



# XXIV QUARK MATTER DARMSTADT 2014

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## Viscous corrections to photon emission in heavy-ion collisions

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Photons are believed to be clean and penetrating probes of the medium created in ultra-relativistic heavy-ion collisions. The thermal photon spectrum and its anisotropy coefficients,  $v_n$ , 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 [1,2]. In this talk, we will present state-of-the-art calculations of event-by-event photon emission from nuclear collisions at RHIC and LHC energies including both shear and bulk viscous corrections. Momentum spectra of thermal photons and their  $p_T$ -differential anisotropic flow coefficients  $v_n(p_T)$  ( $n$  up to 5) are computed, both with and without accounting for viscous corrections to the standard thermal emission rates. Viscous corrections to the rates are found to have a larger effect on the  $v_n$  coefficients than the viscous suppression of hydrodynamic flow anisotropies. Effects from non-zero initial flow and viscous pressure tensor to photon spectra and their anisotropies are also investigated by evolving fluctuating initial density profiles with free-streaming on the event-by-event basis before matching to hydrodynamics. Complementary to the majority of hadronic observables, thermal photons provide us with additional constraints on the evolution of the viscous pressure tensor as well as the early dynamics of heavy-ion collisions. Their anisotropic flows, especially higher order  $v_n$ , can be used as a sensitive viscometer for the quark-gluon plasma.

[1] C. Shen, U. Heinz, J.-F. Paquet and C. Gale, "Thermal photons as a quark-gluon plasma thermometer revisited", arXiv:1308.2440 [nucl-th].

[2] C. Shen, U. Heinz, J.-F. Paquet, I. Kozlov and C. Gale, "Anisotropic flow of thermal photons as a quark-gluon plasma viscometer", arXiv:1308.2111 [nucl-th].

### On behalf of collaboration:

JET

**Primary author:** SHEN, Chun (Ohio State University)

**Co-authors:** GALE, Charles (McGill University); DENICOL, Gabriel (McGill University); Mr LIU, Jia (The Ohio State University); HEINZ, Ulrich (The Ohio State University)

**Presenter:** SHEN, Chun (Ohio State University)

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