APCTP SEMINAR

Artificial-Neural Network and Polarized-Target Technology for Probing Nucleon Structure

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The spin structure of the nucleon has been of particular interest since the EMC measurements, which showed that the helicity of the constituent quarks account for only a fraction of the nucleon spin. How quarks and gluons assemble into a spin-1/2 proton is still a mystery. An intense experimental effort has been dedicated to reveal the structure of nucleons in terms of partonic degrees of freedom, which allows to understand the partonic decomposition of the nucleon spin and probe the 3D structure of the nucleon. These information are encoded in Generalized Parton Distributions (GPDs) and Transverse Momentum Distributions (TMDs).

GPDs could be cleanly accessed from the Deeply Virtual Compton Scattering (DVCS) channel, where a photon with large virtuality is scattered off a proton and producing a real photon in the final state. Extracting GPDs from experimental data is challenging due to the highly model dependent nature of the fitting and the complexity arise from the large number of kinematic variables. However, Compton-Form Factors (CFFs) which more accessible experimentally, at leading order factorize into convolution of GPDs and hence, provide indirect access to the distributions of partons. Artificial-Neural Network (ANN) has been increasingly applied to problems related to nuclear and particle physics. The model dependence nature of ANN offers an advantage for extracting the CFFs observable. It also provides a convenience method to propagate the measurement uncertainties via replica method.

Sivers function, one of the TMDs, represents the correlation of the transverse momentum of an unpolarized parton with the spin of a transversely polarized nucleon. Measurement of Sivers function requires highly polarized nucleon target. A state-of-the-art, high luminosity polarized proton target have been constructed for the SpinQuest experiment at Fer- milab to measure the Sivers function for sea quarks using the Drell-Yan process. Measuring a nonzero Sivers asymmetry would provide “smoking gun” evidence for nonzero orbital angular momentum of sea quarks.

In this talk, I will present the extraction of CFFs using ANN from JLAB data and the construction of polarized-target technology for the SpinQuest experiment at Fermilab.

■ **ZOOM Webinar**

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