Reprinted from the JOURNAL OF THE WASHINGTON ACADEMY OF SCIENCES
Vol. VIII, No. 1, January 4, 1918

PHYSICS.—*The size and shape of the electron.* ARTHUR H. COMPTON, Research Laboratory, Westinghouse Lamp Company. (Communicated by G. K. Burgess.)

The radius of the electron is usual y deduced from the energy of the electron in motion, assuming its magnetic energy to be identical with its kinetic energy. If the electron is a sphere, its radius must be, according to this assumption, about 1×10^{-13} cm. It is thus sufficiently small to act as a point charge of electricity even with the shortest γ-rays.

Calculating on the basis of such an electron, J. J. Thomson[1] has shown that the fraction of the energy of an electromagnetic wave incident upon an electron which is scattered by it is given by the expression

$$\frac{8\pi}{3}\frac{e^4}{m^2C^4}.$$

This corresponds to a mass absorption coefficient due to a scattering of the primary beam equal to

$$\frac{\sigma}{\rho} = \frac{8\pi}{3}\frac{e^4N}{m^2C^4}, \qquad (1)$$

where N is the number of electrons which contribute to the scattering in a gram of the absorbing medium, C is the velocity of light, and e and m have their usual significance. As Barkla has pointed out, there may be absorption due to other causes,

[1] THOMSON, J. J. Conduction of Electricity through Gases, 2d ed., p. 321.

Summary. Ishino's experiments, showing that the scattering of hard γ-rays by different materials is strictly proportional to the number of electrons and is not proportional to the masses, proves that the electrons are responsible for practically all of the scattering, and that for these wave-lengths they act independently of each other. According to the classical electrodynamical theory, this means that if the electrons are sensibly point charges of electricity, the absorption coefficient due to scattering for these rays must be given by equation (1). Since this equation does not hold for these wave-lengths, we cannot consider the electron to be a point charge. In order to account for the small absorption coefficient of γ-rays *the electron must have an effective radius of about* 2.3×10^{-10} *cm.* In order to explain the fact that the emergent scattered radiation is more intense than the incident radiation, it is necessary to assume further that *the different parts of the charge of the electron can possess certain motions independently of each other.* It appears that these phenomena, together with the electromagnetic mass of the electron, can be quantitatively explained on the hypothesis that the electron consists of a ring of electricity subject to rotation about any axis and of radius about 2.3×10^{-10} cm. This hypothesis is confirmed by the fact that it explains satisfactorily Forman's effect of magnetization of iron upon its absorption coefficient, for which there is no other apparent explanation.