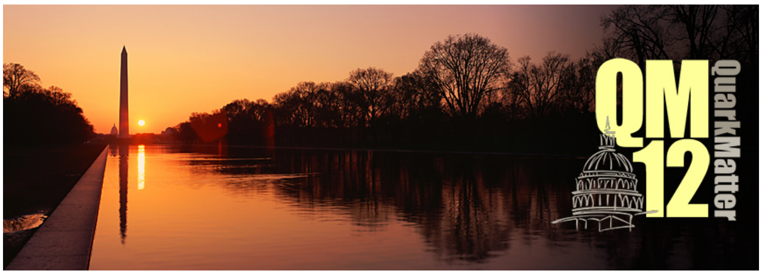

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Thermal Photon emission with partial chemical equilibrium equation of state

Thursday 16 August 2012 16:00 (2 hours)

Photons are believed to be clean and penetrating probes of the medium created in ultra-relativistic heavy-ion collisions. The thermal photon spectra and their anisotropy are known to be very sensitive to the thermalization time, the specific shear viscosity, the equation of state of produced matter, and the initial state fluctuations [1]. Previous computations of photon emission spectra have been mostly carried out in a fully thermalized medium evolving dynamically under the influence of an equation of state with a first order phase transition. Today, a realistic state-of-the-art equation of state based on lattice QCD results and partial chemical equilibrium (PCE) in the hadronic phase is available for relativistic hydrodynamic simulations [2]. The non-zero chemical potentials will enhance thermal photon production rates in the hadronic phase by their corresponding non-equilibrium fugacity factor ˜ eˆ{mu/T}. However, the breaking of chemical equilibrium below the quark hadron phase transition also changes the relation between temperature and energy density, which results in faster cooling evolution during the hadronic phase. This reduces the space-time volume for photon emission from the hadronic phase. In this work, we study PCE effects on the yields and the azimuthal anisotropies of produced thermal photons in heavy-ion collisions at RHIC and LHC energies, using a realistically evolving hydrodynamic medium. We study in detail the interplay between the chemical potential enhancement in the thermal photon emission rates and faster cooling evolution of the medium. We compare our calculations with data from RHIC, and make predictions for measurements at the LHC.

[1] M. Dion, J. F. Paquet, B. Schenke, C. Young, S. Jeon and C. Gale, "Viscous photons in relativistic heavy ion collisions," Phys. Rev. C 84, 064901 (2011)

[2] Chun Shen, Ulrich Heinz, Pasi Huovinen and Huichao Song, "Systematic parameter study of hadron spectra and elliptic flow from viscous hydrodynamic simulations of Au+Au collisions at √s_{NN} = 200A GeV," Phys. Rev. C 82, 054904 (2010)

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