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Novel ways for accessing the spatial structure of polarized light ions

We present new opportunities to explore the structure of light nuclei leveraging the ability of future facilities to perform collisions with polarized deuterons and other light ions. First, we study diffractive vector meson production at small-x in the collision of electrons and polarized deuterons as anticipated at the Electron Ion Collider. We consider the polarization dependence of the nuclear wave function of the deuteron, which results in an azimuthal angular dependence of the produced vector meson when the deuteron is transversely polarized. The Fourier coefficients extracted from the azimuthal angular dependence of the vector meson differential cross-section exhibit notable differences between longitudinally and transversely polarized deuterons. The angular dependence of the extracted effective deuteron radius provides direct insight into the structure of the polarized deuteron wave function at small-x. We further study anisotropic flow with respect to the polarization axis in Pb+d collisions which will be possible at SMOGII at the LHC. This measurement is sensitive to the spatial structure of the deuteron via the conversion of initial geometry to observable momentum distributions by final state effects. Both measurements will provide new independent insight into the spatial structure of polarized deuterons. The same methods can be applied to other light ions, such as ^{3}He, ^{7}Li, or ^{7,9}Be.

Ref: H. Mäntysaari, F. Salazar, B. Schenke, C. Shen, W. Zhao, Phys.Lett.B 858 (2024) 139053, arXiv:2408.13213 [nucl-th]

Category

Theory

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