Int. Workshop “Shapes and Dynamics of Atomic Nuclei: Contemporary Aspects”
ed. Nikolay Minkov, Heron Press, Sofia 2021

# New opportunities to probe nuclear deformation using high-energy heavy-ion collisions

**Jiangyong Jia**[1,2]

[1]Physics Department, Brookhaven National Laboratory, Upton, NY 11976, USA
[2]Department of Chemistry, Stony Brook University, Stony Brook, NY 11794, USA

## Abstract

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, 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, tri-axial 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 at RHIC and other facilities could open new direction of research in nuclear physics.

## References

[1] STAR Beam Use Request for RUN 2022-2025, Chapter 5.2 https://drupal.star.bnl.gov/STAR/system/files/STAR_Beam_Use_Request_Runs22_25.pdf.

[2] J. Jia, “Shape of atomic nuclei in heavy ion collisions,” [arXiv:2106.08768 [nucl-th]].

[3] J. Jia, S. Huang and C. Zhang, “Constraining nuclear quadrupole deformation from correlation of elliptic flow and transverse momentum in nuclear collisions,” [arXiv:2105.05713 [nucl-th]].

[4] G. Giacalone, J. Jia and C. Zhang, “The impact of nuclear deformation on relativistic heavy-ion collisions: assessing consistency in nuclear physics across energy scales,”, [arXiv:2105.01638 [nucl-th]].

[5] ”Nuclear deformation effects via Au+Au and U+U collisions from STAR Collaboration”, https://indico.cern.ch/event/854124/contributions/4135480/