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

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We investigate the non-equilibrium 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 behaviour in the high-temperature limit. Our work reconciles contrasting observations of recent experiments with Rydberg atoms in the cold-gas and hot-vapour domain, and introduces an efficient theoretical framework in the latter regime.

- H2020 [2]
- QIPC [3]
- RySQ [4]
- 15.10.En Atomic ensembles [5]
- Result [6]
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