

circle, like the magnetic metals, it forms two concentric circles, leaving thus a narrow white band, in the very place where the other metals form a circle, as if it were repelled by the more lively action of the iron armature of the magnet. The effect is so marked, that on mixing, for example, some sesquichloride of chromium very finely pulverized with some bismuth, likewise in very fine powder, the violet circle of the chloride is seen, and the two circles of the bismuth which are separate from them, although very near. Amber seems to give the same appearances as the bismuth, though in a much weaker degree.

No attractive or repulsive effect is observed by this means, either on very pure antimony or on the other metals, binary or other compounds (among the rare metals, I have only experimented on tellurium and the uranium of M. Peligot), nor on the alkalis, sulphur, iodine, charcoal, and diamond. I regret that I had not at my disposal either cerium or any of its compounds.

These negative results cannot invalidate in the least the general proposition of M. Faraday, who has doubtless operated with more delicate means or with more energetic magnets. I merely mention them here to point out the easy process which I have employed, and the limit of its sensibility.

There is another process for investigating the magnetic properties,—that which was employed by Coulomb when he discovered that all bodies are subject to the influence of magnets, and which has been since employed in the same view by many experimentalists, and very recently by M. Ed. Becquerel (*Comptes Rendus*, vol. xx. p. 1708). Mr. Faraday appears to have employed it; but doubtless, from the weakness of my electro-magnets, although excited by a battery of 100 pairs, I have not obtained the same results as he; in my experiments, bismuth and amber are the only two substances which took a direction perpendicular to the line of the poles, and without doubt the relation existing between this direction of the bismuth and the effect of repulsion which the fine powder of that body experiences from the part of the armature of the magnet will appear highly remarkable. These two mechanical actions of magnetism upon bodies—the attraction and repulsion of fine powders, placed almost in contact with one of the poles, and the direction given to more considerable masses, oscillating in the presence of the two poles—appear therefore to be dependent one upon the other; but in what degree are they connected with the third action, the optical action which Mr. Faraday has just discovered?

Admitting with this philosopher that all the substances

which are not magnetic after the manner of iron, are *diamagnetic* or magnetic after the manner of bismuth, we should be led to conclude immediately that the optical action being concomitant with a certain mechanical action, it is at least presumable that this action is exerted upon the bodies, and not directly and immediately on the light which passes through them.

But if it happens, as in my experiments, either from the relative weakness of my magnets or from the imperfection of the methods which I have employed, or from other causes—if it happens that the various kinds of glasses, distilled water, the fatty bodies, &c., which are so sensitive to the optical action, are nevertheless insensible to the mechanical action of the magnetism, it would not be a reason to conclude that magnetism acts directly upon the light itself; a conclusion which, moreover, would only have a precise meaning in the system of emission, for in the undulatory theory, which seems at present so completely demonstrated, it is the æther of the body submitted to the experiment which would be modified by the magnetism, and it would doubtless be very difficult to recognise whether it is modified without any participation of the ponderable matter of the body with which it is so intimately connected.

## LII. On the Aberration of Light. By G. G. STOKES, M.A., Fellow of Pembroke College, Cambridge\*.

I WISH to say a few words more on the subject of aberration, to prevent misapprehension. It is evident from Prof. Challis's last communication, that we differ merely as to the phenomenon which we understand by the term "aberration of light." When the position of a star has been corrected for refraction, precession, and nutation, and proper motion if it has any, let  $s$  be its mean annual place referred to the celestial sphere,  $s_1$  the point to which the star is referred by astronomical measurement, and  $s_2$  the point in which the sphere is cut by the line along which the light comes from the star, produced backwards,  $s_2$  being corrected in the same manner as  $s_1$ . It is shown by observation that  $s_1$  is displaced from  $s$  towards the point towards which the earth is moving, through an angle equal to the ratio of the velocity of the earth to that of light multiplied by the sine of the earth's way. This is the phenomenon which I understand by the *aberration of light*, and which it was the object of one of my former communi-

\* Communicated by the Author.



cations to account for on the theory of undulations. But it is evident that what Prof. Challis means by aberration, is the circumstance that  $s_1$  is displaced from  $s_2$  through the angle which I have mentioned. Prof. Challis's reasoning, by his own confession, does not explain aberration in the sense in which I used the word; for he says that it follows from *observation* (not theory alone), that  $s_2$  coincides with  $s$ .

