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On Applying the Gauge/Gravity Duality to Physics far from Equilibrium

Abstract

The gauge/gravity duality identifies the dynamics of certain quantum field theories with those of semiclassical spacetimes. In particular, it is possible to characterize a quantum field by studying its gravitational dual in the bulk. For a large class of theories, the ratio of shear viscosity to entropy density is found to obtain a universal value, $\eta/s = 1/4\pi$. However, these results are obtained close to thermodynamic equilibrium.

We relax this constraint and explicitly calculate the shear correlator of a strongly coupled plasma far from equilibrium. On the gravitational side, we consider a charged Vaidya black brane subject to a highly concentrated null matter infall. On the field theory side, this corresponds to a sudden temperature increase. We find considerable time-dependent deviations from the universal value which is interesting for time-dependent applications like heavy-ion collisions.