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Measurements of quark transversity and orbital motion in hard scattering

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The spin structure of nucleon has been one of the most important topics of QCD for about two decades. Recent results in hard scattering processes from the various experiments shed light on ‘quark transverse motion’ for understanding the structure of nucleon. It implies that parton distribution and fragmentation functions are extended so that the transverse momentum of the parton is incorporated into the framework.

Single spin azimuthal asymmetries of hadron production in polarized lepton deep inelastic scattering at HERMES, JLab and COMPASS offer an access to such distribution functions, quark transversity and Sivers function, in conjunction with the corresponding fragmentation function. Measurements in hadron collisions such as at a proton collider at RHIC are also essential approaches to study these quantities. One of the novel fragmentation function, Collins function, could be extracted in electron-positron collider experiments. The expected results from BELLE would be a key for the extraction of the quark transversity from the experimental observables in other experiments. Generalized parton distribution (GPD) has been proposed to unify the standard quark distribution functions and the nucleon form factors. It was also pointed that the 2nd moment of GPDs is related with orbital angular moment of the parton and can be extracted from hard exclusive productions, such as deeply virtual compton scattering (DVCS). The measurements of hard exclusive photon or meson productions have been performed at HERMES and JLab.

Recent experimental progress on these topics and its interpretation are presented.