experiments such as those made by Bellati. Suppose, for example, p grammes of silica having a specific heat k, and w grammes of water, are mixed and raised to a temperature t, and the mixture is then put into a Bunsen's ice calorimeter and cooled to 0° C., the heat given up is

$$\left(pk+w+p\,.\,s\,.\frac{dc}{ds}-p\,.\,s\,.\,\frac{dh}{dt}\right)t=\left(pk+w-p\,.\,s\,.\frac{h}{\tau}\right).\,t,$$

approximately, from equation v.

It is necessary, therefore, to distinguish between the *true* or *absolute* variation and the *apparent* variation in the specific heat of water in contact with a solid. The *true* variation in the specific heat is proportional to $\frac{dc}{ds}$, and is probably very small; but since in any experiment it is impossible to prevent the evolution or absorption of heat at the surface depending on the term $\frac{dh}{dt}$, the *apparent* variation in the specific heat, that is, the variation actually observed in any experiment, is proportional to the difference of the terms $\frac{dc}{ds}$ and $\frac{dh}{dt}$, that is, approximately proportional to $\frac{h}{\tau}$.

Hence the *apparent* specific heat of water in contact with a solid is approximately $\left(1-\frac{A}{w}\cdot\frac{h}{\tau}\right)$, where A is the area of the surface of the water in contact with the solid, and w the mass of the water. For example, in the earlier experiments of the present investigation, the mass of water was about 200 grammes and the area of surface exposed by 4 grammes of powder was $4\times10900=43600$ sq. cm., and the value of $\frac{h}{\tau}$ was 37×10^{-7}: hence the *apparent* specific heat of the water was equal to $(1-\frac{43600}{200}\times37\times10^{-7})=\cdot99919$. It is evident that if the mass of water is small compared with the mass of powder, the variation in the apparent specific heat may be very great, so that it is not necessary to assume, as Martini did, that some of the water is solidified on the surface of the powder, in order to account for the apparent variation in the specific heat.

VI. *Experiments with Mercury.*

Experiments were made to show a *fall* of temperature on putting a finely divided solid into mercury. After several fruitless attempts with silica, the following method was adopted.

About 3000 grammes of mercury were placed in a glass beaker, and some cotton silicate was placed in the same beaker above the mercury; above the cotton silicate was a cardboard disk which covered the silicate entirely, except that a space was left for the insertion of the thermometer, and a little space was allowed for the edge of the disk to clear the sides of the beaker. On pressing down the disk the cotton silicate was suddenly immersed in the mercury, and in some experiments there was a fall of temperature amounting to ·016° C. But the results were not consistent, for in other experiments there was a slight rise of temperature, caused probably by the cotton silicate being at a higher temperature than the mercury. After leaving the cotton silicate immersed in the mercury for some time, so as to take the same temperature, it was suddenly released, and a rise of temperature was the invariable result. With 11 grammes of cotton silicate the rise of temperature was about ·02° C., and with 30 grammes of silicate the rise of temperature was about ·05° C., but the results varied considerably.

These experiments do not lend themselves to quantitative measurement, for the surface of the mercury cannot be determined. When the filaments of cotton silicate are put into mercury they tend to cling together in bundles or tufts, and the mercury breaks up into a great number of little globules between the tufts of silicate. The surface exposed by the mercury is thus large and indeterminate. The results show, however, that the sudden contraction of a mercury surface causes an evolution of heat and corresponding rise of temperature, and the effect can be regarded as a modification of the Pouillet effect for a liquid which does not *wet*, or enter into intimate contact with the solid.

H.M. Dockyard School, Portsmouth,
March 1902.

XXVIII. *On some of the Consequences of the Emission of Negatively Electrified Corpuscles by Hot Bodies.* By J. J. Thomson, *M.A., F.R.S., Cavendish Professor of Experimental Physics, Cambridge*.*

IT was shown by Elster and Geitel† that an incandescent metal wire in a good vacuum emits negative electricity; in 1899 I showed that the carriers of this negative electricity were "corpuscles," *i. e.* were identical with the carriers of

* Communicated by the Author.

