Theory Seminar

October 29, 2024 @ 11 AM

In-person 1200 LAB

Online Zoom ID 967 5086 5323 (48824)

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" Transport model based on inputs from chiral effective field theory"

Heavy ion collisions make it possible to study the properties of nuclear matter at high density. After briefly describing the history of heavy ion collisions, a short review on the determination of the equation of state of nuclear matter from heavy ion collisions will be given. These studied were based on the use of transport models with mean-filed potentials derived from phenomenological energy density functionals and nucleon-nucleon in-medium scattering cross sections fitted to observables measured in these collisions. Because of the recent advance in chiral effective nucleon-nucleon interactions and its successful applications to nuclear structure studies, where only sub-saturation densities are present, it is of great interest to test their predictions of nuclear matter properties at higher densities. As a first step in this direction, the χBUU model was developed in Ref. [1] by using a Skyre-type energy density functional that was constructed from fitting the nuclear equation of state and nucleon effective masses in asymmetric nuclear matter predicted by the two- and three-body chiral interactions. This energy density functional was shown to describe well the binding energies of finite nuclei and their dipole polarizabilities [2]. Work is in progress to replace the phenomenological nucleon-nucleon scattering cross sections used in χBUU with those calculated from chiral effective field theory for nuclear matter at various densities, isospin asymmetries, and temperatures. With such an extended χBUU model, one can then study heavy ion collisions at intermediate energies available at the FRIB without arbitrary parameters, which would provide the test of chiral nuclear interactions at higher densities as well as allow for more stringent constraints on the nuclear equation of state from the experimental data.

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