Charged pion production from Au + Au collisions at $\sqrt{s_{NN}}$ = 2.4 GeV in the relativistic Vlasov-Uehling-Uhlenbeck model

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We have used the isospin-dependent Vlasov-Uehling-Uhlenbeck (RVUU) model [1,2], extended from Refs. [3,4], to study the production of charged pions from Au+Au collisions at $\sqrt{s_{NN}}$ = 2.4 GeV [5]. With the medium dependence of the Delta resonance production cross section from the nucleon-nucleon inelastic scattering determined by fitting the total multiplicities of π^- and π^+ measured in the HADES experiment [6], we have obtained a good description of the rapidity distributions of both π^- and π^+ for various centrality bins (Fig.1). For the transverse momentum spectra, the RVUU underpredicts π^- at low transverse momentum p_t, while overpredicts both π^- and π^+ at high p_t region (Fig. 2). We have attributed

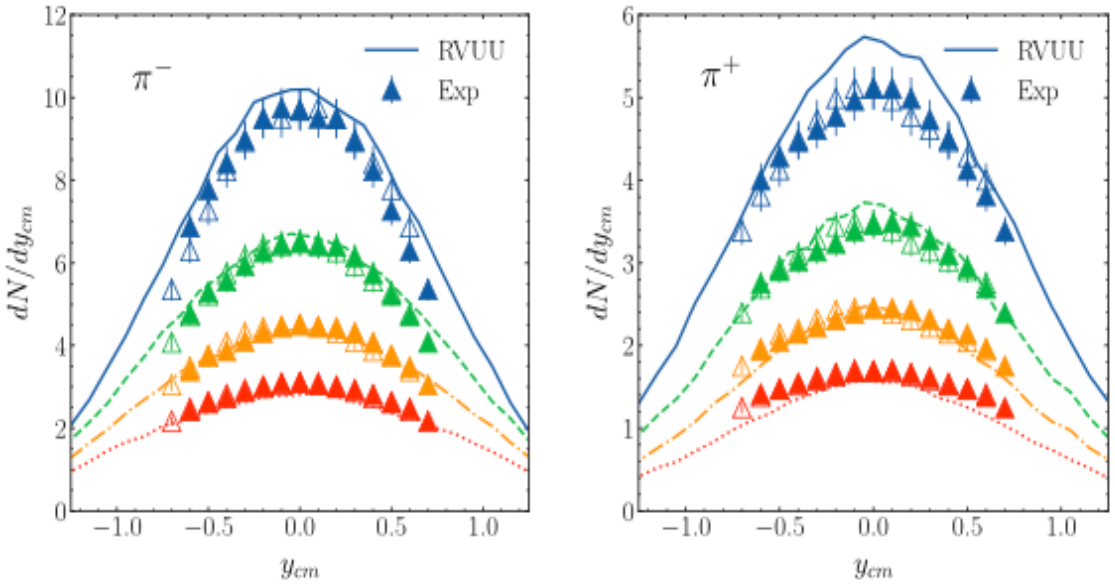

Fig. 1. Rapidity distributions of π^- (left window) and π^+ (right window) from RVUU (lines) and experimental data (triangles) from Ref. [6]. Results are shown across 4 centrality bins: 0% − 10% (blue, solid line), 10% − 20% (green, dashed line), 20% − 30% (orange, dot-dashed line), 30% − 40% (red, dotted line).

this discrepancy to the absence of the pion mean-field potential in the RVUU model. The reasonable success of the RVUU model in describing the HADES pion data is in contrasts to the results from other transport models used by the HADES Collaboration to compare with its data, which all overestimate the π^- and π^+ multiplicities by about a factor of two. The reason for the difference between our results and those from other transport models are mainly due to our introduction of a density-dependent reduction factor to the nucleon-nucleon inelastic cross section, which is absent in other models. To understand the origin of this reduction factor requires further theoretical studies. We have also calculated the proton rapidity distribution

in the most central collisions and found it a factor of 1.23 larger than the coalescence invariant proton rapidity distribution extracted from preliminary HADES data on protons, deuterons tritons, and helium-3 [7], which also requires more theoretical and experimental studies.

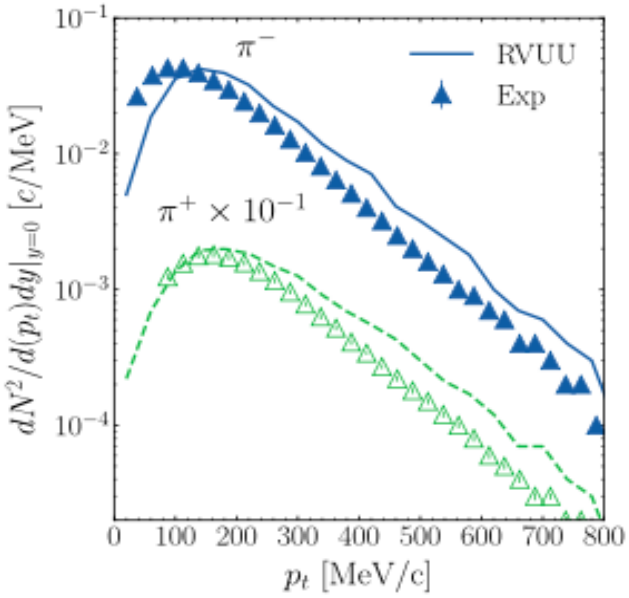

Fig. 2. Charged pion transverse momentum spectrum from RVUU (lines) and experimental data (triangles) from Ref. [35]. Negative pions are represented by filled blue symbols and solid blue line, while positive pions are scaled down by 10^{-1} and are drawn with hollow green symbols and green dashed line. Results are shown for mid-rapidity events for the most central (0% − 10%) class of collisions.

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