other crystals, which are thick enough to intercept all the primary rays. Yet the intensity ratios are, to all appearances, nearly correct before the allowance is made, and become quite wrong afterwards. The diamond behaves as if, like the other crystals, it were quite thick.

I have therefore renewed a search for an effect which I have more than once failed to find, a special absorption of rays which are undergoing reflection. Since the earlier attempts the apparatus has gained in sensitiveness and accuracy, and I now find that the effect is easily visible. That is to say, when the pencil of rays strikes the diamond at the proper angle for reflection there is a diminution in the amount transmitted.

In the experiment as arranged at present a pencil of X-rays from a rhodium bulb passes through a slit one-tenth of a millimetre wide, and falls upon the diamond, which is mounted on the revolving table of the spectrometer. The rays that pass through the diamond fall afterwards upon a crystal of rock salt so placed as to reflect a pencil into the ionisation chamber. When the diamond is turned, a minute of arc at a time, through the angle (about 9°) at which the diamond itself reflects the principal rhodium ray, the intensity of the ray reflected by the rock salt drops in the ratio 100 to 70. No doubt this ratio could be increased by more accurate arrangement.

The principal rhodium ray is really a doublet, the two constituents of which are separated by an angle of four minutes under these arrangements. The doublet is resolved not only in the pencil reflected by the diamond, but also in the absorption band occurring in the reflection from the rock salt.

The effect is no doubt analogous to the selective absorption shown by crystals of chlorate of potash (R. W. Wood, *Phil. Mag.*, July, 1906).

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Experiments Bearing upon the Origin of Spectra.

IT has been known for some years that a stream of luminous vapour can be distilled away from the mercury arc *in vacuo*, the vapour still remaining luminous when it has passed far beyond the limits of the electric field. It is known also that this luminosity is quenched when the stream passes near a negatively electrified metal surface.

I have from time to time attempted to extend these results to other less volatile metals, and have now succeeded in a large number of cases.

A preliminary account of some of the more significant observations will be given, without dwelling on experimental details.

In the case of sodium under favourable conditions, a very curious behaviour is observed. Where the distilled luminous vapour leaves the lamp, and where, of course, it is most brilliant, the light is yellow, and is dominated by the D lines. Further on, it becomes green, and the lines of the two subordinate series outshine the D lines. Finally, further still, the D lines again predominate. It would seem that if we represent the intensity of each series as dependent on time by a curve, the curve for the principal series will cut that for the subordinate series at two points. It is not, however, easy to find a law of decay which seems physically probable, and will satisfy this condition.

Another interesting effect is seen when the luminous stream is made to pass through a negatively electrified wire net. As in the case of mercury, the glow is partially extinguished. But, if the glow is watched through a spectroscope while the negative potential is applied to the gauze, it is seen that the lines of the subordinate series are far more affected than the D lines.

We may regard the distilled glow as due either to persistent vibration of the luminous centres originally excited in the arc, or to some subsequent interaction occurring in the gas, such as molecular association, or the neutralisation of ions. Whichever view is taken (and neither view is free from difficulty, as I shall show in a more complete publication) we must attribute the action of the electrified gauze to its power of attracting and neutralising positively charged ions. On either view the experiment cited shows that *the systems which gave rise to the subordinate series are not the same as those which give rise to the principal series.*

In the case of potassium, the development of the subordinate series in the distilled glow is very striking, and the existence of a series relation between the lines is visible at a glance, since the series are not confused by extraneous lines. The photography of this spectrum will be undertaken, and it is hoped will lead to an improvement in existing knowledge of the series and their convergence point.

Lastly, I will refer to the behaviour of the glow from magnesium vapour. Initially, the colour is green, dominated by the triplet *b*, and the green band of the "magnesium hydride" spectrum, upon which as a background *b* lies. As the vapour moves on these die out, but the blue flame line at $\lambda 4571$ survives much longer. The vapour was passed through a wire gauze screen. On electrifying this to -40 volts, all the features of the spectrum which have been mentioned were seen to diminish in intensity, but the effect on the blue line and on the bands of magnesium hydride was much stronger than the effect on *b*. The extinction of the band spectrum of magnesium hydride is specially significant.

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Unidirectional Currents within a Carbon Filament Lamp.

THE following experiments are good illustrations of the thermionic current, or Edison effect, in a carbon filament lamp, and require only such apparatus as is usually found in a laboratory.

The type of lamp used is that having two large loops in the filament, with the middle of the loop fixed by a short wire fused in glass at the top of the lamp. If the terminals are earthed and a charged body, either positive or negative, is brought near the lamp, then the two leaves diverge like two leaves of a simple electroscope. The loops may touch the glass bulb, and, if so, they spring back discharged.

But if the lamp is lighted and a pointed rod, connected to a Wimshurst, gives a powerful positive discharge, the loops are not displaced, even if the point is close to the bulb. On the other hand, with a negative discharge, even a foot or two away, the two loops of the filament rapidly and repeatedly strike the glass and spring back. Apparently this action will go on for a long period, if the point of discharge is continued.

The action may be explained from the fact that the lamp acts like a valve, and that the current can pass in one direction only, between the hot filament and the interior of the bulb. There can only be a thermionic current of electrons from the filament to the sides, and when there is an equilibrium distribution the carbon is at a relatively high positive potential compared with the inner wall. If this equilibrium is disturbed, it is adjusted by a thermionic current only, in one direction, or by movement of the loops only, in the other direction.

Thus if the negatively charged plate of an electro-