Contribution ID: **426** Type: **Contributed Talk**

Multidimensional, high precision measurements of semi-inclusive pion beam spin asymmetries from the proton over a wide range of kinematics with CLAS12

Thursday, 15 April 2021 13:09 (18 minutes)

Many decades of experiments in deep inelastic scattering (DIS) of lepton beams off nucleons have mapped out the momentum distributions in the nucleon in terms of one-dimensional (1-D) parton distribution functions (PDFs). While these measurements provided significant insight into the structure of the nucleon, many important and interesting aspects of the nucleon structure cannot be revealed in this 1-D picture since PDFs are essentially averaged over all degrees of freedom except the longitudinal momentum. Remarkable theoretical advances over the past decade have led to a rigorous framework where information on the confined motion of the partons inside a fast moving nucleon is matched to transverse momentum dependent parton distribution functions (TMDs), which allow us to study the 3-D structure of the nucleon. Semi-inclusive DIS (SIDIS), where a specified hadron is detected in the final state, is a powerful tool to study the transverse structure of the nucleon, described by TMDs. High precision measurements of the polarized electron beam-spin asymmetry in SIDIS from the proton have been performed using a 10.6 GeV incident electron beam and the CLAS12 spectrometer at Jefferson Lab. The talk reports a multidimensional study of the structure function ratio $F_{LU}^{sin\varphi}/F_{UU}$ extracted from single pion (π^+, π^0) SIDIS data over a large kinematic range in z, x_B, P_T and virtualities Q^2 ranging from 1 GeV^2 up to 7 GeV^2. $F_{LU}^{sin\varphi}$ is a twist-3 quantity that can reveal novel properties of quark-gluon correlations within the nucleon. Theoretical models for the different contributing transverse momentum dependent parton distribution functions are compared and the impact of the data on the evolving understanding of the underlying reaction mechanisms and their kinematic variation is discussed. The comparison with calculations allows a clear differentiation between competing reaction models and helps to understand the role of so far poorly known TMDs. In addition, the results provide new empirical information in support of an important role for axial-vector diquark correlations in the proton's wave function.

Primary author: DIEHL, Stefan (JLU Giessen and UCONN)

Presenter: DIEHL, Stefan (JLU Giessen and UCONN)

Session Classification: Spin Physics

Track Classification: Spin Physics