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Holography & quasinormal modes - tools for strongly coupled far from equilibrium dynamics

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We briefly review the holographic (gauge/gravity correspondence) techniques allowing to study strongly coupled systems far from equilibrium and near equilibrium. Then we compute the quasi-normal mode frequencies of gauge field and metric perturbations around black branes which are electrically and magnetically charged. By use of the gauge/gravity correspondence, these fluctuations are dual to conserved current operators of a particular class of strongly coupled field theories with a chiral anomaly. Within such a theory, we consider a thermal charged plasma state subjected to an external magnetic field. Quasi-normal mode frequencies are dual to the poles in the two-point functions of these conserved currents, encoding information about transport and dissipation in the plasma. For comparison, we also compute the same two-point functions in the hydrodynamic limit with field-theoretic methods. Together, these two approaches reveal various effects of the magnetic field and chiral anomaly on the location of the hydrodynamic poles (in analogy to the chiral magnetic and chiral vortical effects expected in Quantumchromodynamics), as well as transport effects far beyond the hydrodynamic approximation. We conjecture qualitative conclusions for heavy-ion collision experiments.

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