† Elster and Geitel, Wied. *Ann.* xxxvii. p. 315.

negative electricity in the cathode-rays*. Quite recently Mr. O. W. Richardson † has made a series of measurements at the Cavendish Laboratory of the rate at which the electricity escapes at different temperatures. The results of these measurements are very interesting; they show that surprisingly large currents can pass in the best vacua between a negatively electrified incandescent wire and a conductor placed in its neighbourhood; thus Richardson has shown that the negative electricity streams so fast from carbon at a white heat as to be equivalent to a current of about 1 ampere for each square centimetre of carbon surface. If we suppose that the corpuscles which carry the negative charge have the same kinetic energy as the same number of molecules of a perfect gas at the same temperature, this stream of corpuscles would carry with them from the metal energy at the rate of about $\frac{1}{10}$ of a calorie per square centimetre of surface per second: the number of corpuscles coming in each second from this area is about 5×10^{18}. The question naturally suggests itself whether this great crowd of corpuscles does not produce other effects besides the electrical ones already mentioned: it is the object of this paper to indicate some of these effects.

In the first place, since the corpuscles carry a charge of negative electricity, they will move when acted on by an electric force; so that, assuming the Electromagnetic Theory of Light, they will be set in motion by a wave of light; they will thus absorb energy from the wave and give out this energy as scattered light. We can easily calculate the energy in the light scattered in this way.

The rate at which a small charged particle, charge e and acceleration f, radiates energy is equal to

$$\frac{1}{3}\frac{e^2 f^2}{\mathrm{V}}$$

where V is the velocity of light. If the charged particle is acted on by an electric force X, then

$$f = \frac{\mathrm{X}e}{m},$$

where m is the mass of the particle; hence the rate at which the charged particle is emitting energy is equal to

$$\frac{1}{3}\frac{e^4}{m^2}\frac{1}{\mathrm{V}}\mathrm{X}^2.$$

* J. J. Thomson, Phil. Mag. xlviii. p. 547.
† O. W. Richardson, Proc. Camb. Phil. Soc. xi. p. 286.

Now if the electric force is that in a light-wave the mean energy E per unit volume in the wave is equal to the mean value of $\mathrm{X}^2/4\pi\mathrm{V}^2$; hence we see that the mean rate at which the particle is emitting energy (this is the rate of emission of the energy of the scattered light) is

$$\frac{4\pi}{3}\frac{e^4}{m^2}\mathrm{VE}.$$

If there are N corpuscles per unit volume the energy in the scattered light coming from each unit of volume per second is equal to

$$\frac{4\pi}{3}\frac{\mathrm{N}e^4}{m^2}\mathrm{VE}.$$

The scattered light will be polarized in the same way as light reflected from small particles. This scattering of the light will cause the medium to absorb light. We can find the coefficient of absorption as follows:—Suppose the axis of z is the direction of propagation of the light. Let AB and CD be two planes at right angles to z separated by a distance δz, CD being in front. Then if A is the area of either of these planes, the rate at which energy is being scattered by the particles between the planes is equal to

$$\frac{4\pi}{3}\frac{\mathrm{N}e^4}{m^2}\mathrm{VE}\,.\,\mathrm{A}\delta z.$$

Now when things are in a steady state this energy must be supplied by the excess of the energy flowing into the region between AB and CD through AB, over that flowing out through CD: the average rate at which energy flows across AB is AEV; the rate at which it flows out across CD is $\mathrm{A}(\mathrm{E}+\delta\mathrm{E})\mathrm{V}$: hence we have

$$-\mathrm{A}\delta\mathrm{EV} = \frac{4\pi}{3}\frac{\mathrm{N}e^4}{m^2}\mathrm{VEA}\delta z;$$

or

$$\frac{d\mathrm{E}}{dz} = -\frac{4\pi}{3}\frac{\mathrm{N}e^4}{m^2}\mathrm{E};$$

thus

$$\mathrm{E} = \mathrm{C}\epsilon^{-\frac{4\pi}{3}\frac{\mathrm{N}e^4}{m^2}z};$$

and thus the coefficient of absorption is $\frac{4\pi}{3}\frac{\mathrm{N}e^4}{m^2}$.

Thus the region round incandescent metals or carbon will, in virtue of the corpuscles coming from these substances, scatter light; and the scattered light will be polarized in the same way as if the light had been reflected from small particles. Since the corpuscles are in rapid motion if the incident light is homogeneous, the spectrum of the scattered light will by Döpler's principle broaden out into a band. Similarly, if the corpuscles were illuminated by light showing Frauenhofer's dark lines, these will be obliterated in the scattered light.

