SEARCH FOR ELECTRIC DIPOLE MOMENT OF THE MUON †

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We have carried out a search for possible electric dipole moment structure in the positive muon. The technique is based on the facts that:

(1) the external muon beams are produced with a high degree of longitudinal polarization by decay-in-flight of pions near the cyclotron target; and

(2) if the muon possesses an electric dipole moment, the term $\sigma \cdot \mathbf{v} \times \mathbf{H}$ ($\mathbf{v}$ = velocity, $\mathbf{H}$ = external magnetic field) will result in a precession of the spin vector way from the momentum and toward the (vertical) applied magnetic field. Thus, during the $\sim 135°$ bending of the muon trajectory in the cyclotron field and the subsequent $-45°$ bending in the steering magnet (Run I), the net precession of the spin vector is: $\theta_H \cdot \beta \cdot f$ where $\theta_H = 90°$ is the trajectory deflection angle, β is the velocity and f is the electric dipole moment in units of $\frac{e\hbar}{\mu c}$.

The component of spin angular moment in the transverse plane is sought by precession of stopped muons through $\pm 90°$ (and also $0°$) in a *longitudinal* magnetic field applied to a carbon target in which the muons are arrested. Careful attention is paid to stray magnetic fields and geometric alignment of the precession coil ($5 \times 5 \times 8''$ long-aligned to $\pm {}^1/_3{}°$).

The results of Run I: $f = 0.03 \pm 0.011$. This corresponds to a dipole moment eD where $D = 6 \pm 2.2 \times 10^{-15}$ cm. At this stage we prefer to say $D < 10^{-14}$ cm. In Run II, the magnetic deflection angle is increased to 180°, increasing the sensitivity by a factor 2.

† Appendix to Session 8. — Experimental.