Abstract Template

Universal Magnetocaloric Effect and Grüneisen Ratio near Quantum Critical Points

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Quantum magnets exhibit universal magnetocaloric effects near field-induced quantum critical points, which can be used in adiabatic demagnetization cooling. Such magnetocaloric effects are characterized by the Grüneisen ratio, which follows a universal scaling function determined by the universality class of the QCP. In this work, we investigate the critical scaling behavior of the Grüneisen ratio of both one and two-dimensional spin models, including ferromagnetic transverse-field Ising model, spin-1/2 antiferromagnetic Heisenberg model in a uniform magnetic field, the q-state Potts model and J_1-J_2 antiferromagnetic columnar dimer model. By means of thermal tensor network method and stochastic series expansion quantum Monte Carlo (SSE QMC) simulations, we calculate the Grüneisen ratio near the QCPs and extract the universal scaling function from the finite-size scaling. Our simulation provide numerical results for analyzing and predicting magnetocaloric-effect measurements in experiments.