu Haarlem*, which was first published in 1913, and which Einstein reviewed for *Die Naturwissenschaften* in 1914.[2402]

Einstein also reiterated Lorentz' work on the Fresnel coefficient of drag in Einstein's "Theorem of the Addition of the Velocities. The Experiment of Fizeau", Chapter 13. While Einstein credits Lorentz, he credits his older works and attempts to draw a distinction between his analysis and Lorentz' synthesis, but Lorentz makes clear in his 1913 lecture that he is fulfilling the principle of relativity. Einstein also fails to cite Laub and Laue's work in this area, with which he was intimately familiar.[2403] This misled some to conclude that Einstein's statements about the Fresnel coefficient of drag were original. In private correspondence in 1919, Einstein wrote to Pieter Zeeman, "The derivation of the latter from the kinematics of the special theory of relativity was first provided by Laue."[2404]

Chapter 20 of *Relativity: The Special and the General Theory*, "The Equality of Inertial and Gravitational Mass as an Argument for the General Postulate of Relativity", as Arvid Reuterdahl noted, parrots "Kinertia".[2405] Einstein also fails to acknowledge Poincaré's contributions of the principle of relativity of electrodynamics and of four-dimensional space-time. Einstein's popular book effectively relegated Poincaré's legacy with respect to the theory of relativity to a hushed scandal.

Another of Albert Einstein's "Eureka!" stories was his "happiest thought in life"—the principle of equivalence. It was no more original to Einstein than the "Aarau question" or the concept of, and exposition on, relativity of simultaneity.

9.7 Conclusion

In the mid-1880's, Ludwig Lange argued for the principle of relativity based on the empirical dynamics of inertial motion, as opposed to the ontological kinematic definitions based on absolute space and absolute time of Galileo, Newton and Neumann,[2406] which absolutist notions lingered in the Einsteins' absolutist theory of 1905. In 1887, Woldemar Voigt gave the principle a new mathematical form based on a new concept of time—the mathematical form of the special theory of relativity. Joseph Larmor (1894-1900) and George Francis FitzGerald (1889) changed scale factors from Voigt's transformation, producing the "Lorentz Transformation", before Hendrik Antoon Lorentz. In 1898, Poincaré argued that simultaneity is relative, based on his light synchronization procedure, which presumes that light speed is invariant in Lange's "inertial systems".

In 1887, Woldemar Voigt[2407] published the following relativistic transformation,

$$\xi_1 = x_1 - \varkappa t$$
$$\eta_1 = y_1 q$$
$$\zeta_1 = z_1 q$$
$$\tau = t - \frac{\varkappa x_1}{\omega^2}, \quad \text{where } q = \sqrt{1 - \frac{\varkappa^2}{\omega^2}}.$$

In 1901, Albert Einstein wrote to Mileva Marić on 28 December 1901,

> "I now want to buckle down and study what Lorentz and Drude have written on the electrodynamics of moving bodies. Ehrat must get the literature for me."[2408]

In 1899, Lorentz published a paper setting forth the "Lorentz Transformation" within a scale factor, "Simplified Theory of Electrical and Optical Phenomena in Moving Bodies".[2409] In 1904, Lorentz published the transformation named in his honor. Einstein owned a copy of Drude's *Lehrbuch der Optik* of 1900, which featured Lorentz' theories.[2410]

Emil Cohn cited Lorentz' 1904 paper in his 1904 paper on the electrodynamics of moving systems. Einstein had a copy of Cohn's paper containing a citation to Lorentz' 1904 paper with the "Lorentz Transformation" and Einstein cited it in 1907 in the direct context of Lorentz' 1904 paper.[2411] Einstein was eager to read everything Lorentz published on the subject. In 1913, Lorentz' 1904 article and the Einstein's 1905 article were republished together in the book *Das Relativitätsprinzip*.

The Einsteins' 1905 paper, which contained no references, so obviously plagiarized Lorentz' prior work, that an unplausible note was added in the book to deny the obvious, which note claimed that Einstein did not know of Lorentz' prior work.[2412] No notes were added to give Poincaré credit for the clock synchronization method by light signal that the Einsteins' plagiarized, though Einstein had cited Poincaré's 1900 paper containing this procedure in 1906, before the 1913 republication of the 1905 paper.[2413] Poincaré had died in 1912, and Lorentz and Einstein did not wait long to steal from him his legacy, publishing a book titled after *his* idea, without presenting any of his work in it—work with which both Lorentz and Einstein were intimately familiar.

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"In order for the compensation to occur, the phenomena must correspond, not to the true time t, but to some determined *local time* t' defined in the following way.

