

Long-time equilibration can determine transient thermality

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When two initially thermal many-body systems start to interact strongly, their transient states quickly become non-Gibbsian, even if the systems eventually equilibrate. To see beyond this apparent lack of structure during the transient regime, we use a refined notion of thermality, which we call g-local. A system is g-locally thermal if the states of all its small subsystems are marginals of global thermal states. We numerically demonstrate for two harmonic lattices that whenever the total system equilibrates in the long run, each lattice remains g-locally thermal at all times, including the transient regime. This is true even when the lattices have long-range interactions within them. In all cases, we find that the equilibrium is described by the generalized Gibbs ensemble, with three-dimensional lattices requiring special treatment due to their extended set of conserved charges. We compare our findings with the well-known two-temperature model. While its standard form is not valid beyond weak coupling, we show that at strong coupling it can be partially salvaged by adopting the concept of a g-local temperature.

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