AN EXPERIMENT TO DETECT A POSSIBLE EFFECT OF A TRANSVERSE ELECTRIC FIELD ON LIGHT

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In *Science* for February 21, 1930, we proposed a possible explanation of the dielectric action of the ether. In this we assume that empty space is the medium called the ether, by which electric forces are transmitted. The modern theory of dielectrics, developed particularly for gases and liquids by Debye and others, explains the dielectric action as due to "dipoles"; extending this concept to the ether, we think of the ether as containing "ether dipoles." When we have an electric field across the simple ether (empty space), we have these "ether dipoles" lined up, that is, the ether will have a structure, a "grain" in the direction of the lines of electric force.

The following experiment has been devised as a possible means of testing any such ether structure. It consists in brief in sending a beam of plane polarized light across a long electric field maintained in a very high vacuum. The entering beam is polarized at 45° to the direction of the electric field, so that the ether structure, if it exists sufficiently, should produce elliptical polarized light at emergence. The emergent light can be examined by using a second nicol, and noting any change by the eye; but, as the change will be small and possibly uncertain to the eye, it has been arranged to examine the emergent light photographically. For this purpose, we are using a "Memo" camera. In this we have a film such as used for "moving" pictures, each exposure being one inch by three-fourths inch. The film is changed for a new exposure by simply pressing down a lever. The shutter can be set for one twenty-fifth, one fiftieth, or one one-hundredth of a second exposure, and there are four stops for different illuminations, so that it is easy to get a succession of fifty exposures on the strip of film for the same stop and time of exposure. Thus an exposure can be made with no electric field, and a second later with the maximum electric field intensity. Any difference of intensity or of pattern of the transmitted light should then be detected by studying the exposures. This assumes that the "structure" of the ether is not

so fine as to affect the light. It may be that such structure can be detected by some light of ultra short wave length, when light of ordinary wave lengths is not affected. The arrangement of the experiment as it has been set up is shown in figure 1.

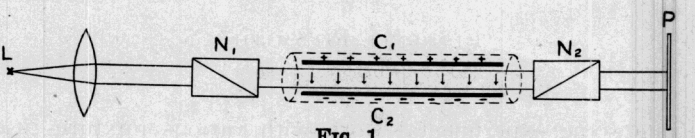

FIG. 1

L is a source of light, a "Pointelite" lamp; the light is made parallel and is polarized by the Glan-Thomson nicol N_1; it then passes between the plates C_1C_2 of the electric condenser; and then through the nicol N_2, and strikes the photographic film at P. The condenser C_1C_2 is enclosed in a vacuum. The electric field is 60 centimeters long, 2 centimeters wide, and the distance between the plates is 2 millimeters.

This experiment has been planned on the assumption of an ether in which light is a wave motion. Within recent years a number of our leaders in physics have returned to a corpuscular theory of light. This is not the place to discuss such phenomena as the photo-electric and Compton effects, which have led to a particle or quanta theory of light. The experiment described above, will, interpreted on this corpuscular theory, afford a test as to whether photons or light quanta have electric moments to be affected by a strong transverse electric field. A recent experiment by Watson at the Cavendish Laboratory (Proc. R. S. June, 1929) has shown these photons have no measurable magnetic moments, so that question of the electric moment of the photon is as important in the quanta theory of light as is the ether structure in the ether theory.

ADDENDUM—**The experiment as described in the paper read before** the Academy on May 8, 1931, was arranged also with a sensitive visual **polarizing apparatus. It was estimated that a rotation of less than thirty minutes could have been** detected with the arrangement, but no effect was observed with an electric field estimated as fully 50,000 volts between the plates of the vacuum condenser. At the time of printing, the experiment **was being continued with still more sensitive apparatus.**