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Probing the photon emission rate of quark-gluon plasma in lattice QCD

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We investigate the emission rate of photons in a perfectly thermalized quark-gluon plasma via lattice QCD correlation functions of the electromagnetic current. The thermal correlation functions can be split into a spatially longitudinal and a transverse part, and the photon rate is determined by the transverse part, since the longitudinal part vanishes at light-like kinematics. However, we focus mostly on the difference of the transverse and longitudinal parts, because this difference vanishes identically in the vacuum and is therefore directly sensitive to thermal effects. We thus probe the photon rate in the range of photon momenta between $\pi T/2$ and $2\pi T$. The relevant Euclidean correlation functions are
computed with $N_f = 2$ O(a) improved Wilson fermions in the high-temperature phase and extrapolated to the continuum. In order to estimate the photon rate, an ill-posed problem for the vector-channel spectral function must be solved. Within a class of Pade-form spectral functions describing in particular the diffusion pole, we determine the subset that is not excluded by the lattice data and obtain from it a range of possible photon emission rates. Comparisons are made with the non-interacting spectral functions and with the well-known N=4 super-Yang-Mills spectral functions at infinite coupling obtained by AdS/CFT methods.

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