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Imprints of proton structure fluctuations in pA and AA collisions

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One of the striking results from the LHC has been the observation of collective behavior in high-multiplicity proton-proton and proton-nucleus collisions. The characteristic features of multi-particle correlation measurements are similar to those previously observed in collisions of heavy nuclei, and have been interpreted as a result of the hydrodynamic evolution of the produced QCD matter.

In order to study the applicability of the hydrodynamical description in these smaller systems, it becomes crucial to have a good control of the fluctuations of the proton wave function which drives the initial state geometry in pA and pp collisions. This input we obtain by studying the HERA diffractive vector meson production data, that can be used to determine both the average shape and the amount of shape fluctuations in the proton.

We use the constrained fluctuating proton shape in hydrodynamical simulations of proton-nucleus collisions at LHC energies. We find that while pure color charge fluctuations do not give large enough initial state eccentricities to describe the large observed flow harmonics, the simulations using fluctuating proton shapes are compatible with the LHC data. In particular, we find a good description of the mean transverse momentum and the elliptic and triangular flow down to multiplicities ˜2 times the mean multiplicity. The description of the HBT radii is also found to be reasonable.

We also study the effect of subnucleon scale fluctuations in ultraperipheral heavy ion collisions, which are basically just photon-nucleus collisions. We find that the inclusion of the proton and neutron shape fluctuations clearly changes the transverse momentum spectrum of the diffractively produced J/Psi mesons in incoherent events. This happens at a scale realted to the size scale of the sub-nucleoninc fluctuations and should be observable at the LHC. We present predictions for the LHC Run-2 measurements at 5 TeV, and show that the previously measured incoherent/coherent cross section ratio at 2.76 TeV prefers the inclusion of the nucleon shape fluctuations that significantly increase the incoherent cross section. Finally, we discuss how to obtain the energy (Bjorken-x) dependence of the proton shape by solving the JIMWLK equation with an initial condition compatible with the HERA DIS measurements.

References:

H. M, B. Schenke, Phys. Rev. D94, 2016, 034042, arXiv:1607.01711

H. M, B. Schenke, Phys. Rev. Lett. 117, 2016, arXiv:1603.04349

H. M., B. Schenke, C. Shen, P. Tribedy, arXiv: 1705.03177

H. M., B. Schenke, arXiv: 1703.09256

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