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Multi-particle correlations and collectivity in pA collisions from an initial state parton model

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We report on recent progress in understanding multi-particle correlations in pA collisions from the initial state. We consider a proof of principle model of eikonal quarks from the projectile proton multiple-scattering off of a dense nuclear target. With this model, we find that many of the features observed in light-heavy ion collisions at RHIC and the LHC which are often ascribed to collectivity can be qualitatively reproduced in an initial state model. These include the ordering of the two-particle azimuthal angle n-th Fourier harmonics, $v_n\{2\}$; a negative four-particle second Fourier cumulant $c_2\{4\}$, giving rise to a real $v_2\{4\}$; the energy and transverse momentum dependence of $v_2\{4\}$; the similarity in multi-particle second Fourier harmonics $v_2\{4\} \approx v_2\{6\} \approx v_2\{8\}$; and the energy dependence of the four-particle symmetric cumulants. Finally, we consider the Glasma graph approximation of our model and find that many of these features cannot be reproduced, leading to the conclusion that multiple-scattering is a key ingredient for the observed multi-particle correlations from the initial state.

[1] K. Dusling, M. Mace, R. Venugopalan. Multiparticle collectivity from initial state correlations in high energy proton-nucleus collisions. arXiv:1705.00745 [hep-ph]
[2] K. Dusling, M. Mace, R. Venugopalan. Parton model description of multiparticle azimuthal correlations in pA collisions. arXiv:1706.06260 [hep-ph]

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Primary author: MACE, Mark (Stony Brook University)

Co-authors: DUSLING, Kevin (Physical Review Letters); VENUGOPALAN, Raju (Brookhaven National Laboratory)

Presenter: MACE, Mark (Stony Brook University)

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