I suppose that observers located at different points synchronize their watches with the aid of light signals; which they attempt to adjust to the time of the transmission of these signals, but these observers are unaware of their movement of translation and they consequently believe that the signals travel at the same speed in both directions, they restrict themselves to crossing the observations, sending a signal from A to B, then another from B to A. The local time t' is the time determined by watches synchronized in this manner.

If in such a case

$$1 / K_0^{1/2}$$

is the speed of light, and v the translation of the Earth, that I imagine to be parallel to the positive x axis, one will have:

$$t' = t - vx / V^2$$

"Pour que la compensation se fasse, il faut rapporter les phénomènes, non pas au temps vrai t, mais à un certain *temps local* t' défini de la façon suivante.

Je suppose que des observateurs placés en différents points, règlent leurs montres à l'aide de signaux lumineux; qu'ils cherchent à corriger ces signaux du temps de la

transmission, mais qu'ignorant le mouvement de translation dont ils sont animès et croyant par conséquent que les signaux se transmettent également vite dans les deux sens, ils se bornent à croiser les observations, en envoyant un signal de *A* en *B*, puis un autre de *B* en *A*. Le temps local *t′*est le temps marqué par les montres ainsi réglées.

Si alors

$$1 / K_0^{1/2}$$

est la vitesse de la lumière, et *v* la translation de la Terre que je suppose parallèle à l'axe des *x* positifs, on aura:

$$t' = t - vx / V^2$$"

and *Electrité et Optique*, Gauthier-Villars, Paris, (1901), p. 530: "Allow me a couple of remarks regarding the new variable *t′*: it is what Lorentz calls *the local time*. At a given point *t* and *t′* will not defer but by a constant, *t′* will, therefore, always represent the time, but the origin of the times being different for the different points serves as justification for his designation." "Disons deux mots sur la nouvelle variable *t′*: c'est ce que Lorentz appelle *le temps locale*. En un point donné *t* et *t′* ne différeront que par une constante, *t′* représentera donc toujours le temps mais l'origine des temps étant différente aux différents points: cela justifie sa dénomination." and from 1902, *Science and Hypothesis*, Dover, New York, (1952), p. 90: "There is no absolute time. When we say that two periods are equal, the statement has no meaning, and can only acquire a meaning by convention. Not only have we no direct intuition of the equality of two periods, but we have not even direct intuition of the simultaneity of two events occurring in two different places. I have explained this in an article entitled "Mesure du Temps."

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Though Lorentz averred that the Fizeau result compelled a resting æther, in 1895, it was Jakob Laub, in 1907, who first sought to arrive at the Lorentz Transformation by means of the Fizeau experiment of moving medium with respect to Fresnel's coefficient of drag, and it was Max von Laue who corrected Laub's formulation: J. Laub, *Annalen der Physik*, 23, (1907), pp. 738-744; **and**, 25, (1908), pp. 175-184. M. v. Laue, *Annalen der Physik*, 23, (1907), pp.989-990.

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For further discussion of Voigt's relativistic transformation, *see:* F. Hund, "Wer hat die Relativitätstheorie geschaffen?", *Phyiskalische Blätter*, Volume 36, Number 8, (1980), pp. 237-240. ***See also:*** W. Schröder, "Hendrik Antoon Lorentz und Emil Wiechert (Briefwechsel und Verhältnis der beiden Physiker)", *Archive for History of Exact Sciences*, Volume 30, Number 2, (1984), pp. 167-187. ***See also:*** R. Dugas, *A History of Mechanics*, Dover, New York, (1988), pp. 468, 484, 494. ***See also:*** A. Pais, *Subtle is the Lord*, Oxford University Press, Oxford, New York, Toronto, Melbourne, (1982), pp. 121-122.

2408. Letter from A. Einstein to M. Marić of 28 December 1901, English translation by A. Beck, *The Collected Papers of Albert Einstein*, Volume 1, Document 131, Princeton University Press, (1987), pp. 189-190.

2409. H. A. Lorentz, "Théorie Simplifiée des Phénomènes Électriques et Optiques dans des Corps en Mouvement", *Verslagen der Zittingen de Wis- en Natuurkundige Afdeeling der Koninklijke Akademie van Wetenschappen* (Amsterdam), Volume 7, (1899), p. 507; reprinted *Collected Papers*, Volume 5, pp. 139-155; "Vereenvoudigde theorie der electrische en optische verschijnselen in lichamen die zich bewegen", *Verslagen van de gewone vergaderingen der wis- en natuurkundige afdeeling, Koninklijke Akademie van Wetenschappen te Amsterdam*, Volume 7, (1899), pp. 507-522; English translation,

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2410. P. Drude, *Lehrbuch der Optik*, S. Hirzel, Leipzig, (1900); translated into English *The Theory of Optics*, Longmans, Green and Co., London, New York, Toronto, (1902), *see especially* pp. 457-482. On Einstein's ownership of this work, *see: The Collected Papers of Albert Einstein*, Volume 2, Princeton University Press, (1989), pp. 135-136, footnote 13.

