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Proton structure fluctuations: constraints from incoherent diffraction and applications to pA collisions

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Exclusive vector meson production can be used to directly probe the gluon density of a hadron. Measuring the cross section differentially in momentum transfer t makes it possible to determine the transverse density profile (via coherent diffraction) and density fluctuations (incoherent diffraction) of the target hadron. This knowledge on the geometric fluctuations of the proton is particularly important for understanding collective phenomena observed in proton-nucleus collisions.

We calculate coherent and incoherent diffractive vector meson production in photon-proton scattering. The dipole model used in the calculation is constrained by the proton structure function data. We demonstrate that incoherent gamma-p scattering is sensitive to sub-nucleon scale fluctuations. We also show that the effect of geometric fluctuations can be disentangled from saturation scale fluctuations.

The fluctuating proton, constrained by the HERA data, is then used as an input to calculations of proton-nucleus collisions. In particular, we use relativistic hydrodynamics to calculate azimuthal anisotropy coefficients and show that they are sensitive to initial state geometric fluctuations.

References:
H. Mäntysaari, B. Schenke, arXiv:1603.04349, to be published in PRL
H. Mäntysaari, B. Schenke, arXiv:1607.01711

Summary

Presentation type

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