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New opportunities for nuclear shape imaging in high-energy heavy-ion collisions

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High-energy heavy-ion collisions, a branch of nuclear physics that focus on study of quark-gluon plama (QGP) and nuclear phase diagram, have always assumed an initial condition from the nuclear structure physics, e.g. the Woods-Saxon geometry. Recent progress in hydrodynamic modeling together with the wealth of precision collective flow data, especially from the Isobar collisions, however, allow us to not only perform quantitative extractions of the transport properties of the QGP, but very importantly start to strongly constrain the initial state of the colliding nuclei. In this talk, I will discuss the exciting possibility of imaging the shape of atomic nuclei using precision flow measurements, including the quadruple, triaxial and octupole deformations. I will discuss how the shape information probed by heavy ion collision might be different or complementary to those obtained in the nuclear structure experiments. I will argue how a carefully planned system scan of stable species in the nuclear chart in high-energy nuclear collisions may lead to new direction of research in nuclear physics.

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