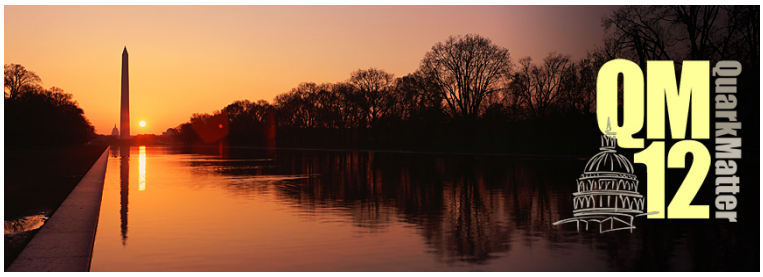

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Dijet Correlations in the Forward pA (eA) Collisions to Map the Phase Structure of Cold Nuclei Matter at Small-x

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As the foundation of high energy hadronic physics, QCD factorization enables us to separate the short distance perturbative physics from the long distance non-perturbative effects. Its prediction power relies on the universality of the parton distributions among different processes. In our recent publication [1], we established an effective factorization in hard processes in nuclei scattered by a dilute probe. This factorization enables us to identify the key observables to probe the so-called unintegrated gluon distributions, the central objects in the saturation framework. This has been a long-standing issue in small-x physics. From our studies, we found that the dijet-correlations in deep inelastic scattering of electron-nucleus collisions directly measure the Weizacker-Williams gluon distribution function, whereas the photon-jet correlation in nucleon-nucleus (pA) collisions probes the dipole gluon distribution. The dijet (di-hadron) correlations in pA collisions can probe both gluon distributions. Current experiments in deuteron-gold (dAu) collisions at RHIC, and future pA collisions at LHC, and the planed electron-ion collider (EIC) experiments, will provide great opportunities to study two-particle collisions and the associated strong interaction dynamics of the gluon distributions in cold nucleus at small-x.

Recently, both STAR and PHENIX collaborations have reported the measurements of two-hadron correlations in the forward direction of dAu collisions at RHIC [2], where the strong de-correlation of the away-side hadron have been considered as the best evidence for saturation physics. The numeric calculations based on our factorization formalism provides a quantitative and thorough description of the experimental data in the saturation formalism [3], including the large broadening of the angular distribution and suppression of the peak for the away-side hadron. The disappearing of the away-side peak in central collisions indicates that the saturation scale is the same order as the hard jet transverse momentum, which is a clear signal of the onset of the saturation. From the kinematics, we conclude that the saturation scale reaches 2GeV at x˜6x10-4 in the center of the gold nucleus with jet transverse momentum kt˜3GeV at rapidity 3.2. Future measurements at RHIC and LHC and the planed EIC will provide more information and help to map out the complete phase structure of the cold nuclei matter at small-x.

[1] F. Dominguez, B. Xiao and F. Yuan, kt-factorization for Hard Processes in Nuclei, Phys. Rev. Lett. 106, 022301 (2011); F. Dominguez, C. Marquet, B.W. Xiao and F. Yuan,
Universality of Unintegrated Gluon Distributions at small x, Phys. Rev. D83, 105005 (2011).
[2] E. Braidot, for the STAR Collaboration, Two Particle Correlations at Forward Rapidity in STAR, Nucl. Phys. A 854, 168 (2011); A. Adare, et al., [PHENIX Collaboration], Suppression of back-to-back hadron pairs at forward rapidity in d+Au Collisions at \sqrt{s}_{NN}=200GeV, Phys. Rev. Lett. 107, 172301 (2011).
[3] A. Stasto, B. Xiao, F. Yuan, Back-to-Back Correlations of Di-hadrons in dAu Collisions at RHIC, e-Print: arXiv:1109.1817 [hep-ph].

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