Constraining the small system collectivity using d+Au and O+O collisions at $\sqrt{s_{\rm NN}}$ = 200 GeV from STAR

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The understanding of collectivity in small collision systems must address three key issues related to the initial conditions: (1) the role of nucleon and sub-nucleon fluctuations, (2) nucleon forces and emergent correlations in light ions, such as alpha clustering, and (3) the influence of longitudinal fluctuations and their impact on flow decorrelations. We present two- and four-particle cumulants of v_2 and v_3 based on new d+Au and O+O datasets collected in the year 2021 with extended forward and midrapidity acceptance of STAR. Notably, we observe a significant enhancement in both $v_2\{2\}$ and $v_2\{4\}$ in d+Au collisions compared to O+O collisions, in the highest-multiplicity events, suggesting markedly different ellipticities in these two systems. Comparisons with model calculations reveal a clear influence of sub-nucleon fluctuations and nuclear structure effects. The v_n measurements are performed using two-particle correlations in rapidity ranges $|\eta| < 1.5$ and $2.1 < |\eta| < 5.1$. The role of flow decorrelations with rapidity is investigated and the findings are compared to previous RHIC measurements and model predictions. These new findings greatly expand our understanding of small system collectivity.