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Realistic Few-Body Calculations of Wigner Phase-Space Densities for Nuclear Clusters and Hypernuclei

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Nuclear clusters and hypernuclei serve as essential probes of the strong interaction.
The production of clusters and hypernuclei in heavy-ion collisions is an intricate process that involves the formation of few-body bound systems within a dynamic many-body environment. Accurate knowledge of their static properties is essential input for transport approaches, as it directly determines their production in nuclear matter.

In this talk, we will present solutions of the Schrödinger equation with realistic nucleon–nucleon and nucleon–Λ interactions for few-body systems to obtain the wave functions of light nuclear clusters and hypernuclei, including d, t, ^{3}He, $^{3}_{\Lambda}$H, ^{4}He, $^{4}_{\Lambda}$He, $^{4}_{\Lambda}$H, $^{5}_{\Lambda}$He, and $^{5}_{\Lambda\Lambda}$He. The solutions are projected onto hyperspherical harmonic basis states to construct corresponding density matrices and Wigner phase-space distributions. The calculated binding energies and root-mean-square (rms) radii reproduce the available experimental data with high accuracy and also provide reliable predictions for unmeasured systems. The resulting Wigner densities offer a solid foundation for improving coalescence models used to identify clusters formed in relativistic heavy-ion collisions. Finally, we will present results for the production of these nuclear clusters and hypernuclei in heavy-ion collisions based on the obtained Wigner densities.

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