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# Pion Spectra and Entropy per Rapidity in Au–Au Collisions at NICA Energies Using HRG with Resonance Decays and Tsallis Distribution

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We investigate the transverse momentum spectra and entropy per unit rapidity of charged pions produced in central Au–Au collisions at $\sqrt{s_{NN}} = 7.7$ and 11.5~GeV, relevant for the NICA energy domain. The low-$p_T$ region is fitted using a Tsallis distribution, while the intermediate-to-high $p_T$ tail is described by a hadron resonance gas (HRG) model incorporating resonance decay contributions. A smooth transition point is chosen to ensure continuity between the two models. The combined fits are employed to extrapolate the measured spectra toward $p_T = 0$ and high $p_T$ regions, enabling a reliable estimation of the entropy density per rapidity. Our analysis shows that the hybrid Tsallis+HRG approach captures the pion spectra across the full $p_T$ range with good precision. The extracted entropy values serve as important thermodynamic observables in the study of strongly interacting matter at high baryon density.

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