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A fluid-dynamic approach to heavy-quark diffusion in the quark-gluon plasma

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Heavy quarks (i.e. charm and beauty) are powerful tools to characterize the quark-gluon plasma (QGP) produced in heavy-ion collisions. Although they are initially produced out of kinetic equilibrium via hard partonic scattering processes, recent measurements of anisotropic flow of charmed hadrons pose the question regarding the possible thermalization of heavy quarks in the medium. Our recent work [1] has provided new insights on the level of thermalization of charm and beauty quarks in the QGP. In particular, exploiting a mapping between transport theory and fluid-dynamics, we have shown how a fluid-dynamic description of the dynamics of charm quarks in the QCD plasma is feasible. Inspired by recent lattice-QCD calculations [2], we will show how a partial thermalization within the lifetime of the QGP is expected also for beauty quarks. We will present results for spectra of charmed hadrons obtained with a fluid-dynamic code (FluidUM [3]) coupled with the conservation of a heavy-quark - antiquark current in the QGP. We will also show preliminary calculations for beauty spectra. We compare our calculations with the most recent experimental data providing further constraints on the heavy-quark spatial diffusion coefficient [4].

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[1] Phys.Rev.D 106 3, 034021 (2022)

[2] e-Print: 2302.08501 [hep-lat]

[3] Phys. Rev. C 100, 014905 (2019)

[4] Capellino, Dubla, Floerchinger, Grossi, Kirchner, Masciocchi; in preparation

Category

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