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Impact of the vortical pre-equilibrium stage of relativistic heavy ion collisions on quark-gluon plasma dynamics and photon production

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The initial non-equilibrium phase in relativistic heavy ion collisions at finite impact parameter experiences a large vorticity induced by the huge orbital angular momentum which is produced by the two colliding nuclei. Embedding this vortical structure in a relativistic transport approach allow us to simulate the evolution of the fireball created in heavy ion collisions at RHIC and LHC energies and investigate the effects of vorticity on quark-gluon plasma. We find that the initial vortical flow in the reaction plane could result in an enhancement of the differential elliptic flow at intermediate and high transverse momenta and modifies particularly the rapidity dependence of the flow harmonics of quark-gluon plasma. We investigate how these effects are transferred to photons, which are studied including the pertinent scattering processes in the collision integral of the Boltzmann equation. Moreover, the impact of the early stage on parton dynamics and photon production is disentangled by comparing hydro-like simulations starting from a standard equilibrium initial condition to a model in which an initial state of color-electric fields with negative pressure decays into partons through the Schwinger mechanism.

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