Dilepton production in relativistic heavy ion collisions

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Using the Parton-Hadron-String Dynamics (PHSD) approach [1], which consistently describes the full evolution of a relativistic heavy-ion collision from the initial hard scatterings and string formation through the dynamical deconfinement phase transition to the quark-gluon plasma as well as hadronization and to the subsequent interactions in the hadronic phase, we have studied dilepton production in In+In collisions at 158 AGeV at SPS [2] and Au+Au collisions at $\sqrt{s_{NN}}$= 200 GeV [3] by including a collisional broadening of vector mesons, microscopic secondary multi-meson channels, and the strongly interacting QGP radiation, which is described by the interactions of dynamical quasiparticles in line with the degrees of freedom propagated in the transport approach. As shown in the left window of Fig.1, the data of the

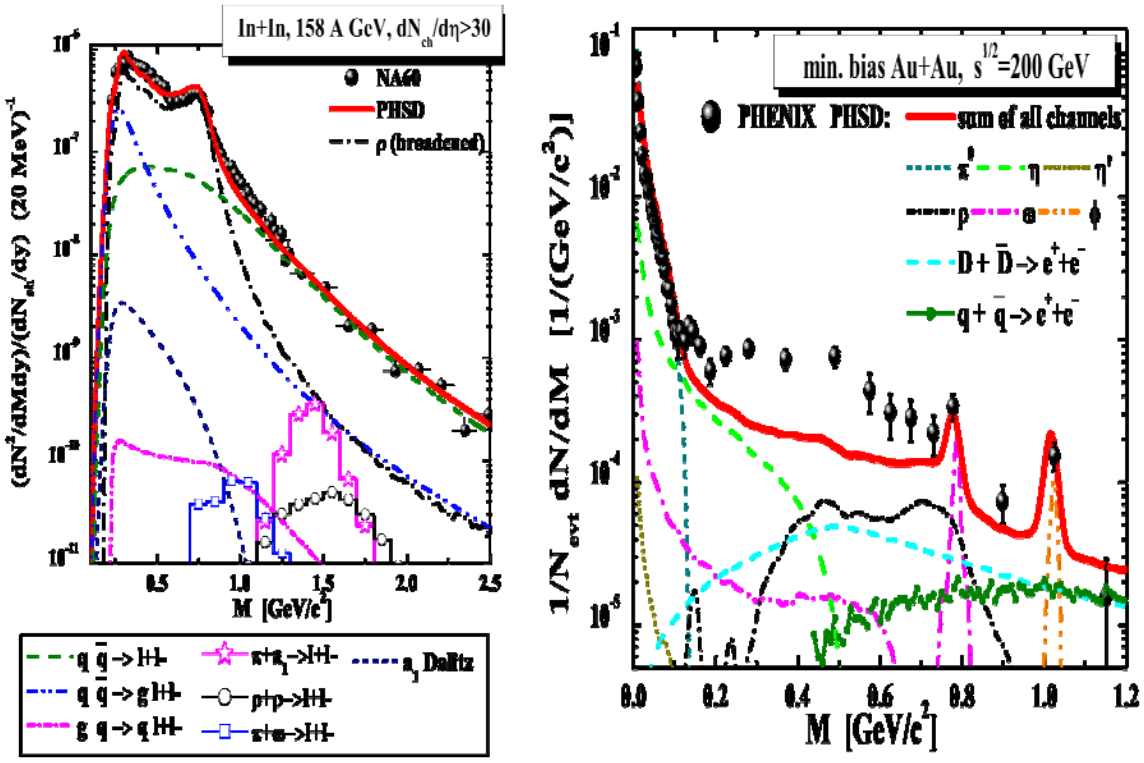

FIG. 1. Left window: Acceptance corrected mass spectra of excess dimuons from In+In at 158 AGeV integrated over p_T in $0.2 < p_T < 2.4$ GeV from PHSD compared to the data of NA60 [4]. Dash-dotted line shows the dilepton yield from the in-medium rho with broadened spectral function, dashed line presents the yield from the quark-antiquark annihilation, dash-dot-dot line gives the contribution of the gluon Bremsstrahlung process, solid line is the sum of all contributions. For the description of the other lines, which correspond to the non-dominant channels, we refer to the figure legend. Right window: Same as left window for Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV within the PHENIX acceptance cuts in comparison to the data from the PHENIX Collaboration [5] for invariant masses $0 \le M \le 1.2$ GeV.

NA60 Collaboration on the dilepton yield [4] is well described by including the collisional broadening of vector mesons, while simultaneously accounting for the electromagnetic radiation of the strongly coupled quark-gluon plasma (sQGP) via off-shell quark-antiquark annihilation, quark annihilation with gluon Bremsstrahlung and the gluon-Compton scattering mechanisms. In particular, the spectra in the intermediate mass range (1 GeV $\leq$ M $\leq$ 2.5 GeV) are dominated by quark-antiquark annihilation in the nonperturbative QGP. Also, the observed softening of the transverse mass spectra in this region is approximately reproduced. For the dilpeton data from the PHENIX Collaboration [5] shown in the right window of Fig. 1, our studies have demonstrated that the observed excess in the low mass dilepton region from 0.15 to 0.6 GeV cannot be described by either the hadronic or the partonic reaction channels. Similar to our findings at SPS energies, the partonic dilepton production channels are visible in the intermediate-mass region between the ϕ and J/ψ peaks. Their contribution is about the same as the correlated background from D-meson decays. On the other hand, our results are in a rough agreement with the preliminary data from the STAR Collaboration [6].

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