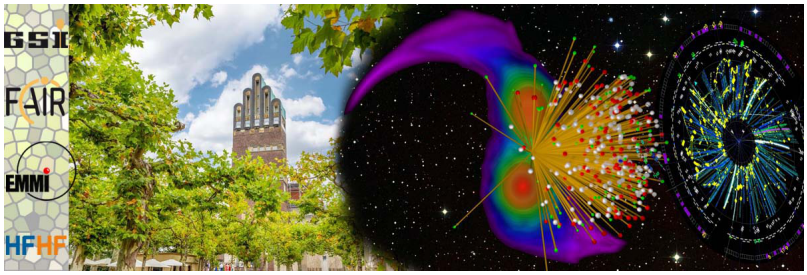

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Impact of the momentum dependence of the neutron and proton potentials on pion production in heavy-ion collisions

Thursday, 21 September 2023 17:10 (20 minutes)

The momentum dependence of the nucleon mean-field potential in a wide momentum range can be an important factor to determine the Δ resonance and pion production in intermediate-energy heavy-ion collisions. In particular, in neutron-rich systems such as 132Sn+124Sn collisions, we need to carefully treat the momentum dependence because the neutron and proton potentials can have different momentum dependence, as characterized at low momenta by effective masses. We rigorously calculate the collision terms of $NN \leftrightarrow N\Delta$ and $\Delta \leftrightarrow N\pi$ processes with the precise conservation of energy and momentum under the presence of momentum-dependent potentials for the initial and final particles of the process. The potentials affect not only the threshold condition for the process but also the cross section in general as a function of the momenta of the initial particles, which is treated in a natural way in our work.

We calculate central 132Sn+124Sn collisions at 270 MeV/nucleon by combining the nucleon dynamics obtained by the antisymmetrized molecular dynamics (AMD) model with a newly developed transport code which we call sJAM. The calculated results clearly show that the momentum dependence of the neutron and proton potentials has a significant impact on the $NN \to N\Delta$ process, and this information is strongly reflected in the charged pion ratio (π^-/π^+). We also investigate the effects of the high-density symmetry energy and the isovector part of the potential of Δ resonances on pion production, which we find are relatively small compared to the effect of the momentum dependence of the neutron and proton potentials.

I will give a presentation based on Ref. [1].

[1] N. Ikeno and A. Ono, arXiv:2307.02395 [nucl-th].

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