### LIII. Intelligence and Miscellaneous Articles.

#### ANALYSIS OF DIASPORE FROM SIBERIA.

BY M. A. DAMOUR.

THE remarkable characters of diaspoire have frequently attracted the attention of mineralogists, and have been extremely well described and analysed by MM. Children, Dufrenoy, and Hess. The author observes, that he should therefore have abstained from referring to them, if he had not had occasion lately to observe a singular property of this mineral which had not been previously noticed. The diaspoire is a well-known hydrate of alumina. It is shown by the experiments of M. Dufrenoy, that this mineral, even when long boiled in sulphuric acid, not only resists its action, but retains all its water. M. Damour, on repeating this experiment, obtained the same result; but he afterwards found that the diaspoire, when deprived of its water by calcination, was almost totally soluble in sulphuric acid when assisted by heat.

This property is the inverse of that which chemists always observe with respect to hydrates, and in general with respect to substances which have not been calcined. In fact, the greater number of these substances lose their solubility in acids after they have been heated to redness. In this case the contrary occurs: the peculiar molecular condition of the crystallized hydrate of alumina, constituting the diaspoire, appears then to be the only obstacle to the natural affinity of this hydrate for the sulphuric acid; for calcination, by destroying this arrangement of the molecules, restores the usual properties of alumina.

M. Damour took advantage of this circumstance in order to simplify the method of analysing diaspoire.

The mineral was first purified by digesting it, reduced to very fine powder in dilute hydrochloric acid at a moderate heat. There was dissolved a notable quantity of oxide of iron accidentally mixed with it. The powder, after washing, was perfectly white. The proportion of water was found to be nearly similar in three different operations: to determine this the dried powder of the mineral was suffered to remain under a receiver over a stratum of pumice moistened with sulphuric acid, this powder was weighed and placed in a small covered platina crucible; in order to prevent the projection of the powdered mineral, the crucible was placed in another of the same metal; the whole being weighed, the crucibles were submitted to

the highest temperature which could be produced by the flame of an alcohol eolipyle. The crucibles were cooled in a receiver with a glass stopper, containing fragments of chloride of calcium. When perfectly cool they were again weighed, and the difference between the first weighing and that after calcination was attributed to the quantity of water disengaged, and was 14.97, 14.96, and 14.90 in three experiments.

In order to act upon the diaspoire deprived of water, hydrated sulphuric acid was poured upon the mineral remaining in the crucible in which it had been calcined. The whole was heated in a sand-bath so as to volatilize the greater part of the sulphuric acid; when the matter had become of a pasty consistence, water was added, which dissolved a great quantity of sulphate of alumina; the solution was poured off, and more sulphuric acid was added, and this operation was repeated five times. The aluminous solution was filtered in order to separate a small portion of a white earthy deposit; this, which had resisted the prolonged action of sulphuric acid, still contained much alumina; when moistened with nitrate of cobalt and heated to redness, it acquired a very decided blue tint, and readily dissolved in the salt of phosphorus.

The solution of sulphate of alumina was supersaturated with carbonate of ammonia; the alumina was collected, washed and heated for a long time to strong redness. It was very white, and nitrate of cobalt gave a fine blue tint to it.

One hundred parts of diaspoire yielded—

|                           |             |
|---------------------------|-------------|
| Alumina .....             | 79.91       |
| Water .....               | 14.90       |
| Mineral unacted upon .... | 5.80—100.61 |

M. Damour admits that this analysis is superfluous after those of MM. Dufrenoy and Hess, and gives it merely to exhibit a property worthy of attention, and which had not been previously noticed with respect to any mineral whatever.—*Ann. de Ch. et de Phys.*, Mars 1846.

#### ON BORACIC ÆTHER.

M. Ebelmen having ascertained that boracic acid is volatilized by the vapour of water and of alcohol, succeeded in preparing, after some trials, boracic æther by the following process:—fused and finely-powdered boracic acid was put into a tubulated retort, and an equal weight of absolute alcohol was added to it. In a few minutes the temperature of the mixture became 122° Fahr., that of the atmosphere being only 64°. The retort was heated, and a thermometer placed in it showed that the liquid did not begin to boil until heated to about 203°, and its temperature continued rising from this point. At about 230° the distillation was stopped to cohobate the distilled liquid, and it was again distilled at 230°. The boracic acid swelled much during the operation, and the liquid which covered it while the distillation was going on, had completely imbibed it the following day. The distilled liquid had the slightly alliaceous smell of absolute alcohol, became very turbid on admixture with water, deposited

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