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Scaling of quantum Zeno dynamics in thermodynamic systems
WING CHI YU, LI-GANG WANG, SHI-JIAN GU, Department of Physics, The Chinese University of Hong Kong, Hong Kong — Quantum Zeno effect (QZE) refers to the inhabitation of the unitary time evolution of a quantum system by repeated frequent measurements. It has been studied intensively within the content of quantum optics in recent decades. Among those analyses, the systems under consideration are only of a few levels. Little attention of QZE in thermodynamic systems has been paid so far. In this presentation, we will investigate the QZE in thermodynamic systems from the viewpoint of condensed matter physics. We take the one-dimensional transverse-field Ising model and the Lipkin-Meshkov-Glick (LMG) model as examples to illustrate analytically the criteria, in terms of the size dependence of the leading term of the survival probability in the short-time limit, for observing the QZE. Our analysis shows that in order to observe the QZE in the Ising model, the frequency of the projective measurement should be of comparable order to that of the system sizes. The same criterion also holds in the symmetry broken phase of the LMG model. However, in the polarized phase of the LMG model, the leading term of the survival probability is independent of the system size and the QZE can be easily observed.

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