Transverse Target-spin Asymmetry Associated with Deeply Virtual Compton Scattering on the Proton and a Resulting Model-dependent Constraint on J_u and J_d

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Abstract:

Results are reported on the transverse target-spin asymmetry (TTSA) associated with deeply virtual Compton scattering on the proton. The data have been accumulated in the years 2002-2004 by the HERMES experiment at DESY, in which the HERA 27.6 GeV e^+ beam scattered on a transversely polarized hydrogen target. The azimuthal amplitudes of the TTSA appearing to LO in 1/Q and α_S, $A_{UT}^{\sin(\phi-\phi_S)\cos\phi}$ and $A_{UT}^{\cos(\phi-\phi_S)\sin\phi}$, are given as a function of -t, x_B and Q^2 in the kinematic range $|t| < 0.7$ GeV^2, $0.3 < x_B < 0.35$ and $1 < Q^2 < 10$ GeV^2. The TTSA amplitude $A_{UT}^{\sin(\phi-\phi_S)\cos\phi}$ is sensitive to the generalized parton distribution (GPD) E of the proton. Within a GPD model that includes the total angular momentum carried by the quarks in the nucleon, J_q (q=u, d), in the parameterization of the GPD E, it has been found that the TTSA amplitude $A_{UT}^{\sin(\phi-\phi_S)\cos\phi}$ is sensitive to J_q and insensitive to the other model parameters. By comparing the HERMES result and the theoretical predictions based on the GPD model, a model-dependent constraint on J_u and J_d is obtained.