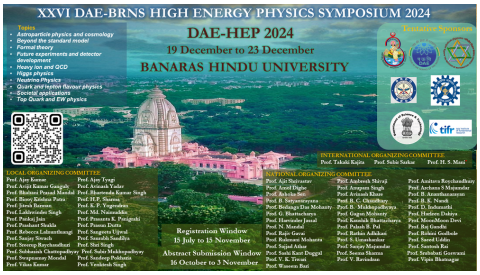

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Effect of α-clustering on photon flow in O+O collisions at 7 TeV

In relativistic nuclear collisions, spatial anisotropies characterized by initial eccentricity, triangularity, and higher-order eccentricities arise from the geometry of the collision and fluctuations in the initial energy density distribution. These spatial anisotropies subsequently manifest as momentum anisotropies in the final-state particles through the collective expansion of the hot and dense medium produced in such collisions. The presence of cluster structures in light nuclei, such as 7Be, 9Be, 12C, and 16O, induces nuclear deformities, leading to significant spatial anisotropies in the overlap region when collided at relativistic energies.

Recent studies have explored the potential to investigate α-cluster structures in light nuclei by examining final state observables in relativistic nuclear collisions. A recent proposal for dedicated 16O-16O collision runs at 7 TeV at the LHC offers the opportunity for experimental verification of cluster structures at such energies. Moreover, the system size of 16O-16O collisions is comparable to high-multiplicity proton-proton (pp) and peripheral lead-lead (Pb-Pb) collisions, providing a unique opportunity to investigate the origins of collective behavior in small collision systems.

In this work, we investigate the initial state produced in collisions of α-clustered oxygen nuclei at 7 TeV assuming tetrahedral structures. We use GLISSANDO initial conditions and study the resulting flow observables for photons within the framework of the MUSIC hydrodynamics model and state-of-the-art rate of photon production. Our study compares these results with those from unclustered 16O-16O collisions, revealing significant qualitative and quantitative differences in photon observables between the two cases.

We demonstrate that photon observables in 16O-16O collisions can serve as a valuable probe for investigating the nucleon-level geometry as well as the initial state produced in relativistic nuclear collisions.

Field of contribution

Phenomenology

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