Pressure and Magnetic Field Induced Fermi Surface Reconstruction in Chromium

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Introduction

In order to better understand the impact of charge density wave formation on the Fermi surface of depleted uranium we have studied elemental chromium, which has spin and charge density waves.

Experimental

In our experiment we used the 45 Tesla magnet with a top loading ^{3}He system to study the effects of pressure and magnetic fields on the Fermi surface of chromium. These measurements were performed using a tunnel diode oscillator circuit with the resonant inductor coil inside the miniaturized piston cylinder pressure cell.

Results and Discussion

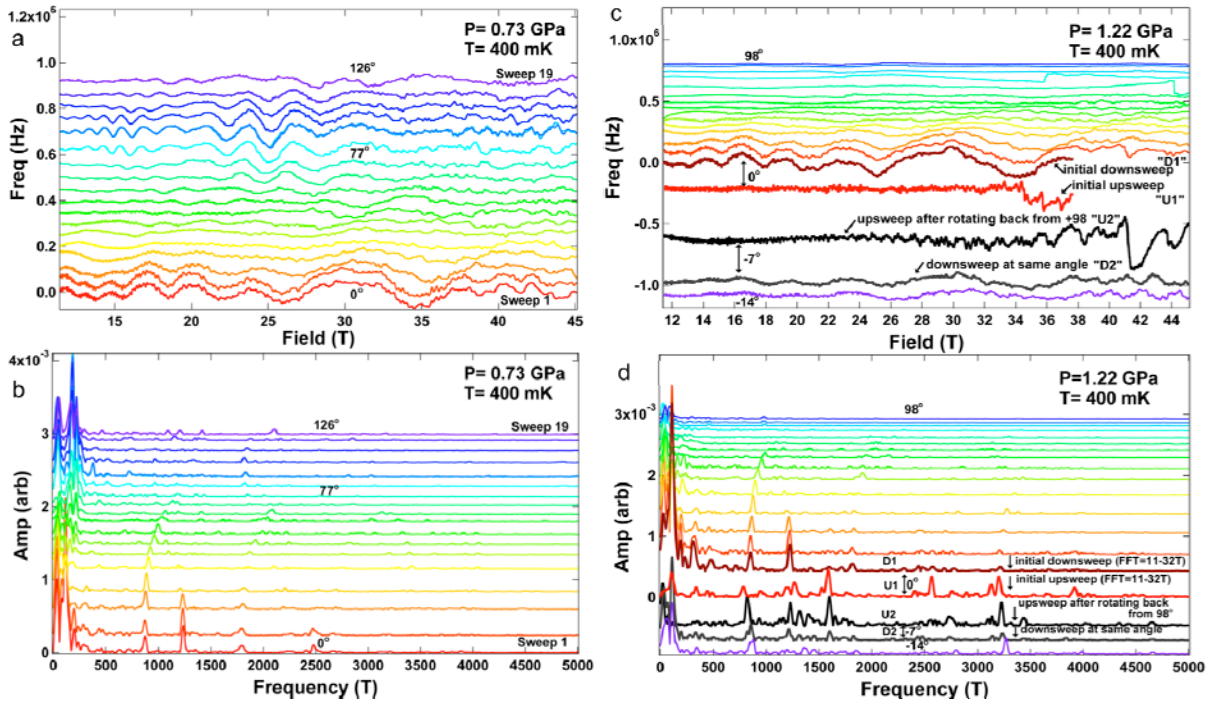

Figure 1 (**a**) Background subtracted TDO frequency and (**b**) FFT spectrum of chromium at P=0.73 GPa and T=400 mK, showing angular dependence of the Fermi surface in a [100] plane through 126° of rotation. (**c**) Background subtracted TDO frequency and (**b**) FFT spectrum of chromium at P=1.22 GPa and T=400 mK, showing angular dependence of the Fermi surface in a [100] plane through 98° of rotation. Graph **a** shows two first order phase transitions on initial upsweeps, "U1" and "U2", and graph **b** shows the loss of frequencies and amplitude of certain frequencies on the following downsweeps, "D1" and "D2".

Conclusions

This data shows that there is a pressure-induced, first order phase transition seen in chromium above P=0.73 GPa that results in a reconstructed Fermi surface. The critical field for this phase transition is angle dependent (fig. 1**c**), but requires further investigation to establish a phase boundary. This pressure is above the spin-flip transition (P_{SF}(2K)=0.93 GPa), but well below the antiferromagnetic transition (P_{AFM}(2K)=9.7 GPa), suggesting that this may be a previously unseen structural distortion and/or magnetic phase transition.

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