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Symmetry-resolved Rényi fidelities and quantum phase transitions

Fidelities share important properties with entanglement entropies. In particular they can detect and characterise quantum phase transitions (QPTs). In the context of quantum many-body systems with a global conserved charge, understanding how each symmetry sector contributes to the total entanglement is a timely challenge. In this talk, I introduce Rényi fidelities and discuss their symmetry resolution close to a quantum phase transition. For simplicity, I focus on the XX spin chain because this model has a global $U(1)$ symmetry, exhibits a QPT and is exactly solvable. We argue that symmetry-resolved fidelities, similarly to the total ones, can detect QPTs. However, symmetry-resolved fidelities are sensitive to the inner structure of the states and can detect QPTs through the reorganisation of the charge sectors that takes place at the critical point, even though it does not affect the total fidelities. On the technical side, we also provide an exact formula for charged fidelities of Gaussian states in term of the corresponding two-point correlation matrices. This talk is based on arXiv: 2208.09457.