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Fidelity Spectrum in Quantum Phase Transitions WING CHI YU, SHI-JIAN GU, HAI-QING LIN, The Chinese University of Hong Kong — A quantum phase transition (QPT) is incarnated by an abrupt change in the qualitative structure in the ground state wavefunction of a many-body system as the external driving parameter varies. The ground state fidelity, which is a measure of similarity between two states, is expected to show a sudden drop across the transition point and its possibility as a witness to QPTs has raised much interest in recent years. However, the ground state fidelity does not capture much information about the contribution of the low-lying excitations. In this presentation, we introduce the concept of fidelity spectrum, i.e. the matrix elements of $M = |\Psi(\lambda)\rangle\langle\Psi(\lambda + \delta\lambda)|$, where λ is the external driving parameter and $\Psi(\lambda)$ is the wavefunction of the system at λ. By studying the fidelity spectrum, we hope to shed light on the role of excited states played in QPTs. We investigate the fidelity spectrum in two many-body systems, namely the one-dimensional transverse-field Ising model and the two-dimensional Kitaev model defined on a honeycomb lattice. We found that in different phases, as well as at the critical points, the fidelity spectrum shows significant different behaviors.

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