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Evidence for chiral symmetry restoration in heavy-ion collisions

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We study the effect of the chiral symmetry restoration (CSR) on heavy-ion collisions observables in the energy range $\sqrt{s_{NN}}$=3−20\,GeV within the Parton-Hadron-String Dynamics (PHSD) transport approach. The PHSD includes the deconfinement phase transition as well as essential aspects of CSR in the dense and hot hadronic medium, which are incorporated in the Schwinger mechanism for particle production. Our systematic studies show that chiral symmetry restoration plays a crucial role in the description of heavy-ion collisions at $\sqrt{s_{NN}}$=3−20\,GeV, realizing an increase of the hadronic particle production in the strangeness sector with respect to the non-strange one. We identify particle abundances and rapidity spectra to be suitable probes in order to extract information about CSR, while transverse mass spectra are less sensitive. Our results provide a microscopic explanation for the "horn" structure in the excitation function of the K^+/π^+ ratio: the CSR in the hadronic phase produces the steep increase of this particle ratio up to $\sqrt{s_{NN}} \approx 7$ GeV, while the drop at higher energies is associated to the appearance of a deconfined partonic medium. Furthermore, the appearance/disappearance of the 'horn' structure is investigated as a function of the system size and collision centrality. We additionally present an analysis of strangeness production in the (T, μ_B)-plane (as extracted from the PHSD for central Au+Au collisions) and discuss the perspectives to identify a possible critical point in the phase diagram.

Preferred Track

Baryon-Rich QCD Matter and Astrophysics

Collaboration

Not applicable

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