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Effects on the dilepton radiation induced by a background magnetic field

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Dilepton radiation is known to be an effective thermometer of the quark-gluon plasma (QGP) [1]. In this study, we explore the possibility of using dilepton radiations as a QGP magnetometer. We calculate corrections to dilepton production rate at finite baryon chemical potential, in the presence of a time-dependent magnetic field typically found in heavy-ion collisions. At first order, such a correction includes the non-equilibrium effects from Faraday induction: electric fields induced by a decaying magnetic field, and the relative motion of the fluid with respect to the background magnetic field. We then compute the thermal dilepton spectra from Au+Au collisions at BES energies —$\sqrt{s_{NN}}$ =7.7, 19.6, 62.4 and 200 GeV —using a realistic (3+1)-dimensional multistage hydrodynamic simulation [2]. Other non-equilibrium effects, such as viscosities and baryon diffusion, are also considered. We find signals such as dilepton elliptic flow to be very sensitive to the strength and the lifetime of the magnetic field, as well as the intrinsic QGP conductivity. This study highlights the feasibility of using dileptons as probes for the electromagnetic properties of the QGP.

[1] Jessica Churchill, Lipei Du, Charles Gale, Greg Jackson, and Sangyong Jeon, Phys. Rev. Lett. 132 (2024) 4, 172301
[2] Lipei Du, Han Gao, Sangyong Jeon, and Charles Gale, Phys. Rev. C 109 (2024) 1, 014907

Category

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