Effects of energy conservation on equilibrium properties of hot asymmetric nuclear matter

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We have employed the relativistic Vlasov-Uheling-Uhlenbeck (RVUU) transport model [1] to study a thermalized nucleon-Delta-pion system in a box with periodic boundary conditions [2]. We have found that with the inclusion of both baryon scalar and vector potentials in the energy conservation condition for particle production or absorption in scattering and decay processes, our results can well reproduce the equilibrium numbers of particles obtained in thermal model calculations, shown by open circles in Fig. 1, which verifies the reliability of the RVUU model. Omitting the vector potentials of baryons in the energy conservation conditions for scattering and decay processes reduces slightly the number of pion-like particles by about 3.3%, but significantly the effective charged pion ratio by about 26.7%. Neglecting also the scalar potential further reduces the pion-like particle number by a factor of about 2 and increases the effective charged pion ratio by about 9%. Our results thus indicate that the correct treatment of the energy conservation condition in scattering and decay processes in transport

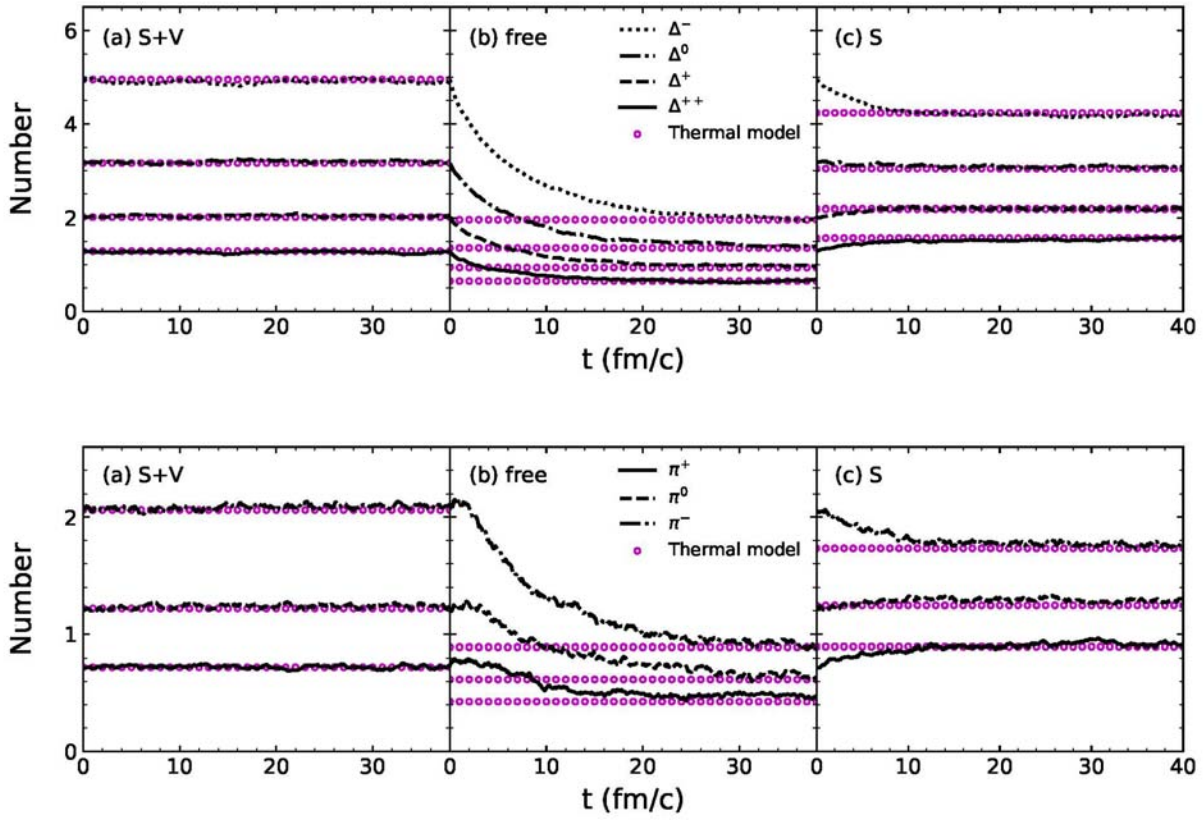

FIG. 1. Time evolutions of Delta (upper window) and pion (lower window) numbers in a box with periodic boundary conditions for the three cases of mean-field potentials. For comparison, the thermal model results are shown as open circles.

models, which have not been included in most transport models, is very important for studying pion production in heavy ion collisions at intermediate energies, particularly for extracting the nuclear symmetry energy at high density from the ratio of charged pions [3].

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