

New results on spin structure functions at very low momentum transfers from the EG4 experiment at Jefferson Lab

Tuesday, 11 September 2018 15:40 (30 minutes)

Several experiments at Jefferson Lab have collected a large amount of data on the spin structure of nucleons using a polarized electron beam directed onto various polarized targets (NH₃, ND₃, and 3He). In these double polarization experiments, either the double spin asymmetries $A_{||}$ and A_{\perp} or the polarized cross section differences $\Delta\sigma_{||}$ and $\Delta\sigma_{\perp}$ are measured with unprecedented precision and over a wide kinematic range, with $0.01 \text{ GeV}^2 < Q^2 < 5.0 \text{ GeV}^2$ and $1.08 \text{ GeV} < W < 3.0 \text{ GeV}$. From these measurements, the spin structure functions and their moments are extracted. These data help us shed more light on the nucleon spin structure in the region of quark-confinement as well in the transition region between hadronic and partonic degrees of freedom. At sufficiently low momentum transfer, it is possible to test various predictions for moments of structure functions from sum rules and QCD-based effective theories such as Chiral Perturbation Theory (cPT) as well as from phenomenological models. In particular at very low momentum transfers ($Q^2 \rightarrow 0$), the first moment (G_1) of the structure function g_1 is constrained by the GDH sum rule and its extensions based on cPT, which makes measurements of g_1 in this region uniquely interesting. In this talk, I will present new results from the EG4 experiment with CLAS, which measured the double polarized cross section difference on NH₃ and ND₃ (with both electron beam and targets longitudinally polarized), down to $Q^2 = 0.02 \text{ GeV}^2$. The results of a parallel analysis of double polarization observables in exclusive pion electroproduction in the same kinematic region will also be shown.

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Session Classification: Spin physics in Nuclear Reactions and Nuclei

Track Classification: Spin Physics in Nuclear Reactions and Nuclei