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Studying the Dependence of Particle Ratios on Collision Energy in Pb+Pb High-Energy Heavy-Ion Collisions using the Ultra-relativistic Quantum Molecular Dynamics model (UrQMD-3.4).

We investigated the dependence of particle ratios on collision energy in Pb+Pb high-energy heavy-ion collisions using the Ultra-relativistic Quantum Molecular Dynamics model (UrQMD-3.4). This latest model version incorporates charmed particles (e.g., D, J/ψ, X_c), crucial in understanding particle production mechanisms and the chemical freeze-out of hadronic matter. Our simulations focused on central rapidity and an impact parameter of b = 5 fm, covering a broad range of beam energies from E_{lab} = 100 to 1000 AGeV. With parameters set to t = 400 fm/c and 200 events, we analyzed the evolution of meson and baryon ratios, which serve as key indicators for distinguishing between hadronic cascade and hydrodynamical models, including scenarios involving a Quark-Gluon Plasma (QGP) phase transition. The results provide insights into the dynamics of particle production and the approach to thermal equilibrium as collision energy varies. Our findings enhance the understanding of phase transitions in hadronic matter under extreme conditions, offering a deeper perspective on the underlying physics of high-energy heavy-ion collisions.

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