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Revealing nucleus properties by exploring ultra-central symmetric heavy-ion collisions with scale-invariant initial states

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Heavy-ion collision experiments are a valuable tool for studying nuclear properties. Accurately modeling entropy production at the initial collision time and subsequent collective evolution is crucial to connect the nuclear structure to heavy-ion measurements. In this talk, we argue that, based on experimental data, it is reasonable to assume scale-invariance at the initial state, meaning the produced entropy scales similarly to the thickness function of the nuclei participants. This implies that the observables receive a small contribution from the entropy production process and more from nuclear properties in ultracentral symmetric heavy-ion collision. With this conclusion, we employ cluster expansion decomposition to study the ellipticity fluctuation and introduce a formula for it. The formula is common for all scale-invariant initial state models and depends on the one-body and two-body density of the colliding nuclei. We show that this result is compatible with initial state models that obey scale invariance, such as TrENTo, with various values for p and initial state models based on CGC. We also explore its implications for studying nuclear properties in the isobar ratio measurements.

Primary author: TAGHAVI, Seyed Farid

Presenter: TAGHAVI, Seyed Farid

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