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Revealing light nuclei structure through collectivity with modern ab initio calculations in high-energy ^{16}O+^{16}O collisions

Understanding the many-body properties of ground-state light nuclear shape, is a key question to further study initial conditions and collectivity in high-energy small system collisions at RHIC and the LHC. In this talk, we interface insights from ab initio nuclear structure calculations of ^{16}O geometry with simulations of high-energy ^{16}O+^{16}O collisions. Bulk observables, such as the elliptic flow, mean transverse momentum fluctuations, and flow decorrelations, exhibit strong sensitivity to the nuclear model input, responding to realistic nucleon clustering and short-range repulsive correlations [1,2]. This approach provides a new avenue to probe these nuclear features experimentally, further constraining initial conditions in small-system collisions and enhancing connections to effective field theories of nuclei rooted in quantum chromodynamics.
[1] Ab-initio nucleon-nucleon correlations and their impact on high energy ^{16}O+^{16}O collisions, https://arxiv.org/abs/2404.08385
[2] Revealing the longitudinal structure of QGP through modern ab initio calculations in high-energy ^{16}O+^{16}O collisions, In preparation.

Category

Theory

Collaboration (if applicable)

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