The most conspicuous example of a hot body is the sun, the photosphere of which is supposed to contain large quantities of carbon or silicon at a temperature far higher than any we can produce by artificial means. Thus the photosphere must be emitting corpuscles in large quantities, these coming from such hot bodies will be moving with great velocities, and may leave the sun and travel out through the solar system. These corpuscles will scatter the light from the sun; and since the corpuscles are densest close to the sun, we should get a distribution of luminosity due to the scattered light which would be most intense close to the sun, and would fade away at greater distances from it. The rate of decay would be fairly rapid; for not only would the intensity of the incident light diminish inversely as the square of the distance, the number of corpuscles per unit volume would also diminish according to the same law; so that the intensity of the light scattered from the corpuscles would vary inversely as the fourth power of the distance. It seems to me probable that many of the phenomena of the corona may be due to light scattered by corpuscles ejected from the sun. Since cathode-rays produce luminosity when they pass through rarefied gas, the corpuscles ejected from the photosphere would in their passage through the chromosphere cause the gases in the latter to become luminous. The presence of some of the corpuscles throughout the solar system would cause each part of this system to scatter a certain amount of light, so that no part of it would be absolutely dark, nor would it be perfectly transparent. I am not aware of the existence of any observations bearing on the absorption of light by interplanetary space.

The corpuscles when under the action of a wave or pulse of electric and magnetic force will be pushed forward in the direction in which the wave is travelling; and thus if these waves proceed from the sun, the latter will appear to repel the corpuscles.

To show this, let the direction of propagation of the wave be along the axis of z, let X the electric force in the wave-front be parallel to the axis of x, H the magnetic force parallel to y. Let x, y, z be the coordinates of the corpuscle.

Then we have, since $X = VH$, where V is the velocity of light,

$$m\frac{d^2x}{dt^2} = Xe - He\frac{dz}{dt} = He\left(V - \frac{dz}{dt}\right) = -He\frac{d\zeta}{dt}, \quad (1)$$

$$m\frac{d^2y}{dt^2} = 0, \quad (2)$$

$$m\frac{d^2z}{dt^2} = He\frac{dx}{dt}, \qquad m\frac{d^2\zeta}{dt^2} = He\frac{dx}{dt}, \quad (3)$$

where $\zeta = z - Vt$.

Let us first take the case where a pulse of constant electric force is passing over the corpuscle. Then if x, z vanish when $t=0$ and u and w are the initial values of $\frac{dx}{dt}$ and $\frac{dz}{dt}$, we get from (1) and (3)

$$z = Vt + \frac{m}{e}\frac{u}{H}(1 - \cos\omega t) + \frac{\omega - V}{\omega}\sin\omega t,$$

and

$$\frac{dz}{dt} = V + u\sin\omega t + (\omega - V)\cos\omega t,$$

where $\omega = He/m$.

Thus if the pulse lasts for a time T, long enough to make ωT large, the corpuscle will be set in motion in the direction in which the wave is travelling, and the average velocity of the corpuscle will be that of the wave. Now

$$\omega T = THe/m = 10^7 . T . H;$$

thus if T the time the pulse takes to pass over the corpuscle is large compared with $1/10^7H$ seconds, the corpuscle will be shot forward with great velocity in the direction in which the pulse is travelling. If ωT were small, the velocity acquired by a particle starting from rest would be $\frac{1}{2}V\omega^2T^2$.

Let us now take the case of a periodic disturbance; let H be given by the equation

$$H = A\cos\frac{2\pi}{\lambda}(Vt - z) = A\cos\frac{2\pi}{\lambda}\zeta.$$

Equations (1) and (3) become

$$m\frac{d^2x}{dt^2} = -Ae\cos\frac{2\pi}{\lambda}\zeta . \frac{d\zeta}{dt}, \quad (4)$$

$$m\frac{d^2\zeta}{dt^2} = Ae\cos\frac{2\pi}{\lambda}\zeta . \frac{dx}{dt}; \quad (5)$$

from (4) we get

$$m\frac{dx}{dt}=-\mathrm{A}e\frac{\lambda}{2\pi}\sin\frac{2\pi}{\lambda}\zeta.$$

