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Dynamical description of heavy quarks and electromagnetic probes in heavy-ion collisions at ultra-relativistic energies

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Relativistic heavy-ion collisions produce extremely hot dense matter. Heavy flavor and electromagnetic particles are promising probes to investigate the properties of the hot dense matter. The parton-hadron-string dynamics (PHSD) is a Boltzmann-type transport code, but it further includes the off-shellness of particles based on Kadanoff-Baym equations. The equation-of-state and shear viscosity of a partonic matter from lattice QCD calculations are implemented in the PHSD. We use the PHSD to show how heavy flavor mesons and dileptons are produced and modified through the interactions with hot dense matter in relativistic heavy-ion collisions from the SPS to the LHC energies. We have found that not only cold nuclear matter effects such as (anti)shadowing but also hot nuclear matter effects significantly modify the production of heavy flavor particles in relativistic heavy-ion collisions. While intermediate-mass dilepton is mainly contributed from heavy flavor pair in high-energy heavy-ion collisions, the contribution from partonic interactions becomes more dominant as collision energy decreases. It implies that intermediate-mass dilepton in low-energy heavy-ion collisions has a possibility to carry the information of partonic matter.

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