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Heavy flavor energy loss from AdS/CFT: A novel diffusion coefficient derivation and its predictions

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We present a new derivation of the heavy quark diffusion coefficient in a strongly-coupled plasma using the AdS/CFT correspondence. Our main result is that, unlike some previous calculations, our diffusion coefficient does not increase with heavy quark velocity: we find that the effect of momentum fluctuations smoothly interpolates between light and heavy flavors. Taking our diffusion coefficient derivation as fundamental, we use the fluctuation-dissipation theorem to predict a strong-coupling heavy quark drag that is slightly different from the original calculations of Gubser and Herzog et al. We then show recent numerical work that supports some of the key assumptions in our analytic derivation. Incorporating our novel heavy flavor drag and diffusion into an energy loss model, we compare with pQCD predictions of Nahrgang et al. at the partonic level, and with data from LHC for heavy flavor observables. While our predictions are in good agreement with the data from LHC, the partonic momentum correlations exhibit an order of magnitude difference in low momentum correlations to the pQCD calculations. We thus propose heavy flavor momentum correlations as a distinguishing observable of weakly- and strongly-coupled energy loss mechanisms.

List of tracks

Heavy-flavour (open and hidden)

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