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Thermal expansion and specific heat of MnSi: evidence for quantum critical behavior

Christoph Meingast
Forschungszentrum Karlsruhe, Institute of Solid State Physics, PO 3640 Karlsruhe, Germany
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In weak itinerant ferromagnets, such as MnSi or ZrZn2, the ordered magnetic moment in the ferromagnetic phase is much smaller than the Curie-Weiss-like moment found above the transition. These systems become paramagnetic with the application of modest (10 - 20 kbar) pressures and are, thus, quite close to a pressure-tuned phase transition at T=0, i.e. a so called quantum critical point (QCP). The ferromagnetic transition temperature can also be driven to zero by replacing some of the Mn by Fe. Recently it was shown (M. Garst et al. Phys Rev. B72, 205129 (2005)) that the Grueneisen parameter, i.e. the ratio of the thermal expansion coefficient to the specific heat, is expected to diverge near such a pressure-tuned QCP. Here we present both thermal expansion and specific heat data of pure and Fe doped MnSi at ambient pressure. We derive the Grueneisen parameters as a function of temperature, magnetic field and Fe doping and compare the results to the expected theoretical behavior.