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Dimensional Crossover of Quantum Critical Behavior in $CeIn_5$

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$CeMIn_5$ (M = Co, Rh) compounds are of great current interest due to their interplay of magnetism, superconductivity and non-Fermi-liquid behavior. In order to classify quantum criticality in these systems, we use low-temperature thermal expansion and the Grüneisen ratio Γ of thermal expansion to specific heat. We compare these thermodynamic properties with theoretical predictions for an antiferromagnetic quantum critical point (QCP) [1]. $CeCoIn_5$ displays a field-induced QCP which almost coincides with the upper critical field of unconventional superconductivity [2]. At the field-tuned quantum phase transition (H_{QCP} = 5T), a crossover scale T* $\approx$ 0.3K is observed, separating $\alpha(T)/T \sim T^{-1}$ ($T >$ T*) from a weaker $T^{-1/2}$ divergence ($T <$ T*). We ascribe this change to a crossover from 2D to 3D critical fluctuations which may go along with a change from unconventional to conventional quantum criticality. The effect of disorder on quantum criticality, which is studied in $CeCoIn_{5-x}Sn_x$ ($0 \leqslant x \leqslant 0.18$), shifts T* to higher temperatures [3].

[1] L. Zhu el al.; Phys. Rev. Lett. **91**, 066404 (2003).
[2] E. D. Bauer et al.; Phys. Rev. Lett **94**, 047001 (2005).
[3] J. G. Donath et al.; Phys. Rev. Lett. **100**, 136401 (2008).