PHASE DIAGRAM OF THE QUASI-TWO-DIMENSIONAL ANTIFERROMAGNET USb_2 VIA FIBER BRAGG DILATOMETRY AND MAGNETOMETRY IN PULSED MAGNETIC FIELDS

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The uranium dipnictides UX_2 (X= P, As, Sb, Bi) show unusual transport and magnetization properties due to their highly anisotropic, quasi-two-dimensional nature[1, 2]. These materials consist of antiferromagnetically ordered uranium layers aligned along the c-axis in either an up-down or up-down-down-up configuration [3]. It has also been shown that the 5*f*-electrons from the uranium ions are hybridized with the conduction electrons[4].

Our recent results revealed the antiferromagnetic to paramagnetic phase transition in USb_2 via a fiber Bragg grating dilatometer (figure 1) in which we were able to follow the transition from T=203-80K using pulsed magnetic fields up to 65T. The observed transition sharpens significantly below T= 150K, with the strain as a function of magnetic field going from H^2-like for fields below the transition to independent of H above the transition. We believe that this behavior suggests a possible AFM to spin-flop transition for T< 150 K, similar to the classical antiferromagnet MnF_2 [5].

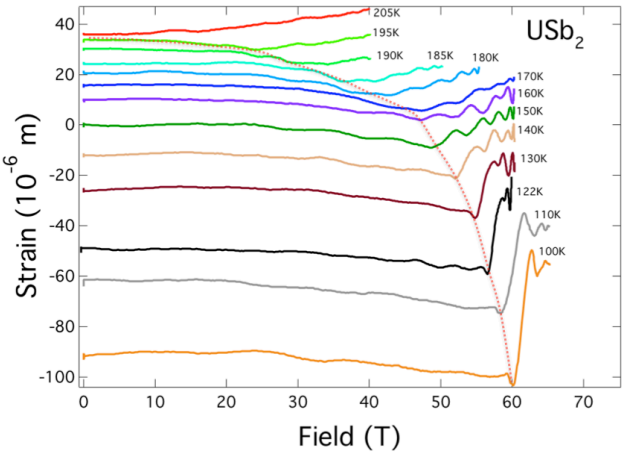

Figure 1. Strain versus applied magnetic field of USb_2 at various temperatures below the AFM transition. The AFM transition is marked with a dashed line for clarity and the traces are vertically offset for ease of viewing the transition. The sharpening of the transition as the temperature is lowered suggests a possible crossover from AFM-PM for T>140K, to AFM-spin-flop transition for T<140K.

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[1] R. Wawryk, Philos. Mag., 86, 1775 (2006).
[2] D. Aoki, et *al.* Philos. Mag. B, 80, 1517 (2000).
[3] J. Leciejewicz, et *al.*, Physica Status Solidi (b), 22, 517 (1967)
[4] E. Guziewicz, et *al.*, Phys. Rev. B, 69, 045102 (2004).
[5] Y. Shapira, S. Foner, Phys. Rev. B, 1, 3083 (1970).

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