



# LIV. The effect of gravitation on light

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warming them up, the reddish colour gradually disappeared with a simultaneous increase in conductivity. On allowing them to cool, they very slowly began to present the former tint, conductivity, too, decreasing at the same time. The second variety of crystals were usually found to be deposited in the hotter part of the tube, and had slight conductivity which did not show any appreciable change on slightly heating. The third variety was primarily non-conducting. The peculiar heat sensitivity of the first variety is therefore quite possibly responsible for the enormous temperature variation of resistance of selenium; and that something akin to transformation is actually taking place, is suggested from the change of colour on warming. It is hoped that, time being available, researches will be pursued in this direction.

#### 6. *Summary.*

1. The variation of resistance of selenium with temperature has been carefully determined, and a formula has been proposed to express the said variation.

2. It has been shown experimentally that not more than  $1/25$  of the "light effect" is attributable to heat produced by light.

3. A change of colour taking place at the same time as the change in resistance has been observed by warming crystals of selenium produced by the sublimation method.

4. A modified theory of transformation is suggested to account for the various observations in connexion with the heat-effect.

In conclusion, I beg to thank Prof. A. O. Rankine for the kind interest he took in this work and for the facilities given to me in conducting the experiment.

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#### LIV. *The Effect of Gravitation on Light.*

By HAROLD JEFFREYS, M.A., D.Sc.\*

THE query in Sir Oliver Lodge's note (Phil. Mag., June 1921, pp. 944-5) concerning the legitimacy of deriving the equations

$$\gamma \frac{dt}{ds} = k \quad \text{and} \quad r^2 \frac{d\theta}{ds} = h$$

for the motion of a light wave is relevant to my paper "On the Crucial Tests of Einstein's Theory of Gravitation." (Monthly Notices of R. A. S., Dec. 1919, pp. 138-154). Of

\* Communicated by the Author.

these equations the first is equation (16) of my paper and the second equation (15); I derived them as two of the conditions that a principle of least action should be satisfied for the path of a particle. To assume that the same equations hold for a light wave is to say that the motion of a light wave is the *limit* of that of a particle when the velocity at a great distance from the Sun tends to that of light. My suggestion was that this is a natural hypothesis to make, and that Einstein's law is the only reasonable one that makes it fit the observations. I do not think it is obviously true *a priori*, but that it is highly probable.

#### LV. *Proceedings of Learned Societies.*

##### GEOLOGICAL SOCIETY.

[Continued from p. 200.]

March 9th, 1921.—Mr. R. D. Oldham, F.R.S., President, in the Chair.

THE following communications were read:—

1. 'The Surface of the Marls of the Middle Chalk in the Somme Valley and the Neighbouring Districts, and the Effect on the Hydrology.' By William Bernard Robinson King, O.B.E., M.A., F.G.S.

During the war numerous boreholes were made by the British Armies in France. In the valley of the Somme and in neighbouring districts of France, where the Chalk forms the main deposit of the area, water was obtained for the troops, largely from boreholes. These were made by the percussion method, so that the passage from the chalk of the Upper Chalk to the marls of the Middle Chalk usually was only approximately determined; the great number of bores, however, enables one to construct a map of the contours of the marl-surface with sufficient accuracy for it to be of value.

These curves bring out several points of interest, which may be briefly tabulated as follows:—

(1) The main anticlinal crest (axis of Artois) is not continuous, but consists of a series of curved axes arranged en *échelon*, in such a way that the crest-line is stepped gradually more and more to the north on going from east to west.

(2) The close relationship of the river-systems to the tectonic axes is demonstrated; but, in several cases, the physiographical lines, while being parallel to, are often not coincident with, the tectonic axes (for instance, the valley of the Somme lies several miles north of the synclinal axis of the Somme).

(3) The capacity of the Chalk to yield water for boreholes measuring about 6 inches in diameter is shown to depend more on the topography of the neighbourhood than on the larger tectonic features, provided about 50 feet of chalk occurs between the marl surface and the surface of the water-table in the Chalk.