Light-antiquark flavor asymmetry in polarized distributions

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ABSTRACT

Flavor asymmetry of polarized antiquark distributions is investigated. Because of extensive studies of $\bar{u}/\bar{d}$ asymmetry in the last ten years, the unpolarized flavor asymmetry is now well established [1]. However, little is known for the polarized flavor asymmetry. In light of upcoming experimental measurements by W production and semi-inclusive processes, it is necessary to clarify the theoretical situation before the experimental measurements. First, there is a perturbative QCD contribution; however, it is not a large effect in the region Q^2 >1 GeV^2. Therefore, a nonperturbative mechanism is expected to dominate the $\Delta\bar{u} - \Delta\bar{d}$ distribution in the similar way to the unpolarized case. There are some theoretical predictions based on meson-cloud, chiral-soliton, and Pauli-exclusion models. We try to investigate further details of the ρ-cloud studies in Ref. [2] by noting new g_2^ρ-type effects [3].

In the meson-cloud model, the proton splits into a meson and a baryon, then the meson interacts with the virtual photon. For the polarized distributions, a contribution comes from the spin-one ρ meson. The $\Delta\bar{u} - \Delta\bar{d}$ distribution is expressed in terms of ρ momentum distributions in the proton and the polarized valence-quark distribution in ρ. We include ρNN and $\rho N\Delta$ splitting processes in the calculation by keeping $1/Q^2$ terms. As a result, we find that $\rho N\Delta$ process terms are small in comparison with the ρNN terms. The g_2^ρ-type contributions become significant in the medium-x region. Numerical estimates indicate that the ρ meson contributes $\Delta\bar{d}$ excess over $\Delta\bar{u}$.

Because the transversity flavor asymmetry cannot be found in the W production unlike the longitudinally-polarized one, the polarized proton-deuteron Drell-Yan process could be a promising way to find it [4]. We hope that the polarized pd Drell-Yan is realized experimentally.

References

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