effect was a fractional increase in σ of amount somewhat greater than $r_0E^{\frac{1}{2}}$, where E is the mass defect of deuterium in MEV (about 2.14 MEV), and r_0 is the interaction distance in units of 6.35×10^{-13} cm ($r_0=0.237$ for an interaction extending to 1.5×10^{-13} cm). For the potential hole, and an r_0 corresponding to 1.5×10^{-13} cm, the correction is 42 percent, which gives $\sigma=10\times10^{-28}$ cm^2. Similar results hold for other types of interaction. For r_0 about 1.0×10^{-13} cm the correction is $(2/3)(0.42)=28$ percent, or $\sigma=9\times10^{-28}$ cm^2.

Considerations based on the WKB method seem to indicate that the effect of any reasonable potential function $v(r)$ will lead to the same essential result, namely, an increase in σ for a finite range of interaction.

These results for σ are just on the verge of the upper limit allowed by Chadwick and Goldhaber, and hence definite conclusions are to be avoided. It is only suggestive that with slightly improved experimental technique, an upper limit may be fixed for r_0.

It seems unlikely that any experiment of this kind can offer definite information about the shape of the interaction in the light of present ideas, since σ is so insensitive to the particular form of interaction chosen.

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February 12, 1936.

[1] Bethe and Peierls, Proc. Roy. Soc. **A148**, 146 (1935).
[2] Chadwick and Goldhaber, Proc. Roy. Soc. **A151**, 479 (1935).

The Scattering of Protons by Protons

We have examined the scattering of protons by protons at 5° intervals from 15° to 45° and at voltages from 320 to 980 kilovolts, using a linear amplifier connected to an ionization chamber which, with its attached slit system, can be oriented at will with respect to a narrow proton beam in a scattering chamber containing palladium-purified hydrogen at 12.0 mm pressure. From 100 to 2000 scattered protons were observed at each point. The angular definition is about 2°. Voltages are held constant to one percent and measured to two percent by a corona-free high resistance voltmeter (1000 ten-megohm resistors). Range limitations prevent observations at the highest angles for voltages below 600 kilovolts.

Data taken at fixed voltages (630, 696, 740, 830, 922, and 980 kilovolts at scattering volume) with variable angle are consistent and in agreement with independent observations at fixed angles (15, 20, 25, 35, and 40 degrees) and variable voltage. All comparisons are made *on an absolute basis*, the largest error (10 to 20 percent) arising from difficulties connected with the continuous absolute determination of the primary proton current, which cannot be measured with an ordinary Faraday cage due to ionization in the hydrogen gas. Our observations do not confirm White's report[1] that the scattering varies with angle from one through one-quarter to nine times Mott's values for proton-energies of 600 to 750 kilovolts. For this voltage range most of our values lie within 25 percent of those predicted by Mott's formula, although at 740 kilovolts and 45° our value is approximately 50 percent higher than Mott's. As the voltage is increased, consistently larger deviations are in evidence at high angles, our values at 980 kilovolts reaching 5.2 and 7.5 times the Mott values at 40° and 45°, respectively.

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[1] M. G. White, Phys. Rev. **47**, 573 (1935).

The Ionization Probability of He^{++}

At a meeting of the American Physical Society in 1932 some results were presented on the probability of producing doubly charged helium at a single electron impact.[1] No other publication has been given for this work, but in view of a large number of inquiries concerning these results we thought it worth while to repeat the measurements on a different instrument and present them in this journal.

The shape of the probability function, Fig. 1, was found

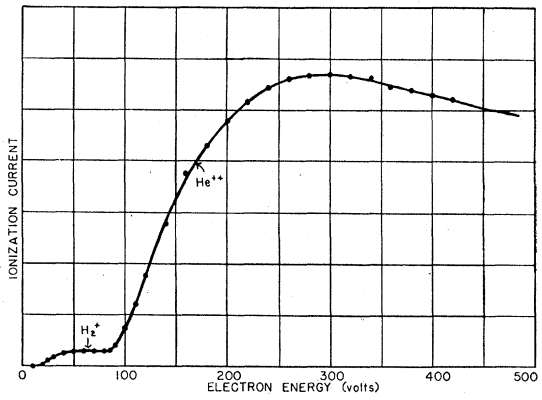

FIG. 1.

by setting the mass spectrograph on the $m/e=2$ peak and varying the electron velocity. A small impurity of molecular hydrogen was present but at about 79 volts an abrupt rise in the curve began which can only be interpreted as He^{++}. At 300 volts the current due to this ion is 1.1 percent of that ascribed to He^{+} which means that at this point only 0.55 percent of the ions are doubly charged. The absolute values may be determined by referring to the data of Smith[2] on the singly charged ion.

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[1] W. Bleakney, Phys. Rev. **43**, 378 (1933).
[2] P. T. Smith, Phys. Rev. **36**, 1293 (1930).
[3] We wish to make acknowledgment of financial assistance from the Penrose fund of the American Philosophical Society.