EPS-HEP 2025

Contribution ID: **635** Type: **Parallel**

Imaging the nuclear structure at the TeV energy scale using reverse engineering

One of the main challenges in nuclear physics is studying the structure of the atomic nucleus. Recently, it has been shown that relativistic nuclear collisions at RHIC and the LHC can complement low-energy experiments. Relativistic nuclear collisions provide a snapshot of the nuclear distribution at the time of collisions, offering a precise probe of the nuclear structure.

In this talk, I present our latest developments in nuclear structure studies using reverse engineering, connecting the multi-particle correlations technique to the nuclear structure at relativistic energies. Specifically, I will demonstrate how to constrain the quadrupole deformation and triaxial structure of ^{129}Xe and showcase new opportunities to discover nuclear shape phase transition in Xe-Xe collisions at the LHC [1]. These can be done using a new multiparticle correlation algorithm that allows us to study genuine multi-particle correlations of the anisotropic flow, v_n, and the mean transverse momentum, $[p_{\mathrm{T}}]$[2]. Furthermore, I will show a unique opportunity to discover the α-clustering structure of ^{16}O in the coming ^{16}O-^{16}O collisions at the LHC, based on the AMPT studies[3,4]. These latest developments have vast potential in the coming data-taking in 2025 at the LHC. They will be a crucial component in spanning the bridge between the fields of low-energy nuclear physics at the MeV energy scale and high-energy heavy-ion physics at the TeV energy scale.

Relevant works:

[1] Phys. Rev. Lett. 133, 192301 (2024);
[2] arXiv: 2504.03044;
[3] arXiv: 2501.14852;
[4] arXiv: 2404.09780.

Secondary track

Author: ZHOU, You (Niels Bohr Institute, University of Copenhagen)

Session Classification: T04

Track Classification: T04 - Ultra-relativistic Nuclear Collisions