

Fluctuation, dissipation, and thermalization in non-equilibrium AdS_5 black hole geometries

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We give a simple recipe for computing dissipation and fluctuations (commutator and anti-commutator correlation functions) for non-equilibrium black hole geometries. The recipe formulates Hawking radiation as an initial value problem, and is suitable for numerical work. We show how to package the fluctuation and dissipation near the event horizon into correlators on the stretched horizon. These horizon correlators determine the bulk and boundary field theory correlation functions. In addition, the horizon correlators are the components of a horizon effective action which provides a quantum generalization of the membrane paradigm. In equilibrium, the analysis reproduces previous results on the Brownian motion of a heavy quark. Out of equilibrium, Wigner transforms of commutator and anti-commutator correlation functions obey a fluctuation-dissipation relation at high frequency.

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