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Diffusion of conserved charges in relativistic heavy ion collisions

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We present the first calculations of all the diffusion transport coefficients related to the baryon, electric and strangeness charge for a hot and dense hadron resonance gas and for a simplified kinetic model of the quark-gluon plasma [arXiv:1711.08680]. We demonstrate that the diffusion currents do not only depend on gradients of their corresponding charge density. Instead, there exists coupling between the different charge currents, in such a way that it is possible for density gradients of a given charge to generate dissipative currents of another charge. Within this scheme, the charge diffusion coefficient is best viewed as a matrix, in which the diagonal terms correspond to the usual charge diffusion coefficients, while the off-diagonal terms describe the coupling between the different currents. We find that the baryon diffusion current is strongly affected by baryon charge gradients, but also by its coupling to gradients in strangeness. The electric charge diffusion current is found to be strongly affected by electric and strangeness gradients, whereas strangeness currents depend mostly on strange and baryon gradients.

The calculated diffusion coefficients can be easily included in hydrodynamic simulations of heavy ion collisions, and will be particularly important for lower energy collisions such as those that are performed at the RHIC Beam energy scan and that will be performed at NICA or FAIR. We show preliminary hydrodynamic calculations that include the effects of the computed diffusion coefficients.

Reference: Greif, Fotakis,Denicol,Greiner: arXiv:1711.08680

Content type

Theory

Collaboration

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