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Influence of magnetic field on the transition temperature of the (Cr₈₄Re₁₆)_{89.6}V<sub>10.4</ alloy

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Abstract content
   (Max 300 words)

In recent years interest in quantum critical behaviour (QCB) has intensified, as is reflected in literature [1,2,3]. A quantum critical point (QCP) is typically found in a material where the phase transition temperature has been driven or tuned to zero by the application of a tuning parameter such as magnetic field, pressure or through doping [1]. Previous studies on the (Cr₈₄Re₁₆)_{100-<i>y</i>}V_{<i>y</i>}alloy system, utilizing doping as a tuning parameter, showed the existence of a putative QCP at a critical concentration <i>y</i>_c of about 10.5 [4].The present study extends these results by focusing on the antiferromagnetic alloy with <i>y</i> = 10.4 and using a new tuning parameter. The (Cr₈₄Re₁₆)_{89.6}V<su alloy has a concentration very close to <i>y</i>_c and possible QCB in this sample is investigated through the application of magnetic field. Magnetic susceptibility (<i>χ</i>)was measured as function of temperature (T) in the temperature range 1.9 K < T < 200 K. The sample was cooled to 2 K in zero field, followed by measurements being collected upon warming the sample in static applied fields (<i>H</i>)in the range 0.01 T to 6.5 T. The <i>χ</i>(<i>T</i>)curves obtained for the various applied fields each show a clear peak and the temperature associated with the peak was taken as the Néel temperature (<i>T</i>_N). Results indicate that the sharpness of the peak improves with
field and that the application of field suppresses <i>T</i>_N. The <i>T</i>_N(<i>H</i>)curve shows a sharp gradient up to 2 T of approximately -6.177 K/T. In the region 2 T < H < 6 T a gradient of approximately -1.823 K/T is observed, above which the <i>T</i>_N(<i>H</i>)curve tends to level off. Interesting conclusions are drawn from the present work and future investigations utilizing higher fields are proposed.

[1] Lee M, Husmann A, Rosenbaum TF and Aeppli G 2004 <i>Phys. Rev. Lett.</i> 92 187201
[2] Yeh A, Soh Y, Brooke J, Aeppli G and Rosenbaum TF 2002 <i>Nature</i> 419 459

[3] Takeuchi J, Sasakura H and Masuda Y 1980 <i>J. Phys. Soc. Japan</i> 49 508

[4] Jacobs BS, Prinsloo ARE, Sheppard CJ and Strydom AM 2013 <i>J.Appl.Phys.</i> 113 17E126

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