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Supplementary note by V. W. HUGHES

**Production and Detection of a Polarized Deuteron Beam Using
the Atomic Beam Magnetic Resonance Method**

21 March 1961

An accelerated beam of completely polarized deuterons has been obtained with the apparatus described. The anisotropy $W(0^\circ)/W(90^\circ)$ obtained from atoms in the state $(F, m) = (3/2, -3/2)$, for which the deuterons have complete polarization transverse to their direction of motion, has been measured to be:

$$\frac{W(0^\circ)}{W(90^\circ)} = 0.45 \pm 0.10$$

in good agreement with the theoretical value of 0.40. The instrumental asymmetry was measured by removing the wire stop and measuring the neutron asymmetry associated with the «flopped-in» atoms, which will include equal numbers in the two states $(F, m) = (3/2, -3/2)$ and $(3/2, -1/2)$, and noting that apart from the instrumental asymmetry the neutrons should have an isotropic angular distribution. As a further check the anisotropy $W(90^\circ)/W(0^\circ)$ obtained from atoms in the state $(F, m) = (3/2, -1/2)$ was measured and found to be:

$$\frac{W(90^\circ)}{W(0^\circ)} = 0.51 \pm 0.28$$

in good agreement with the theoretical value of 0.50.

From the above data we conclude that the accelerated beam of deuterons obtained from atoms flopped into the state $(F, m) = (3/2, -3/2)$ has a polarization of 100%, within the statistical accuracy of the measurement. The intensity of the completely polarized deuteron beam is about 2×10^{-11} ampere. The unpolarized background beam is about 2×10^{-10} ampere and consists primarily of D_2^+ ions.

The ionizer used in these experiments is an electrostatic Pierce-type gun with an ionization efficiency of about 10^{-4} . The only instrumental additions to the apparatus as described are:

1) Titanium-wrapped tungsten filaments for additional pumping in the ionizer region.

2) Helmholtz coils to produce a small magnetic field in the z -direction in the region of the ionizer and of the injector to the accelerator.