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Twist3 mechanism to hyperon polarization in unpolarized proton-proton collision

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We study the transverse polarization of hyperons produced in the high-energy unpolarized proton-proton collision in the framework of the collinear factorization. To understand this phenomenon is one of the big challenges in high-energy hadron physics because it can't occur in the conventional framework for high-energy inclusive reactions: parton model and perturbative QCD. However, using the collinear factorization, it has been known that this phenomenon is caused as a twist3 effect which reflects quark-gluon correlations in hadrons. These effects can be classified into two types of contributions: the twist-3 distribution function in the unpolarized nucleon and the twist3 fragmentation function for the hyperon. In this work, we focus on the former contribution and derive the complete LO cross-section. The cross-section is obtained from two types of pole contributions, the soft-fermion-pole and the soft-gluon-pole which arise from internal propagators in the hard part.
For the soft-gluon-pole term, we develop the "Master formula"which simplify the procedure of the calculation and show explicitly that only the derivative term contributes. Moreover, we calculate the soft-fermion-pole contribution for the first time and show that it vanishes. These results provide a useful tool to explain the mechanism of the hyperon polarization.

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