subordinated to our simple model, since the two isotopes $M=69$ and 71 of Ga with equal j differ only by 2 neutrons. Thus they should not, but do, differ in their values of g. Of course we do not pretend to give here an exact theory of the magnetic properties of nuclei. But we think that at least in first approximation the one proton is responsible for the mechanical and magnetic moment of the whole nucleus of type 4. From this simplified model we infer that *the magnetic moment of a proton is about 2 magnetons* differing from Stern's value by 20 percent. It is quite interesting that the values of the orbital quantum number l assigned to the proton in Table II indicate: *The proton circles around inside or on the surface of the neutron shells only*, and never far outside them. Indeed $l=2$ appears in Table II first with $Z=33$, $l=3$ first with $Z=37$, $l=4$ with $Z=49$, and $l=5$ with $Z=83$, in accordance with a scheme of neutron shells suggested in a previous paper.[2]

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November 9, 1933 at Zurich.

The Electronic Atomic Weight and e/m Ratio

The atomic weight of the electron, determined from measurements of the interval between corresponding components of the $H^1\alpha$ and $H^2\alpha$ lines, has been found to be $(5.491\pm0.002)\times10^{-4}$. Combining this value with that of the Faraday a value of $(1.757\pm0.001)\times10^7$ e.m.u/gram has been obtained as the e/m ratio for the electron.

The desired radiation was secured by passing an electrical discharge through a modified Wood's tube immersed in liquid air and filled with water vapor that contained both isotopes of hydrogen in about the same order of abundance. This "heavy" water was generously supplied by Professor G. N. Lewis.

Interference patterns of the "doublets" of both the $H^1\alpha$ and $H^2\alpha$ lines, formed by a prism spectrometer and an etalon, were photographed on very fine-grained plates. With a 3 mm etalon spacing the $H^2\alpha$ fringes were displaced about two and one-half interference orders from the corresponding fringes of $H^1\alpha$. The exact displacement in orders was computed from measurements of the positions of maxima on large-scale microphotometer curves of these fringes. The isotopic interval in cm^{-1} between the low frequency members of the doublets was then determined from the etalon equation, not neglecting the cosine factor, for each of the thus computed displacements (22 in all, taken from three different plates). This yielded an average interval, when reduced to vacuo, of 4.148 ± 0.0015 cm^{-1}. The measurements were confined to this member of the doublet in order to eliminate any possible discrepancy that might result, if the separation of the microphotometer peak from the component chiefly responsible for the peak were not the same for the two isotopes. In the first place analyses had shown that this separation was the smaller for the low frequency peak, being of the order of 0.002 cm^{-1} for both isotopes. Furthermore, neither of the two components which are measurably responsible for the position of this peak involves levels that are likely to be affected by any departure from a coulomb field such as probably exists very close to the H^2 nucleus or deuton. The measured isotopic interval may thus be safely considered equal to that between the components in the two isotopes arising from the transition $3d\,^2D_{5/2}\rightarrow 2p\,^2P_{3/2}$.

The ratio of the wave numbers for such a transition for the two isotopes is the same as the ratio of the corresponding Rydberg numbers, since, for the component selected, all quantities involving quantum numbers are the same for both isotopes and accordingly cancel out. This cancellation would occur even if these quantities were in error (evidence for which is accumulating), since any correction would in all probability be the same for both isotopes.

Thus:

$$\frac{\nu(H^1\alpha)}{\nu(H^2\alpha)}=\frac{R_{H^1}}{R_{H^2}}=\frac{M^+{}_{H^1}/(m+M^+{}_{H^1})}{M^+{}_{H^2}/(m+M^+{}_{H^2})},$$

where $M^+{}_{H^1}$, $M^+{}_{H^2}$ and m may be taken to represent the atomic weight of the proton, deuton and electron, respectively.

The atomic weights of H^1 and H^2 reported by Bainbridge[1] were obtained by adding an electronic atomic weight of 0.00055 to his experimentally determined results for ionized atoms. Hence a subtraction of this amount from his published results[2] for neutral atoms yields the values of $M^+{}_{H^1}$ and $M^+{}_{H^2}$. Using these, Houston's[3] value for $\nu(H^1\alpha)$, and the measured isotopic interval, the atomic weight of the electron was found to be $(5.491\pm0.002)\times10^{-4}$. Since the other quantities involved have been measured to a higher percent accuracy than the isotopic interval the uncertainty in this result is due chiefly to the uncertainty in the value of the interval.

Dividing the value of the Faraday, as given by Birge,[4] by this value of the electronic atomic weight, we obtain $(1.757\pm0.001)\times10^7$ e.m.u./gram for the ratio of e/m for the electron. This ratio is in excellent agreement with those obtained by magnetic deflection methods as recently reported by Dunnington[5] and by Kretschmar.[6]

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November 21, 1933.

[1] Bainbridge, Phys. Rev. **41**, 115 (1932).
[2] Bainbridge, Phys. Rev. **43**, 103 (1933); **44**, 57 (1933).
[3] Houston, Phys. Rev. **30**, 608 (1927).
[4] Birge, Phys. Rev. Sup. **1**, 1 (1929).
[5] Dunnington, Phys. Rev. **43**, 404 (1933).
[6] Kretschmar, Phys. Rev. **43**, 417 (1933).