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Aspects of holographic Langevin diffusion in the presence of anisotropic magnetic field

We revisit the holographic Langevin diffusion coefficients of a heavy quark, when travelling through a strongly coupled anisotropic plasma in the presence of magnetic field $\mathcal{B}$. The Langevin diffusion coefficients are calculated within the membrane paradigm in the magnetic branes model which has been extensively studied to investigate the magnetic effects on various observables in strongly coupled QCD scenarios by holography.

In addition to confirming some conventional conclusions, we also find several new interesting features among the five Langevin diffusion coefficients in the magnetic anisotropic plasma. It is observed that the transverse Langevin diffusion coefficients depend more on the direction of motion rather than the directions of momentum diffusion at the ultra-fast limit, while one would find an opposite conclusion when the moving speed is sufficiently low. For the Longitudinal Langevin diffusion coefficient, we find that motion perpendicular to $\mathcal{B}$ affects the Langevin coefficients stronger at any fixed velocity. We should also emphasize that all five Langevin coefficients are becoming larger with increasing velocity. We find that the universal relation $\kappa^{\parallel} > \kappa^{\perp}$ in the isotropic background, is broken in a different new case that a quark moving paralleled to $\mathcal{B}$. This is one more particular example where the violation of the universal relation occurs for the anisotropic background.Further, we find the critical velocity of the violation will become larger with increasing $\mathcal{B}$.

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