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Exploring the effects of α-clustered structure of ^{16}O nuclei in anisotropic flow fluctuations in ^{16}O-^{16}O collisions at the LHC within a CGC+Hydro framework

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Azimuthal anisotropy quantified as anisotropic flow coefficients are important observables that can provide key information about the collectivity of the system formed during heavy-ion collisions. The anisotropic flow coefficients are sensitive to both the geometrical configuration of the collision overlap region and the transport properties of the medium. Recently, hints of collectivity in small collision systems like pp and p-Pb have been reported, which are traditionally used for baseline measurements to study the quark-gluon plasma (QGP) signatures and cold nuclear matter effects in heavy-ion collisions. This makes O-O and p-O collisions interesting, as they bridge the multiplicity gap between pp, p-Pb, and Pb-Pb collisions and can provide pivotal information about the observed QGP signatures in small systems. In addition, ^{16}O is a doubly magic nucleus and possesses α-cluster nuclear configuration, where one can imagine four α-particles arranging themselves at the corners of a randomly rotated regular tetrahedron.

In this contribution, we shall present the effect of the presence of the α-cluster nuclear configuration of ^{16}O on elliptic flow (v_2), triangular flow (v_3) and elliptic flow fluctuations in O-O collisions at $\sqrt{s_{\rm NN}} = 7$ TeV using a hybrid CGC+hydro model based on IPGlasma+MUSIC+iSS+UrQMD framework. The results of α-cluster nuclear configuration of ^{16}O are also compared with the Woods-Saxon nuclear profile. The results show an enhanced value of v_2 and v_3 in the highest multiplicity regions for the α-cluster case as compared to the Woods-Saxon profile. Further, a strong increase in the value of v_3/v_2 is observed when going from the top 10-20% to the top 0-10% multiplicity class for the case with α-clusters. Additionally, we find that the elliptic flow fluctuations show opposite trends with a decrease in final state multiplicity for α-cluster and Woods-Saxon nuclear density profiles. We conclude that the observables related to fluctuations are more sensitive and suited to study the effects of the α-clustered geometry in O-O collisions.

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