March 17, 1881.

THE PRESIDENT in the Chair.

The Presents received were laid on the table and thanks ordered for them.

Professor J. Emerson Reynolds was admitted into the Society.

The following Papers were read:—

I. "On the Electrical Resistance of Thin Liquid Films, with a Revision of Newton's Table of Colours." By A. W. REINOLD, M.A., Professor of Physics in the Royal Naval College, Greenwich, and A. W. RÜCKER, M.A., Professor of Physics in the Yorkshire College, Leeds. Communicated by Professor W. GRYLLS ADAMS, F.R.S. Received March 3, 1881.

(Abstract.)

The authors have made numerous measurements of the electrical resistance of cylindrical liquid films. Their object was to determine whether a thinning film gave evidence by change in its specific resistance of an approach to a thickness equal to twice the radius of molecular attraction, and also to devise a method of finding the amount of water which might be absorbed by or evaporated from it. This change of constitution had been neglected by previous observers of the properties of films.

The thickness of the films was determined from their colour. This necessitated a revision of Newton's table of colours, which was carried out partly by observations on Newton's rings, partly by more than 2,000 observations on the films themselves. Two simultaneous but independent measures of the thickness of the film were made by observing two portions illuminated by light incident at different angles. In 84 per cent. of the measures made during the final series of experiments described in the paper, the difference between the two values of the thickness thus obtained did not exceed 2 per cent. of its value.

The films were enclosed in a glass case in which they could be formed without admitting any external air. Elaborate precautions were taken to maintain the aqueous vapour within the case at the tension proper to that in contact with the soap solution.

The resistance of the films was measured by piercing them with

gold wires which were in connexion with the opposite pairs of quadrants of a Thomson's electrometer. The resistance of the film between the needles was calculated by comparing the deflection caused by the difference of potential of the two wires when a current was passing through the film, with that produced by the difference of potential above and below a known resistance placed in the same circuit.

A novel method, the same in principle with the above, was also used to determine the specific resistance of the liquids from which the films were formed. This was deduced from the difference of potential of two platinum wires cemented into a glass tube in which the liquid was contained. As these were at some distance from the electrodes, errors due to polarisation were got rid of. The results of some test experiments made on solutions of sulphuric acid agreed with those of Kohlrausch to within 0·7 per cent.

The authors conclude that their experiments show that the specific resistance of a soap film thicker than $3{\cdot}74 \times 10^{-5}$ centims. (the least thickness at which trustworthy observations were made) is independent of the thickness, and is equal to that of the liquid from which it is formed.

They have, therefore, detected no indication of an approach to a thickness equal to the diameter of molecular attraction, and this leads to the deduction that its magnitude must either be less than is supposed by Quincke ($0{\cdot}5 \times 10^{-5}$ centims.), or that the mean specific resistance of the surface layer, the thickness of which is equal to that magnitude, does not differ by 17 per cent. from that of the liquid in mass.

They have further found that soap films, even in an enclosed space, may, if the precautions above referred to are not taken, readily lose 23 out of the 57·7 volumes of water contained in every 100 volumes of solution, and their experiments show that this quantity may probably be largely exceeded. They think, therefore, that in all accurate observations on soap films these profound modifications of constitution must either be prevented or measured by a method similar to their own. They criticise from this point of view the observations of Plateau* and Lüdtge,† and conclude by pointing out the extreme sensitiveness of the electrical method of investigation.

II. "Molecular Electro-Magnetic Induction." By Professor D. E. Hughes, F.R.S. Received March 7, 1881.

The induction currents balance which I had the honour of bringing before the notice of the Royal Society‡ showed how extremely sen-

* "Statique des Liquides," (1873), vol. i, p. 210.

† "Pogg. Ann.," (1870), vol. cxxxvii, p. 620.

‡ "Proc. Roy. Soc.," vol. 29, p. 56.