

QCD mechanisms for accessing the nucleon GPDs with the exclusive pion-induced Drell-Yan process

$$\pi^- p \rightarrow \ell^+ \ell^- n$$

Thursday, 22 March 2018 09:25 (25 minutes)

The nucleon generalized parton distributions (GPDs) are accessed by deeply virtual Compton scattering and deeply virtual meson production with lepton beam. A complementary probe with hadron beam is the exclusive pion-induced Drell-Yan process, $\pi^- p \rightarrow \ell^+ \ell^- n$, allowing us to access the GPDs at large timelike virtuality [1]. Recent calculations on this process in terms of QCD factorization as the partonic subprocess convoluted with the nucleon GPDs and the pion distribution amplitudes [2,3] have demonstrated the feasibility of its measurement via a spectrometer at the High Momentum Beamline being constructed at J-PARC [3]. At the same time, however, the possibilities of the corrections due to “soft mechanisms” beyond the QCD factorization framework are pointed out [2,4]: those mechanisms could be caused by the treatment of the pion pole contribution arising in the relevant GPDs in the ERBL region, the parton transverse momentum to regularize the endpoint singularities, the so-called soft-overlap mechanism, etc. We discuss a new estimate of the soft mechanisms, which allows us to express the corresponding soft exclusive amplitude in terms of the relevant GPDs, making use of dispersion relations and quark-hadron duality. As a result, we show [4] that, at the J-PARC kinematics, the soft mechanisms could give the several times larger cross sections than the corresponding cross sections calculated by the QCD factorization. We also discuss the possible roles of the similar soft mechanisms in the complementary space-like process, i.e., the deeply virtual pion production in the lepton-proton scattering.

This talk is based on my publication [3] in collaboration with several theorists and experimentalists, and on my recent new results [4].

References:

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- [4] K. Tanaka, arXiv:1709.01063 [hep-ph]] and in preparation.

Primary author: TANAKA, Kazuhiro

Presenter: TANAKA, Kazuhiro