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Longitudinal and transverse polarizations of Λ hyperons in unpolarized SIDIS and e^+e^- annihilations

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We make a systemic study on the longitudinal polarization and two transverse polarizations of the Λ hyperons produced in unpolarized SIDIS and e^+e^- annihilation.

Recently, Belle collaboration measured the transverse polarization (P_N) of Λ hyperons in e^+e^- annihilation [1], which inspired three parameterizations of the $D_{1T}^{\perp}(z, p_T)$ fragmentation function [2-3] so far. Unlike the other two (DMZ and CKT parameterizations) [2], for the first time, our work (CLPSW parameterization) shows that the Belle data does not endorse isospin symmetry violation [3]. The future EIC experiment has the ability to change the target nucleons/nuclei. It can eventually test the isospin symmetry of the polarized fragmentation functions. We make predictions for the transverse polarization (P_N) of Λ with all three parameterizations in ep and eA scatterings. We obtain almost no nuclear modification effect with the isospin symmetric CLPSW parameterization at large-x. However, there is a distinct difference between the results for ep and eA scatterings in the isospin-symmetry-violating DMZ and CKT parameterizations. Therefore, the future EIC experiment can help distinguish different parameterization scenarios and ultimately solve this dispute.

Furthermore, the transverse polarization of the struck quark can be induced by the Boer-Mulders function from an unpolarized hadron. This transverse polarization will further translate to azimuthal asymmetries and polarizations of final state hyperons through chiral-odd fragmentation functions. Therefore, besides P_N, the Λ hyperons produced in unpolarized SIDIS are also polarized along the longitudinal direction (P_L) and the transverse direction inside the production plane (P_T). These two polarizations are azimuthal angle dependent. They disappear in the whole phase space average over the azimuthal angle. We present how to measure these polarizations in the future EIC and the current Belle experiments. We demonstrate their relations with the corresponding structure functions and the leading twist fragmentation functions [4].

Our study bridges the experimental observables to the polarized fragmentation functions. The future measurement at EIC and Belle can significantly improve our understanding of the hadronization mechanism.

References

[1] Belle Collaboration, Phys. Rev. Lett. 122 (2019), 042001 [arXiv:1808.05000].
[2] U. D'Alesio, F. Murgia and M. Zaccheddu, Phys. Rev. D 102 (2020), 054001 [arXiv:2003.01128]; D. Callos, Z.B. Kang and J. Terry, Phys. Rev. D 102 (2020), 096007 [arXiv:2003.04828].
[3] K.B. Chen, Z.T. Liang, Y.L. Pan, Y.K. Song and S.Y. Wei, Phys. Lett. B 816 (2021), 136217 [arXiv:2102.00658].
[4] K.B. Chen, Z.T. Liang, Y.K. Song and S.Y. Wei, arXiv:2108.07740.

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