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Equilibration and Thermalization of Strongly Coupled Field Theories

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Using the AdS/CFT correspondence, we probe the scale-dependence of thermalization in strongly coupled field theories following a quench, via calculations of 2-point functions, Wilson loops and entanglement entropy in 2, 3, and 4 dimensions. In the saddlepoint approximation these probes are computed in AdS space in terms of invariant geometric objects – geodesics, minimal surfaces and minimal volumes. Our calculations for two dimensional field theories are analytical. In our strongly coupled setting, all probes in all dimensions share certain universal features in their thermalization: (1) a slight delay in the onset of thermalization, (2) an apparent non-analyticity at the endpoint of thermalization, (3) top-down thermalization where the UV thermalizes first. For homogeneous initial conditions the entanglement entropy thermalizes slowest, and sets a time scale for equilibration that saturates a causality bound over the range of scales studied. The growth rate of entanglement entropy density is nearly volume-independent for small volumes, but slows for larger volumes.

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