If dx/dt and ζ vanish simultaneously, substituting in (5), we have

$$m\frac{d^2\zeta}{dt^2}+\frac{\mathrm{A}^2e^2}{4\pi m}\lambda\sin\frac{4\pi}{\lambda}\zeta=0;$$

or writing θ for $\frac{4\pi}{\lambda}\zeta$, we have

$$\frac{d^2\theta}{dt^2}+\frac{\mathrm{A}^2e^2}{m^2}\sin\theta=0.$$

The equation of motion of a simple pendulum. Integrating this equation, we find

$$\frac{1}{2}\left(\frac{4\pi}{\lambda}\right)^2\left(\frac{d\zeta}{dt}\right)^2=\mathrm{C}+\frac{\mathrm{A}^2e^2}{m^2}\cos\frac{4\pi}{\lambda}\zeta,$$

where C is the constant of integration. Substituting for ζ its value $z-\mathrm{V}t$, we have

$$\frac{1}{2}\left(\frac{4\pi}{\lambda}\right)^2\left(\mathrm{V}-\frac{dz}{dt}\right)^2=\mathrm{C}+\frac{\mathrm{A}^2e^2}{m^2}\cos\frac{4\pi}{\lambda}(\mathrm{V}t-z).$$

If dz/dt vanish when $\zeta=0$, we have

$$\frac{1}{2}\left(\frac{4\pi}{\lambda}\right)^2\left[\left\{\mathrm{V}-\frac{dz}{dt}\right\}^2-\mathrm{V}^2\right]=\frac{\mathrm{A}^2e^2}{m^2}\left\{\cos\frac{4\pi}{\lambda}(\mathrm{V}t-z)-1\right\}.$$

If w is the maximum value of dz/dt, we have

$$\mathrm{V}^2-(\mathrm{V}-w)^2=\frac{\lambda^2}{4\pi^2}\frac{\mathrm{A}^2e^2}{m^2};$$

hence if

$$\frac{\lambda^2\mathrm{A}^2e^2}{4\pi^2m^2}=\mathrm{V}^2,$$

the maximum value of the velocity of the corpuscle will be equal to the velocity of light. If $\lambda^2\mathrm{A}^2z^2/\mathrm{V}^2\pi^2m^2$ is a small quantity, then the maximum value of w is given by the equation

$$w=\frac{1}{2}\frac{\lambda^2\mathrm{A}^2e^2}{4\pi^2m^2}\frac{1}{\mathrm{V}}.$$

Now $e/m=10^7$, $\mathrm{V}=3\times10^{10}$; hence $\frac{\lambda^2\mathrm{A}^2e^2}{4\pi^2m^2\mathrm{V}^2}=2{\cdot}5\mathrm{A}^2\lambda^2 10^{-9}$,

Here A is the maximum value of the magnetic force and λ the wave-length. We see that for waves of sunlight

$\mathrm{A}^2\lambda^2\times10^{-8}$ would be very small; so that the maximum velocity acquired by the corpuscles would be very small compared with the velocity of light. If, however, the sun gave out Hertzian waves of considerable wave-length, these would communicate to the corpuscles velocities comparable with the velocity of light, so that the sun would appear to repel the corpuscles with great vigour. Thus, for example, if a comet by near approach to the sun got raised to such a high temperature that the corpuscles began to come off, these would be repelled if any Hertzian waves came from the sun, and appear behind the comet as a luminous tail.

