

# Driven-dissipative many-body systems with mixed power-law interactions: Bistabilities and temperature-driven nonequilibrium phase transitions

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<https://journals.aps.org/pr/abstract/10.1103/PhysRevA.94.011401> [2]

We investigate the nonequilibrium dynamics of a driven-dissipative spin ensemble with competing power-law interactions. We demonstrate that dynamical phase transitions as well as bistabilities can emerge for asymptotic van der Waals interactions, but critically rely on the presence of a slower decaying potential core. Upon introducing random particle motion, we show that a finite gas temperature can drive a phase transition with regards to the spin degree of freedom and eventually leads to mean-field behavior in the high-temperature limit. Our work reconciles contrasting observations of recent experiments with Rydberg atoms in the cold-gas and hot-vapor domain, and introduces an efficient theoretical framework in the latter regime.

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