2411. E. Cohn, "Zur Elektrodynamik bewegter Systeme", *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin, Sitzung der physikalisch-mathematischen Classe*, (November, 1904), pp. 1294-1303, at 1295. Einstein cited Cohn's paper in his *Jahrbuch* review article of 1907, and a copy of Cohn's 1904 paper is in his preserved collection. *See: The Collected Papers of Albert Einstein*, Volume 2, Note 128, Hardcover, p. 272. Cohn cites the Dutch version of Lorentz' work, "Electromagnetische Verschijnselen in een Stelsel dat zich met Willekeurige Snelheid, Kleiner dan die van het Licht, Beweegt." *Verslagen van de Gewone Vergaderingen der Wis- en Natuurkundige Afdeeling, Koninklijke Akademie van Wetenschappen te Amsterdam* , Volume 12, (23 April 1904), pp. 986-1009. Einstein cites Cohn in the direct context of Lorentz' 1904 paper in:"Über das Relativitätsprinzip und die aus demselben gezogenen Folgerung"*, Jahrbuch der Radioaktivität und Elektronik*, Volume 4, (1907), pp. 411-462, at 413.

2412. *Das Relativitätsprinzip*, Note 2, B. G. Teubner, Leipzig, Berlin, (1913), p. 27.

2413. A. Einstein, "Das Prinzip von der Erhaltung der Schwerpunktsbewegung und die Trägheit der Energie", *Annalen der Physik*, Series 4, Volume 20, (1906), pp. 627-633, at 627. Einstein cites Poincaré's "La Théorie de Lorentz et le Principe de la Réaction", *Archives Néerlandaises des Sciences Exactes et Naturelles*, Series 2, Volume 5, (1900), pp. 252-278, which gives the clock synchronization method at pp. 272-273.

2414. A. Einstein, *Relativity, The Special and the General Theory*, Crown Publishers, Inc., New York, (1961), pp. 150-151.

2415. A. Einstein and J. Laub, "Über die elektromagnetischen Grundgleichungen für bewegte Körper", *Annalen der Physik*, Series 4, Volume 26, (1908), pp. 532-540.

2416. The Eleatic Philosophers. ***See also:*** Ocellus Lucanus, Taurus, Julius Firmicus Maternus, Proclus, in: T. Taylor, *Ocellus Lucanus. On the Nature of the Universe. Taurus, the Platonic Philosoher, on the Eternity of the World. Julius Firmicus Maternus of the Thema Mundi; in Which the Positions of the Stars at the Commencement of the Several Mundane Periods Is Given. Select Theorems on the Perpetuity of Time, by Proclus*, T. Taylor, London, (1831). Numerous Reprints. ***See also:*** Philo Judæus, "On the Eternity of the World", *The Works of Philo*, Hendrickson Publishers, U.S.A., (1993), pp. 707-724. ***See also:*** Moses Maimonides, *The Guide for the Perplexed*, Part 2, Chapters 13 and 14, Dover, New York, (1956), pp. 171-176. ***See also:*** Spinoza, "Concerning God", *Ethics*, Part 1, (1677), Multiple Editions. ***See also:*** I. Newton, *Principia*, Book I, Definition VIII, Scholium; **and** Book III, General Scholium. *Opticks*, Query 31. ***See also:*** S. Clarke, *A Demonstration of the Being and Attributes of God : More Particularly in Answer to Mr. Hobbs, Spinoza and Their Followers*, W. Botham, for J. Knapton, London, (1705); **and** G. W. Leibnitz, S. Clarke, *Collection of PAPERS, Which passed between the late Learned Mr. LEIBNITZ, and Dr. CLARKE, In the Years 1715 and 1716. Relating to the PRINCIPLES OF Natural Philosophy and Religion*, James Knapton, London, (1717). ***Confer:*** Thomas Reid, *Essays on the Intellectual Powers of Man*, Essay III, Of Memory, CHAPTER III, OF DURATION, (1785); in *The Works of Thomas Reid, D.D. F.R.S. Edinburgh. Late Professor of Moral Philosophy in the University of Glasgow. With an Account of His Life and Writings*, Edited by D.