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# Overview of recent HERMES results on transverse-momentum dependent spin asymmetries

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The HERMES experiment has collected a wealth of data using the 27.6 GeV polarized HERA lepton beam and various polarized and unpolarized gaseous targets. This allows for a series of unique measurements of observables sensitive to the multidimensional (spin) structure of the nucleon, in particular semi-inclusive deep-inelastic scattering (SIDIS) measurements, for which the HERMES dual-radiator ring-imaging Cherenkov counter provided final-hadron identification between 2 GeV to 15 GeV for pions, kaons, and (anti)protons. In this contribution, longitudinal and transverse single- and double-spin asymmetries in SIDIS will be presented. The azimuthally uniform longitudinal double-spin asymmetries using longitudinally polarized nucleons constrain the flavor dependence of the quark-spin contribution to the nucleon spin. For a first time, such asymmetries are explored differential in three dimensions in Bjorken-x and the in the hadron kinematics z and $P_{h\perp}$ (which respectively represent the energy fraction and transverse momentum of the final-state hadron) simultaneously. This approach increases the quark-flavor sensitivity and allows one to probe the transverse-momentum dependence of the helicity distribution. The measurement of hadron charge-difference asymmetries allows, under certain simplifying assumptions, for the direct extraction of valence-quark polarizations. The azimuthal modulation of this double-spin as well as of the single-(beam)spin asymmetry probe novel quark-gluon-quark correlations through twist-3 distribution and fragmentation functions. Also here, asymmetries are explored in several dimensions. Furthermore, in case of the beam-spin asymmetry, results for electro-produced protons and antiprotons have become available. The beam-spin asymmetries for pions are compared to similar measurements for pions at CLAS and unidentified hadrons at COMPASS. Last but not least, a review of similar measurements using a transversely polarized target will be given, providing information on the novel Sivers and Collins effects, among others.Those go beyond the earlier measurements, which were restricted to mainly one-dimensional projections and to mesons, by a first three-dimensional extraction of transverse spin asymmetries for identified pions, charged kaons, as well as protons and antiprotons, and including all single- and double-spin modulations allowed for lepton scattering on a transversely polarized proton target.

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