The Spin and Magnetic Moment of the Potassium K^{39} Nucleus

We have measured the spin and magnetic moment of the potassium K^{39} nucleus by the deflection of a beam of neutral K atoms in a weak magnetic field. To attain sufficient resolution with the weak magnetic fields in question (from 5 to 210 gauss) the beam was made 142 cm long with a measured width of 0.1 mm at the receiving end. The inhomogeneous magnetic field was obtained from two parallel wires carrying currents in opposite directions[1] and was 61.5 cm long. The deflection pattern was very clearly resolved leading to entirely unambiguous results.

The spin of K^{39} as measured is 3/2 in units $h/2\pi$. The hyperfine structure separation of the $^2S_{\frac{1}{2}}$ normal state as calculated from the deflection pattern in the magnetic field is 0.0147 cm^{-1} in agreement with the value of 0.015 which Jackson and Kuhn[2] found independently from hyperfine structure measurements on the resonance lines. This leads to a nuclear magnetic moment calculated according to Goudsmit's[3] formula as extended by Fermi and Segre[4] of 0.38 in units of the nuclear magneton $\mu_0/1838$. Full details will be communicated to this journal.

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[1] Rabi, Kellogg and Zacharias, Phys. Rev. 46, 157 (1934).
[2] Jackson and Kuhn, Nature 134, 25 (1934).
[3] Goudsmit, Phys. Rev. 43, 636 (1933).
[4] Fermi and Segre, Zeits. f. Physik 82, 729 (1933).