Probing initial geometry through collectivity in d+Au and O+O collisions at STAR

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Collisions involving small systems with varying geometries can provide critical insights into the initial conditions of the medium produced in these collisions. The initial state conditions, influenced by structural effects such as the many-body properties of light nuclear shapes, also leave a distinct footprint in the correlations among final-state particles. In this talk, we present preliminary measurements of flow harmonics (v_2 and v_3) obtained from multi-particle correlations in d+^{197}Au, ^{3}He+^{197}Au, and ^{16}O+^{16}O collisions at $\sqrt{s_{NN}}$ = 200 GeV, based on newly collected data from STAR. These measurements are compared to hydrodynamics with the state-of-the-art *ab initio* calculations, illustrating the features of initial geometry, sub-nucleon fluctuations, and nucleonic clustering features. These findings highlight a deeper understanding of initial conditions and collectivity in small system collisions.