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A Low Q^2 Measurement of the Proton Spin Structure Function g2p

We have extracted the spin structure functions g_1 and g_2 of the proton and their moments at Q^2 < 0.13 GeV^2. This data was obtained with the Jefferson Lab polarized electron beam, a polarized solid NH3 target, and the Jefferson Lab Hall A High Resolution Spectrometers. The structure functions were measured by calculating the asymmetry for both transverse and longitudinal kinematics and using it to form polarized cross section differences $\Delta\sigma_{\parallel}(\nu, Q^2)$ and $\Delta\sigma_{\perp}(\nu, Q^2)$. These structure functions were used to form several moments, many of which can be directly compared to predictions of Chiral Perturbation Theory (χPT): $\overline{\Gamma_2}$, δ_{LT}, $\overline{d_2}$, γ_0, and I_{LT}. These results represent the first experimental determination of δ_{LT} for the proton at low Q^2. Current χPT calculations differ in the measured region, and our data shows a strong preference for one of these calculations. Data published in 2004 showed a strong disagreement between neutron δ_{LT} data and chiral theory at low Q^2, this "δ_{LT} Puzzle" has since been well studied, but recently published neutron data shows a new discrepancy, making it very important to study the behavior of this moment for the proton. The proton results shown in this talk agree well with the χPT calculation using a delta power counting scheme and less well with the calculation which uses an epsilon power counting scheme, with the difference in power counting being one known difference between the two.

Summary

We present proton spin structure function results g_1^p and g_2^p as well as their moments, comparing to leading calculations of chiral perturbation theory. These results show good agreement with one of these calculations for several 0th and 2nd order SSF moments.

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