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Analogs of QPTs and ESQPTs in a dissipative spin model

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We will present a model of a quantum collective spin weakly coupled to a spin-polarized Markovian environment which displays extremely exotic spectral properties [1]. As a function of the environment magnetization the spectrum is divided in to two regions by a divergence in the density of Liouvillian eigenvalues. This Liouvillian spectral phase transition is the analog of the ESQPTs in closed quantum systems. One of the spectral phases has the unique characteristic of being made up exclusively of second order exceptional points in the thermodynamic limit, while the other shows a normal non-degenerate spectrum. In the limit of no bath polarization, this criticality is transferred into the steady state implying a dissipative quantum phase transition, the analog of a QPT in closed systems. Moreover, at the critical point the steady state behaves as a boundary time crystal.

[1] Álvaro Rubio-García, Ángel L. Corps, Armando Relaño, Rafael A. Molina, Francisco Pérez-Bernal, José Enrique García-Ramos, and Jorge Dukelsky. Exceptional Spectral Phase in a Dissipative Collective Spin Model. arXiv:2202.09337.

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