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Universal scaling at a pre-thermal dark state

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Many open quantum systems are well described by an effective non-hermitian Hamiltonian generating a time evolution that allows eigenstates to decay and dissipate to the environment. In this framework, quantum coherent scaling is traditionally tied to the appearance of dark states, where the effect of dissipation becomes negligible. Here we discuss the universal dynamical scaling after a sudden quench of the non-hermitian O(N) model Hamiltonian. While universality is generally spoiled by non-hermiticity, we find that for a given set of internal parameters short-time scaling behaviour is restored with an initial slip exponent different from that of closed quantum systems. This result is tied to the compensation of dissipation by interaction effects at short times leading to a pre-thermal dark state, where coherent many-body dynamics can be observed (arXiv:2112.14180). Separately, for hermitian systems we find a new class of analytical quench solutions by scaling in complex space and time (arXiv:2203.06098).

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