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Investigating high-p_T azimuthal anisotropies in small systems using T-odd parton distribution functions

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Experimental observations have measured finite azimuthal anisotropies in small systems produced in pp and pA collisions, even at large pT which may imply the formation of a Quark-Gluon Plasma. In heavy-ion collisions, high-pT azimuthal anisotropies are understood to be generated by the path-length dependent energy loss. However, in small systems, even if a QGP is formed, the medium is so small and short lived that jet-medium interactions are negligible, and no medium modification of the spectrum has been observed.
We present an explanation for the high-pT azimuthal anisotropies, without any nuclear modification of the angle integrated high-pT spectra, using transverse momentum dependent parton distribution functions and fragmentation functions [1]. The presence of transverse momentum allows for the inclusion of T-odd processes with transversely polarized quarks or linearly polarized gluons from unpolarized protons, known as the Boer-Mulders' effect. Due to the correlation between the spin or polarization of partons and their transverse momentum, relative to the proton, large azimuthal anisotropies are generated in the final state. These correlations can simultaneously explain the small azimuthal anisotropies at high-pT in pp collisions and the somewhat larger anisotropies in pA collisions, where, due to initial state effects, the intrinsic transverse momentum of the partons is enhanced by a factor of $A^{1/3}$.
[1] I. Soudi, A. Majumder, arXiv: 2308.14702, 2404.05287

Category

Theory

Collaboration

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