**Pion production in a transport model based on mean fields from chiral effective theory**

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We have developed a BUU transport model based on the Skχm* interaction [1], which is constructed from fitting the equation of state and nuclear effective masses predicted by the chiral effective theory as well as the binding energies of finite nuclei [2]. This χBUU model is then used to study the effect of energy conservation in the collision (or decay) kinematics due to baryon mean-field potentials on the equilibrium properties of a N-Δ-π system in a box with periodic conditions [3]. We have found that the inclusion of baryon mean-field potentials in the energy conservation is necessary to maintain the equilibrium state of the N-Δ-π system, and neglecting this effect would significantly decrease the number of pion-like particles but only slightly decrease the effective charged pion ratio. We have also used the χBUU transport model to study pion production in central $^{197}$Au + $^{197}$Au collisions at the incident energy of E/A = 400 MeV, which was previously studied by us using the relativistic Vlaso-Uehling-Ulenbeck transport model [4,5]. It is found that the χBUU model can well reproduce the experimental measurement by the FOPI Collaboration [6], thus providing an empirical validation of the behavior of nuclear symmetry energy at high density predicted by the Skχm* energy density functional. We have further predicted the pion kinetic energy dependence of $\pi^-/\pi^+$ ratio (left window of Fig.1) and its double and subtract ratio (right window of Fig.1) as well as the isoscaling pion ratio in central collisions (b = 3 fm) of $^{132}$Sn + $^{124}$Sn and $^{108}$Sn + $^{112}$Sn at the incident energy of E/A = 270 MeV. Comparing our predictions with future experimental data from the ongoing experiments at RIKEN in Japan by the SPiRIT Collaboration [7] will provide further check on the validity of the Skχm* energy density functional at high density.

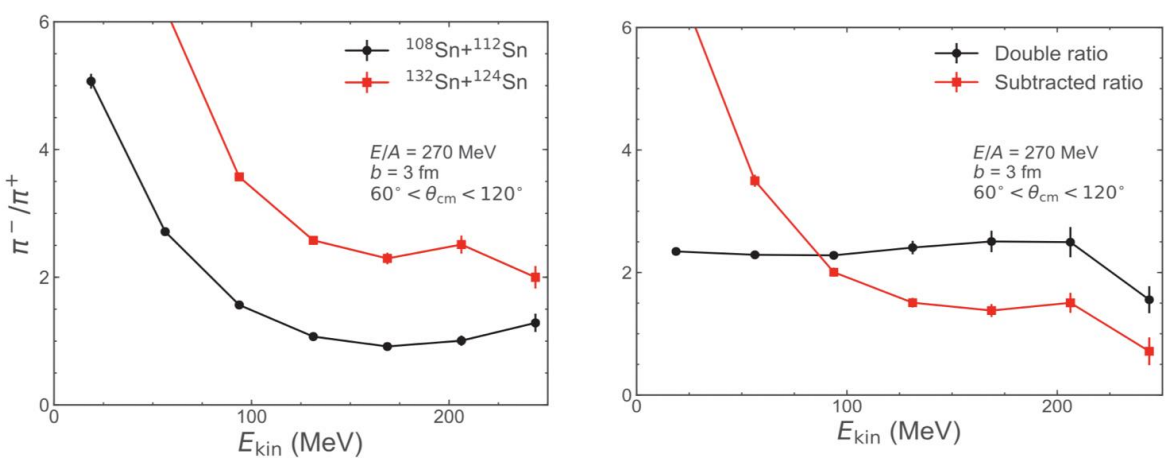


**FIG. 1**. π−/π+ (left window) and its double $[(\pi-/\pi+)^{132+124}/(\pi-/\pi+)^{108+112}]$ and subtracted $[(\pi-/\pi+)^{132+124} - (\pi-/\pi+)^{108+112}]$ ratios as functions of pion kinetic energy from central (b = 3 fm) collisions of $^{132}$Sn + $^{124}$Sn and $^{108}$Sn + $^{112}$Sn at the incident energy of E/A = 270 MeV. The polar angle $\theta_{cm}$ of pion momentum is relative to the incident beam direction.

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