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Entropic Signatures of Quantum Criticality in Itinerant Ferromagnets and Metamagnetic Systems JIANDA WU, Rice University, LIJUN ZHU, LANL, QIMIAO SI, Rice University, ANDREAS ROST, ANDY MACKENZIE, University of St. Andrews — We investigate the thermodynamic properties of itinerant ferromagnets near quantum critical points described by a quantum Landau-Ginzburg ϕ^4 theory. We show that the quartic coupling in this theory, which is dangerously irrelevant, has a singular contribution to the renormalized Gaussian free energy. We trace this singularity to some ultraviolet contributions, thereby demonstrating its unphysical nature. We introduce a procedure to regularize this singularity, and apply the prescription to calculate thermodynamic quantities across ferromagnetic quantum critical points in both two and three dimensions. Our calculation illustrates various thermodynamic signatures of quantum criticality, including the entropy accumulation at the quantum critical point which was first proposed on scaling grounds [1]. We systematically compare our theoretical results with the experimental data on entropy and specific heat as a function of magnetic field in Sr3Ru2O7 [2]. We demonstrate that the thermodynamic data are compatible with a quantum critical scenario, but the critical behavior does not agree well with the conventional itinerant ferromagnetic quantum criticality picture. [1] L. Zhu et al PRL 91, 066404 (2003). [2] A.W. Rost et al, Science 325, 1360 (2009).

Jianda Wu
Rice University

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