Measurements of azimuthal anisotropies in ^{16}O+^{16}O and γ+Au collisions from STAR

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Collectivity in small systems is a crucial area of study in high-energy nuclear physics, as it provides valuable insights into initial conditions and pre-equilibrium stages in heavy-ion collisions. The small system collision scan at RHIC, including both symmetric and asymmetric small systems (O+O > ^{3}He+Au > d+Au > p+Au > γ+Au), provides a better understanding of how collectivity emerges and evolves with system size.

We analyze a large sample of minimum bias and central triggered ^{16}O+^{16}O collisions at $\sqrt{s_{NN}}$ = 200 GeV and inclusive γ+Au processes (center-of-mass energy around 40 GeV) by triggering ultra-peripheral events in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV. Using two- and four-particle correlation methods, we present the first measurements of azimuthal anisotropies, v_2 and v_3, in ^{16}O+^{16}O and γ+Au collisions as a function of p_{T} and multiplicity. We compare our measurements with STAR measurements of v_n in $p/d/^3$He+Au collisions and hydrodynamic model calculations.

New v_n measurements in ^{16}O+^{16}O collisions provide insight into the impact of system symmetry on initial condition and pre-equilibrium dynamics, compared to the previously studied asymmetric systems $p/d/^3$He+Au. We also investigate the ratio $v_2\{4\}/v_2\{2\}$ and correlations between v_n and mean p_{T} as a function of multiplicity, which are sensitive to initial momentum anisotropy, subnucleon fluctuations, and clustering in the ^{16}O nucleus. In addition, v_n measurements in γ+Au processes play an important role in understanding the origin of collectivity and lay the foundation for searching for many-body systems exhibiting collective behavior in photon-induced processes at the EIC.