Centrality Dependence of the Direct Photon Emission

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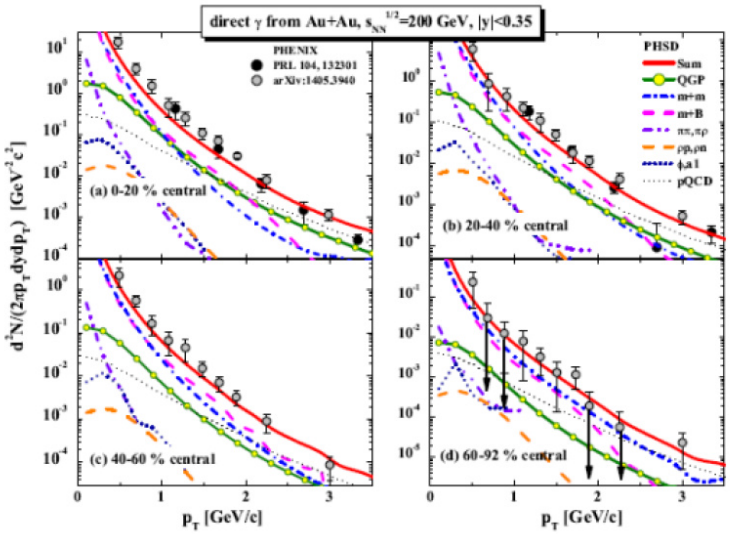


Fig. 1: The direct photon spectra (thermal photons+pQCD photons) at various centralitiy. Our predictions are shown by the red lines and the PHENIX data by the symbols.

Introduction

In our work,[1] the photons produced by partonic interactions in the quark-gluon plasma phase was found to have small elliptic flow v2, because they are dominated by the emission in the initial phase before the elliptic flow fully develops. On the other hand, our calculations reproduced the recent puzzling measurement of the PHENIX Collaboration that the v2 of photons at pT<3 GeV is almost as large as the v2 of the pions (which decouple only in the late stage).

Methods

We attribute the strong v2 of thermal photons to hadronic channels, i.e. to mesonic and baryonic binary reactions. In order to clarify the channel decomposition of the direct photon spectra, we investigated the centrality dependence of the thermal photon yield in (Linnyk et al.)[2] and predicted it to scale as the number of participating nucleons Npart in the power approx a=1.5.

Results

Our prediction turned out to be in a very good agreement with the most recent estimate of a=1.48+-0.08+-0.04 by the PHENIX Collaboration, see the figure for the explicit comparison to the data. For the description of the collision evolution we use the covariant off-shell transport parton-hadronstring dynamics

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(PHSD).[3] The degrees of freedom in the partonic and hadronic phases are the strongly interacting dynamical quasi-particles and off-shell hadrons, respectively. Within the PHSD one solves off-shell transport equations on the basis of the gradient expansion of the Kadanoff-Baym equations for effective Green's functions in phase-space representation for quarks, antiquarks and gluons as well as for the hadrons and their excited states.

Reference

[1] O. Linnyk, V.P. Konchakovski, W. Cassing, and E.L. Bratkovskaya (2013): Photon elliptic flow in relativistic heavy-ion collisions: Hadronic versus partonic sources. Phys. Rev. C 88, 034904. http://dx.doi.org/10.1103/PhysRevC.88.034904

[2] O. Linnyk, W. Cassing, and E.L. Bratkovskaya (2014): Centrality dependence of the direct photon yield and elliptic flow in heavy-ion collisions at √sNN=200 GeV. Phys.Rev. C89, 034908. https://doi.org/10.1103/PhysRevC.89.034908

[3] W. Cassing and E.L. Bratkovskaya (2009): Parton-Hadron-String Dynamics: an off-shell transport approach for relativistic energies. Nucl.Phys. A831, 215. https://doi.org/10.1016/j.nuclphysa.2009.09.007

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