

Dilepton production in heavy-ion collisions within the parton hadron string dynamics (PHSD) transport approach

We describe heavy-ion collisions from the initial phase of colliding nuclei in their groundstates throughout the interaction phase up to the final hadronic elastic and inelastic interactions as well as hadron decays using the nonequilibrium microscopic Parton-Hadron-String Dynamics (PHSD) transport approach, which includes the off-shell dynamics of quarks, antiquarks and gluons as well as a covariant dynamical hadronization scheme in addition to the familiar (off-shell) hadronic reaction dynamics. Within PHSD the low mass dilepton sector ($M < 1$ GeV) at SPS energies (measured by the NA60 and CERES Collaborations) is rather well described by hadronic degrees of freedom when a collisional broadening of the vector mesons (ρ , ω) is incorporated; however, this no longer holds for higher masses. In the intermediate mass regime from 1 to 2 GeV, we find that the contribution from 'massive' $q\bar{q}$ annihilation in the sQGP phase dominates over the hadronic channels like $\pi+a_1$, $\pi+\omega$ and $\rho+\rho$ for In+In reactions at 160 A GeV. On the other hand, we find a quite different pattern of the dilepton production in Au+Au collisions at the top RHIC energy of $\sqrt{s}=200$ GeV. Here the in-medium effects for the ρ and ω vector mesons do not explain the large enhancement relative to p+p collisions observed in the invariant mass regime from 0.2 to 0.6 GeV by the PHENIX Collaboration. For masses above 1 GeV at RHIC energies, we find that the decay of open charm mesons together with the dilepton radiation from partonic interactions in the sQGP phase dominate the measured spectrum.

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