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Sensitivity of Multi-Particle Azimuthal Correlations and Rapidity-Even Dipolar flow to α-Clustering in $^{16}\mathrm{O} + {}^{16}\mathrm{O}$ Collisions at $\sqrt{s_{NN}} = 200$ GeV

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We examine symmetric and asymmetric cumulants as well as rapidity-even dipolar flow in ^{16}O+^{16}O collisions at $\sqrt{s_{NN}} = 200$ GeV to explore α-clustering phenomena in light nuclei within the viscous relativistic hydrodynamics framework. Imprints of α-clustering manifest in the anisotropic flow coefficients and their correlations—particularly in observables involving elliptic-triangular flow correlations. Our results indicate that the final-state symmetric and asymmetric cumulants—especially $\mathrm{NSC}(2,3)$ and $\mathrm{NAC}_{2,1}(2,3)$—are sensitive to the initial nuclear geometry. Moreover, our results reveal a significant difference in rapidity-even dipolar flow, v_1^{even}, between α-clustered and Woods–Saxon configurations in high-multiplicity events. These results highlight the crucial influence of nuclear structure on heavy-ion collision dynamics and offer observables to differentiate nuclear geometries, especially in ultra-central collisions.

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