I now pass on to consider another result of the emission of these negatively electrified corpuscles: we may regard these corpuscles coming out of the metal as evidence for the existence in the metal itself of streams of corpuscles which move freely between the molecules of the metal. Some of these moving at more than a certain speed are able to escape from the attraction of the metal, and produce the stream of negative electricity coming from the metal. These corpuscles moving through the metal constitute streams of cathode-rays, and when they come into collision with the molecules will give rise to pulses of electric and magnetic force analogous to those produced by the stoppage of cathode-rays in a vacuum-tube; inasmuch, however, as the velocity of the corpuscles in a hot body is small compared with that of cathode-rays in a vacuum-tube, the pulses produced by the corpuscles will be very "soft" compared with the Röntgen rays produced in a vacuum-tube, *i. e.* the pulses produced in the hot body are very much thicker than those produced in a vacuum-tube. A succession of sufficiently broad pulses would, however, on the electromagnetic theory of light, produce a continuous spectrum of the kind given out by a hot body. Part of the radiation from a hot metal might arise in this way; and this part would have the characteristic property of radiation from a solid of increasing very rapidly with the temperature. For we may regard the corpuscles in the metal as analogous to the molecules of a liquid, and the escape of the corpuscles from the metal as analogous to the evaporation of the liquid. The corpuscles are supposed to be attracted by the metal; so that it is only those escape from the surface which start from near the surface and move so rapidly that their velocity is sufficient to carry them beyond the region of the attraction of the metal. Thus suppose that c is the distance at which the attraction of the metal on the corpuscles is appreciable—c is analogous to the range of molecular attraction in Laplace's Theory of Capillarity—and consider a layer of the metal of thickness c next the surface: as soon as a corpuscle enters this layer it will be acted upon by a force directed away from the surface; if the corpuscle has only a small amount of kinetic energy it will soon be stopped, and will turn back without ever reaching the surface, one with greater velocity will get nearer to the surface, and those moving above a certain speed will be able to reach the surface and escape from the metal. If the distance c is comparable with the thickness of metal required to absorb the radiation of the type produced by the impact of the molecules against the corpuscles, then the rate of emission of radiation from the metal will depend chiefly upon the more rapidly moving corpuscles. For not only do these possess greater energy, and therefore when in collision produce the more intense pulses, but they travel nearer to the surface so that the radiation which they emit has not to travel through so great a thickness of metal, and is consequently not so much absorbed.

To calculate the rate at which energy is radiated from the metal by the electromagnetic waves produced by the collisions between the corpuscles and the molecules, we require to know the attraction exerted by the molecules on the corpuscles; for without this knowledge we cannot tell how near to the surface a molecule moving with a given velocity will penetrate; we also require to know how much of the radiant energy produced by the collision is absorbed in passing from the place of collision to the outside of the metal. In default of information on these points let us calculate the rate of emission of radiant energy on the assumption that only those corpuscles whose velocity is greater than v_1 get near enough to the surface for any of their radiation to escape, and that all the radiation from those moving with a velocity greater than v_1 escapes without absorption. Assuming Maxwell's law of distribution, and that the energy in the electromagnetic pulse produced by the collision is proportional to the square of the velocity, we find that the rate at which energy is emitted from the metal is proportional to

$$\theta^{-\frac{3}{2}}\int^{\infty} v^5 \epsilon^{-\frac{mv^2}{\theta}}\, dv,$$

where θ is the absolute temperature. If mv_1^2 is large compared with θ, this expression increases very rapidly with θ.

The collision of free corpuscles with the molecules will not be the only source of radiation—indeed if it were only conductors of electricity would radiate—similar radiation will be

produced by the motion of corpuscles inside molecules from which they never become detached. The electromagnetic effect will evidently be of much the same character, whether the velocity of a corpuscle is reversed by a collision or by swinging round a closed orbit under the action of a central force. If the orbits of the corpuscles in the molecules are circular, the calculation of the amount of energy radiated from them is very simple. A corpuscle moving with an acceleration f emits radiant energy at the rate $\frac{1}{3}\frac{e^2f^2}{V}$, where V is the velocity of light. If the corpuscle moving with a velocity v describes a circle of radius r,

$$f=\frac{v^2}{r}=\frac{\mu}{r^n} \text{ if } \mu/r^n \text{ is the force on the corpuscle divided by its mass.}$$

Thus $f^2=\dfrac{v^{\frac{4n}{n-1}}}{\mu^{n-1}}$,

and this is proportional to the rate at which the corpuscle is emitting energy. Thus this rate is proportional to the kinetic energy of the particle raised to the power $2n/n-1$: and if we assume that the kinetic energy of the corpuscles is proportional to the absolute temperature θ, the rate of radiation from the corpuscles varies as $\theta^{\frac{2n}{n-1}}$. If the force on the corpuscle varies inversely as the square of the distance $n=2$, the rate of radiation will be proportional to the fourth power of the absolute temperature. To calculate the rate at which energy comes out of the body we require to know the law of absorption; if the corpuscles are moving with different velocities, the character of the radiation emitted by a corpuscle will depend upon its velocity; if the absorption does not depend upon the character of the radiation, the rate at which energy is emitted from the body is proportional to the fourth power of the absolute temperature (assuming $n=2$); but this is not the case if the absorption depends upon the character of the radiation. If, for example, as in the case of Röntgen rays, the greater the velocity of the corpuscles the more penetrating the radiation they originate, a larger proportion of the radiation from the quicker corpuscles would emerge from the body than of that from the slower corpuscles, and the rate of escape of the radiation would increase more rapidly than the fourth power of the temperature; while if the law of absorption went the other way it would vary less rapidly. Although the calculation of the amount of radiation depends upon a knowledge of the law of absorption which we do not at present possess, it is interesting to find that a collection of corpuscles describing circles under forces varying inversely as the square of the distance in the molecules of a substance which shows no selective absorption would, like the ideal "black" body, radiate at a rate proportional to the fourth power of the absolute temperature.

