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## TMDs for spin-1 hadrons

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We explain possible transverse-momentum-dependent parton distribution functions (TMDs) for spin-1 hadrons up to twist 4 by decomposing a quark correlation function with the conditions of the Hermiticity and parity invariance [1]. In the TMDs, there exist time-reversal-odd functions in addition to the time-reversal-even ones. We showed that 40 TMDs exist in the tensor-polarized spin-1 hadron in the twist 2, 3, and 4. In particular, we found 30 new structure functions in the twist 3 and 4 in our work. Since time-reversal-odd terms of the collinear correlation function should vanish after integrals over the partonic transverse momentum, we obtain new sum rules for the time-reversal-odd structure functions,  $\int d^2 k_T g_{LT} = \int d^2 k_T h_{LL} = \int d^2 k_T h_{3LL} = 0$ . In addition, we indicated that new transverse-momentum-dependent fragmentation functions exist in tensor-polarized spin-1 hadrons. The tensor structure functions may not be easily measured in experiments. However, high-intensity facility such as the Thomas Jefferson National Accelerator Facility (JLab), the Fermilab Main Injector, and future accelerators like electron-ion collider (EIC) may probe such observables. In addition, since the Nuclotron-based Ion Collider fAcility (NICA) focuses on spin-1 deuteron structure functions, there is a possibility to study the details of polarized structure functions of the deuteron at this facility.

[1] S. Kumano and Qin-Tao Song, Phys. Rev. D 103 (2021) 014025.

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