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Transverse single-spin asymmetry with a $\sin\phi_{S_h}$ modulation for proton and lambda production in SIDIS at subleading twist

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We investigate the transverse single-spin asymmetry with a $\sin\phi_{S_h}$ modulation for the transversely polarized proton and lambda production in semi-inclusive inelastic scattering process, where ϕ_{S_h} is the azimuthal angle of the transverse spin of the final hadron. Theoretically, the spin asymmetry can be interpreted by the convolution of the twist-3 transverse momentum dependent distributions and twist-2 fragmentation functions. In this work, three different origins in terms of the hH_1 term, the $f^\perp D_{1T}^\perp$ term and the $g^\perp G_{1T}$ term are taken into account simultaneously for this asymmetry.

We calculate the twist-3 quark transverse momentum dependent distributions h, $f^\perp$ and $g^\perp$ by using the quark spectator diquark model, and we investigate the role of the fragmentation functions H_1, $D_{1T}^\perp$ and G_{1T} in the $\sin\phi_{S_h}$ asymmetry as well. We also predict the numerical results of the asymmetries for the proton and the lambda production at JLab with a 12 GeV beam and at COMPASS with a 160 GeV beam, separately. From the comparison of the different sources for the asymmetry, we find that, the distribution h and the fragmentation function H_1 give the dominant contribution to the $\sin\phi_{S_h}$ asymmetry for proton production, while the distribution $f^\perp$ might be probed by the convolution with $D_{1T}^\perp$ in the lambda production at JLab 12 GeV.

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