Low-Energy Thermal Photons from Hadronic Matter

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Within a hadronic model including electromagnetism via a U(1) gauge, we reinvestigate photon Bremsstrahlung from a hot hadron gas as expected to be formed in relativistic heavy-ion collisions at SPS energies [1]. We calculate photon emission from the reactions $\pi\pi\rightarrow\pi\pi\gamma$ and $\pi K\rightarrow\pi K\gamma$ by explicit (numerical) evaluation of the multi-dimensional phase space integral (Fig. 1). This, in particular, allows to overcome the commonly employed soft photon approximation (SPA), as well as to incorporate final-state Bose enhancement factors. Both improvements are shown to result in an appreciable increase of the pertinent photon production over previous calculations [2] by up to a factor of 2 at low photon energies (q_0=0.1~0.5 GeV).

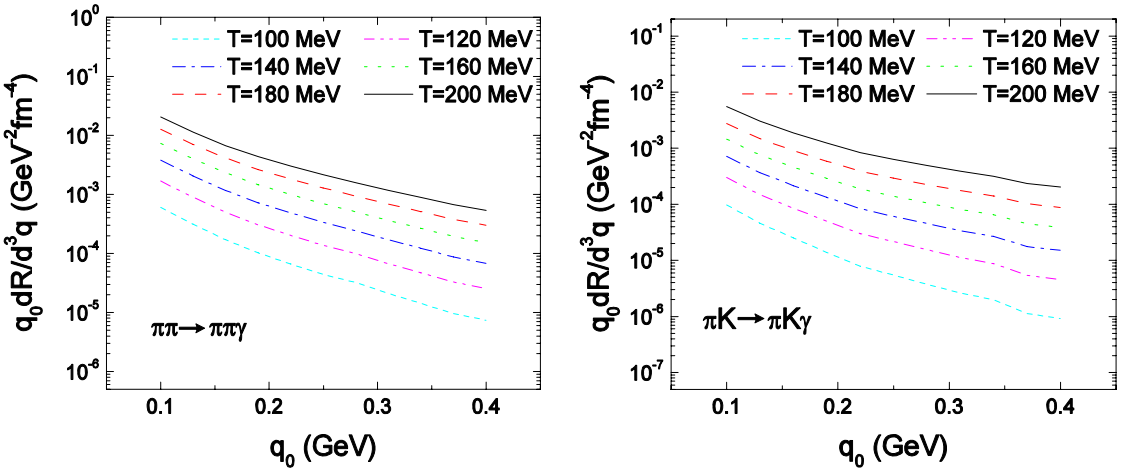

Figure 1. Thermal photon emission rate from Bremsstrahlung via $\pi\pi\rightarrow\pi\pi\gamma$ (left) and $\pi K\rightarrow\pi K\gamma$ (right) reactions as a function of photon energy at different temperatures.

We apply the thermal emission rates to the calculation of photon spectra at low transverse momentum (q_t) in central Pb(158 AGeV)-Pb collisions at SPS via a convolution over a thermal fireball. When comparing the total yield to recent WA98 data [3], we find that Bremsstrahlung leads to a significant improvement in the description of the low-q_t part of the spectrum (Fig. 2).

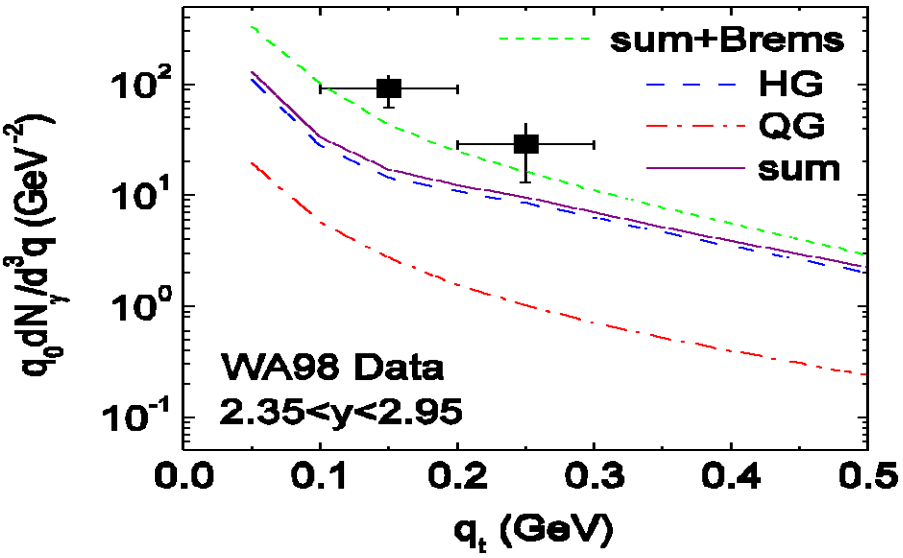

Figure 2. Direct low-q_t photon spectra as measured in central Pb-Pb collisions at SPS [3] compared to the thermal emission spectra from an expanding fireball with QGP phases.

[1] W. Liu and R. Rapp, submitted to Nucl. Phys. **A**; arXiv:nucl-th/0604031.

[2] S. Turbide, R. Rapp, and C. Gale, Phys. Rev. C **69,** 014903 (2004).

[3] M.M. Aggarwal *et al.* (WA98 Collaboration), Phys. Rev. Lett. **93**, 022301 (2004).