Fidelity Susceptibility, Scaling, and Universality in Quantum Phase Transitions

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We report our recent efforts in exploring the relation between fidelity susceptibility and quantum phase transitions by the studies of three models: (1) the one-dimensional asymmetric Hubbard model where we show that the fidelity susceptibility can be used to identify the universality class of the quantum phase transitions. The Kosterlitz–Thouless-type transition occurred at half-filling and the Landau transition away from half-filling can be discriminated from distinct critical exponents of the fidelity susceptibility; (2) the Kitaev honeycomb model where we show that the fidelity susceptibility can be used to identify the topological phase transition from a gapped *A* phase with Abelian anyon excitations to a gapless *B* phase with non-Abelian anyon excitations. Moreover, via fidelity susceptibility, we found a hidden correlation, the bond-bond correlation, which decays exponentially in the gapped phase, but algebraically in the gapless phase; (3) the Lipkin-Meshkov-Glick model where we obtained explicitly the critical exponents of the fidelity susceptibility around the second-order quantum phase transition point and found that the fidelity susceptibility is not always extensive.

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