

metals, still 7 cms. apart. We then found the difference of zeros to be  $-89$  sc. divs., or  $-0.64$  of a volt; but instead of seven minutes, scarcely a quarter of a minute was taken to reach the rays-zero after the metallic connection was broken. These results are substantially in accordance with Erskine Murray's §§ 9 of his paper already referred to.

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*THE EFFECT OF MAGNETISATION ON THE NATURE OF LIGHT EMITTED BY A SUBSTANCE.*<sup>1</sup>

IN consequence of my measurements of Kerr's magneto-optical phenomena, the thought occurred to me whether the period of the light emitted by a flame might be altered when the flame was acted upon by magnetic force. It has turned out that such an action really occurs. I introduced into an oxyhydrogen flame, placed between the poles of a Ruhmkorff's electromagnet, a filament of asbestos soaked in common salt. The light of the flame was examined with a Rowland's grating. Whenever the circuit was closed both D lines were seen to widen.

Since one might attribute the widening to the known effects of the magnetic field upon the flame, which would cause an alteration in the density and temperature of the sodium vapour, I had resort to a method of experimentation which is much more free from objection.

Sodium was strongly heated in a tube of biscuit porcelain, such as Pringsheim used in his interesting investigations upon the radiations of gases. The tube was closed at both ends by plane parallel glass plates, whose effective area was 1 cm. The tube was placed horizontally between the poles, at right angles to the lines of force. The light of an arc lamp was sent through. The absorption spectrum showed both D lines. The tube was continuously rotated round its axis to avoid temperature variations. Excitation of the magnet caused immediate widening of the lines. It thus appears very probable that the period of sodium light is altered in the magnetic field. It is remarkable that Faraday, as early as 1862, had made the first recorded experiment in this direction, with the incomplete resources of that period, but with a negative result (Maxwell, "Collected Works," vol. ii. p. 790).

It has been already stated what, in general, was the origin of my own research on the magnetisation of the lines in the spectrum. The possibility of an alteration of period was first suggested to me by the consideration of the accelerating and retarding forces between the atoms and Maxwell's molecular vortices; later came an example suggested by Lord Kelvin, of the combination of a quickly rotating system and a double pendulum. However, a true explanation appears to me to be afforded by the theory of electric phenomena propounded by Prof. Lorentz.

In this theory, it is considered that, in all bodies, there occur small molecular elements charged with electricity, and that all electrical processes are to be referred to the equilibrium or motion of these "ions." It seems to me that in the magnetic field the forces directly acting on the ions suffice for the explanation of the phenomena.

Prof. Lorentz, to whom I communicated my idea, was good enough to show me how the motion of the ions might be calculated, and further suggested that if my application of the theory be correct there would follow these further consequences: that the light from the edges of the widened lines should be circularly polarised when the direction of vision lay along the lines of force; further, that the magnitude of the effect would lead to the deter-

mination of the ratio of the electric charge the ion bears to its mass. We may designate the ratio  $e/m$ . I have since found by means of a quarter-wave length plate and an analyser, that the edges of the magnetically-widened lines are really circularly polarised when the line of sight coincides in direction with the lines of force. An altogether rough measurement gives  $10^7$  as the order of magnitude of the ratio  $e/m$  when  $e$  is expressed in electromagnetic units.

On the contrary, if one looks at the flame in a direction at right angles to the lines of force, then the edges of the broadened sodium lines appear plane polarised, in accordance with theory. Thus there is here direct evidence of the existence of ions.

This investigation was conducted in the Physical Institute of Leyden University, and will shortly appear in the "Communications of the Leyden University."

I return my best thanks to Prof. K. Onnes for the interest he has shown in my work. P. ZEEMAN.  
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NOTES.

THE Council of the Royal Society have invited Prof. C. S. Sherrington, F.R.S., Professor of Physiology in University College, Liverpool, to deliver the Croonian Lecture on April 1, the subject being "The Spinal Cord and Reflex Actions."

TUESDAY'S *Gazette* contains the formal intimation that the dignity of a Baron of the United Kingdom has been granted to Sir Joseph Lister, Baronet, President of the Royal Society, by the title of Baron Lister, of Lyme Regis, in the county of Dorset.

PROF. DR. RUDOLF VIRCHOW has been elected president of the German Anthropological Society for the year 1897.

It is expected that Prof. Barnard will attend the meeting of the Royal Astronomical Society to-morrow, February 12, to receive the gold medal which has been awarded him for his numerous contributions to astronomy. Sir Robert Ball has been nominated as the new president of the Society.

THE Council of the Royal Meteorological Society have arranged to hold, from March 16 to 19, in commemoration of the diamond jubilee of H.M. the Queen, an exhibition of meteorological instruments in use in 1837 and in 1897, and of diagrams, drawings, and photographs illustrative of the advances which have been made.

THE Government of the Colony of the Cape of Good Hope has undertaken an investigation of the marine fauna of the South African coast, with reference both to economic value and scientific interest. A small marine station will probably be erected on False Bay, and a suitable steam vessel of about 150 tons is now being built for this purpose. It is confidently hoped that results of some scientific value may be obtained from the exploration of this little-known coast, and more especially of the Agulhas Bank. We are requested to state that the services of specialists are invited to work up the material that may be procured, under the following arrangements. Specimens will be forwarded as procured, and, on receipt of manuscript and drawings, each piece of work will be published without delay in a uniform style, so as to form ultimately a complete record of the Cape marine fauna. Authors' copies will be forwarded as soon as published, and a certain circulation will be guaranteed. No money remuneration is offered, but duplicate specimens may be retained by the authors. Unique specimens it is intended to be handed over to the South African Museum in Cape Town. Further information will be supplied to those interested in the work, on application to J. D. F. Gilchrist, Marine Biologist to Cape Government Agricultural Department, Cape Town.

<sup>1</sup> Translated by Arthur Stanton from the *Proceedings* of the Physical Society of Berlin.