NOTE ON THE DIRECT DETERMINATION OF h.

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IN a paper published in the PHYSICAL REVIEW, Vol. 4, p. 73 (July, 1914), under the title "A direct determination of h" Professor Millikan submits a resumé of previous experimental work which I venture to think may be misapprehended by those who are insufficiently familiar with the history of this subject. In discussing Einstein's photoelectric equation he points out that it involves the following consequences:

"(1) That there is a linear relation between the frequency of the impressed light and the maximum energy of emission of the electrons ejected by it.

"(2) That the slope of the line representing the linear relation between P.D. and ν is h/e, *i. e.*, that this slope times e is Planck's "h."

"(3) That the intercept of the P.D. line on the ν axis gives the frequency ν_0 at which the metal in question first begins to be photoelectrically active."

He then goes on to state that "The second and third of these assertions have not heretofore been made the subject of accurate test nor can they be so made without simultaneous measurement *in vacuo* of both contact potentials and photo-potentials in the case of metals which are sensitive throughout a long range of frequencies. The spectral lines used in the test must further be strictly monochromatic and of frequency determinable to a high degree of precision."

As regards the first of the three assertions he quotes an opinion of Pohl and Pringsheim as to the inadequacy, for deciding between various alternatives, of the experiments of Hughes and of Richardson and Compton. I shall not enter specifically into the merits of this particular question since the objections raised by Pohl and Pringsheim have already been answered by Professor Hughes.[1]

I should like, however, to be allowed to call attention to the following facts:

1. The three assertions enumerated above form three of the principal

[1] Phil. Mag., Vol. 27, p. 473 (1914).

conclusions drawn by Richardson and Compton[1] from the experiments they describe in the paper to which Professor Millikan refers.

2. In those experiments the contact potentials and photo-potentials were determined *in vacuo* simultaneously. It is true that the method used for getting the contact potentials was a novel one and depends upon the determination of the applied potential difference at which the photo-electric current just becomes saturated. This method had, however, previously been shown to be reliable by the experiments of Compton[2] and its validity has since been confirmed by Page.[3]

3. Although the experiments did not cover so wide a range of frequency in the exciting light, the metals employed include sodium, the one examined by Professor Millikan.

4. So far as monochromatism and definiteness of frequency are concerned there is no doubt that the apparatus used by Richardson and Compton was quite adequate to the purposes of the experiments.

In drawing attention to the facts mentioned above I am far from desiring to disparage Professor Millikan's achievement, the importance of which can hardly be exaggerated. There is no doubt that the work of Kadesch[4] exhibits an improvement in accuracy over the earlier experiments of Hughes and of Richardson and Compton and that Professor Millikan has succeeded in effecting a still greater advance in the same direction. The results of his investigation I am particularly glad to welcome as they are so entirely in agreement with the views which the experiments made in collaboration with Dr. Compton led me to advocate.

[1] Phil. Mag., Vol. 24, p. 575 (1912), Abstract in PHYS. REV., Vol. 34, p. 393 (1912).
[2] Phil. Mag., Vol. 23, p. 579 (1912).
[3] Amer. Journal of Science, Vol. 36, p. 501 (1913).
[4] PHYS. REV., Vol. 3, p. 367 (1914).