XXIX. *On Spontaneous Nucleation and on Nuclei produced by Shaking Solutions.* By C. Barus *.

Spontaneous Nucleation.

In 'Science' (xv. Jan. 1902, p. 178) I communicated some results which seemed to give evidence of the spontaneous production of nucleï from certain organic liquids. Though my own work is rather more concerned with the diffusion of the nuclei with an ulterior view to their velocity, no matter how the nuclei may be localized, it nevertheless seemed interesting to elucidate the subject incidentally. I therefore made a series of experiments in which condensation was produced by the expansion method in case of gasoline, benzine, petroleum, benzol, carbon bisulphide, and water.

Hydrocarbons.—The first three hydrocarbon liquids may be dismissed summarily. The air above them, if carefully freed from nuclei by precipitation, remained free from nuclei indefinitely. The test was made by leaving the receiver without interference for fifteen or more hours, all the cocks being shut off, except the one communicating with the atmosphere through a filter of compressed cotton, half a metre long. A perfect filter is essential throughout. In case of petroleum it is exceedingly difficult to remove the nuclei by precipitation alone; but they vanish in the lapse of time (days), and thereafter the air remains permanently without nucleation.

In case of benzol I was for a long time erroneously of the opinion that nuclei arise spontaneously out of this liquid, and consistent results leading to this inference were obtained in great number. Doubt was cast on this supposition by the behaviour of the hydrocarbons just mentioned. The true explanation was subsequently found: on removing nuclei by precipitation with the object of obtaining dust-free air, a couche of nuclei is apt to remain brooding immediately over the surface of the benzol, where it escapes detection. It is in this couche that the nuclei which subsequently diffuse * into and fill the whole vessel originate. They do not come out of the benzol.

* Communicated by the Author.

To account for these couches, which occur more or less frequently with all hydrocarbons and other volatile liquids, it is necessary to consider the manner in which the nuclei are introduced into the receiver. This is done expeditiously by partially exhausting the receiver and allowing the inflowing air to pass over phosphorus, or glowing charcoal, or near a sulphur flame. In the case of water vapour the nuclei after entrance remain permanently apart. The nucleated air is always homogeneous and the coronas regular. Semi-coronas never occur. This indefinite suspension of nuclei means that they remain small, diffuse relatively fast, and gravitate very slowly. The phenomenon is very similar to the suspension of particles of clay in water. The speed of subsidence is a minimum.

In case of the hydrocarbons &c. the occurrences are very different. What goes on while the nuclei are being introduced is not of course visible; but the first exhaustion after nucleation shows a horizontally graded distribution, in which the nuclei are wholly confined to a narrow stratum, usually immediately above the liquid, as already stated. The fog stratum may, however, show itself at the top of the vessel, or even between two hemispheres of clear non-nucleated air. Indeed the air is rarely, if ever, nucleated uniformly.

The distribution, therefore, is one of density; and from the relatively insignificant number of nuclei, it may be further supposed that to influence the density of the strata, the nuclei have been loaded on influx, almost without supersaturation, even though the fog particles are small enough to remain invisible. In such a case it is hardly probable that the nuclei have remained individualized as in the case of water vapour; it is more probable that they grow by coalescence or cohesion, until they are large enough to condense hydrocarbon vapour with the minimum of supersaturation or none at all. This again is remarkably like the subsidence of clay in hydrocarbon liquids, in which, from the cohesion of particles, the precipitation is, relatively speaking, instantaneous.

It is not necessary, however, to assume loading. If the nucleus diffuses slowly enough in organic vapours to virtually

* The rate of diffusion (roughly, ·015 centim./sec., upward in benzol vapour, for instance) is the feature of these experiments on which I am now at work. Incidentally one may note that the "granular" particles in water vapour should diffuse much more rapidly than the "flocculent" particles in benzol vapour, the nuclei being otherwise the same.