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Thermalization of Schwinger-Keldysh correlation functions in hologrpahy

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Holography provides a powerful tool for studying out-of-equilibrium strongly interacting quantum fields. Most works on this subject have focused on the dynamics of local operators, as for instance on how quickly they approach hydrodynamic behavior. We have developed the first general method for studying time-dependence of the causal response function in holography for arbitrary non-equilibrium states and external quench protocols by vastly improving pre-existing methods. This method has been further extended for obtaining all non-equilibrium Schwinger-Keldysh correlation functions (to appear soon). We will present results on the time-dependence of the spectral function in AdS-Vaidya geometries dual to non-equilibrium states driven by a homogeneous quench of an arbitrary duration. Unlike the one-point functions, the spectral function exhibits four distinct patterns of time-dependence (initial time dynamics and thermalization) characterized by very well-defined features going to be described. It can be readily argued that holography can help us to classify patterns of thermalization of correlation functions in strongly coupled large-N theories based on a few simple combinations of extrinsic and intrinsic parameters, in a manner analogous to how we use the Reynolds number to classify hydrodynamic flows. We will discuss connections with solid-state experiments and heavy-ion physics.

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