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A global analysis of the shapes of Xe-129 and Pb-208 at the Large Hadron Collider

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The six-hour Xe-129 run at the LHC has produced a remarkable wealth of physics, among which several studies of its nuclear shape. Previous works indicate that the elliptic flow ratio with Pb-208 collisions determines the quadrupole deformation (β_2) of Xe, while the ρ_2 elliptic flow-mean p_T correlator informs us about the so-called triaxiality (γ). In this work, we go one step further and perform a global Bayesian analysis of Xe-Xe and Pb-Pb data at the LHC varying simultaneously the shapes of Xe, Pb and relevant Trajectum model parameters. This allows us to systematically assess the sensitivity of observables or ratio of observables to the shape of both Pb (in particular its neutron skin) and Xe (in particular β_2, its octupole β_3, γ and its skin). Our Bayesian extractions lead to a picture for the ground states of these nuclei that is in remarkable agreement with complementary results using methods in low-energy nuclear structure physics. We comment on implications of the analysis of the shapes of other nuclei via future LHC experiments, with particular focus on isotopes relevant for neutrinoless double beta decay searches.

Category

Theory

Collaboration (if applicable)

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