Pulsed Field Study of URu_2Si_2 Grown Via a New Molten Metal Flux Technique

Coniglio, W.A.; Baumbach, R.E. (NHMFL-TLH); Gallagher, A. (NHMFL-TLH and FSU; Physics); Bauer, E.D. (LANL); Tozer, S.W. (NHMFL-TLH)

Introduction

High purity single crystal specimens of URu_2Si_2 (50 < RRR < 200) were synthesized using a new molten metal flux technique that we recently developed [1]. In contrast to high purity specimens that were previously available (i.e., those produced by a challenging combination of Czochralski technique followed by zone refining) the flux technique that we use is quite simple. We expect that this growth technique will expand access to higher quality URu_2Si_2, and, when combined with our high pressure, pulsed field capabilities, accelerate progress towards an understanding of this material.

Experimental

Preliminary ambient pressure fermiology studies of URu_2Si_2 grown using a new molten metal flux technique were carried out using a resonant tank circuit technique driven by a tunnel diode oscillator (TDO). A small coil with a resonant frequency of 560 MHz was used for these studies at 500 mK in the 65 T short pulse magnet.

Results and Discussion

Figure 1 shows ambient pressure data averaged from two downsweeps (red) and an upsweep for B // c-axis where the hidden order is clearly visible above which SdH quantum oscillations are visible. The sample was rotated 90° and yielded clear quantum oscillations that show a Fermi surface reconstruction.

Conclusions

The success of this preliminary study opens up the possibility of studying this material and other highly correlated systems at high pressure using the TDO technique.

Acknowledgements

A portion of this work was performed at the National High Magnetic Field Laboratory, which is supported by National Science Foundation Cooperative Agreement No. DMR-1157490, the State of Florida, and the U.S. Department of Energy. WAC and SWT acknowledge support from Grant No. DOE NNSA DE-NA0001979

References

[1] R. E. Baumbach, Z. Fisk, F. Ronning, R. Movshovich, J. D. Thompson, and E. D. Bauer, "High purity specimens of URu_2Si_2 produced by a molten metal flux technique," Phil. Mag. Ahead of Print (2014).

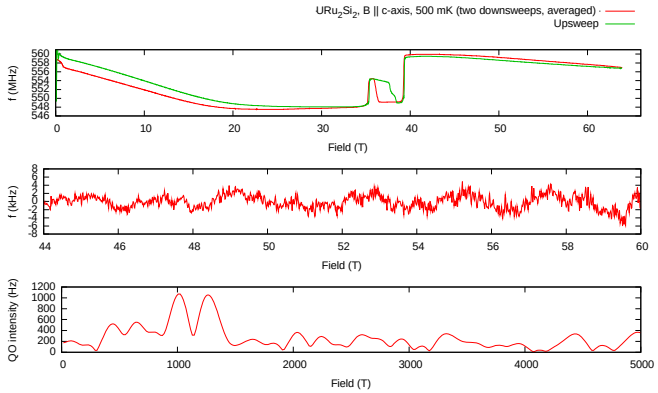

Fig.1 Ambient pressure magnetoresistance using TDO of URu_2Si_2 (B // c-axis, T=500 mK) in the 65 T short pulse magnet clearly showing the hidden order transition. Background subtracted data (B>44 T) and–middle and lower plots, respectively.

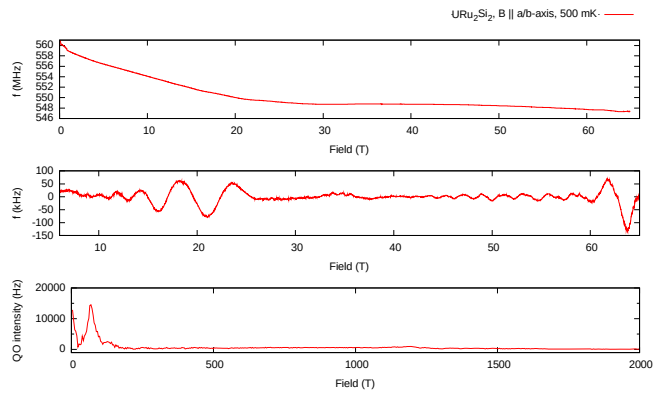

Fig.2 Ambient pressure magnetoresistance using TDO of URu_2Si_2 (B // a-b plane, T=500 mK) in the 65 T short pulse magnet clearly showing the hidden order transition. Background subtracted data and–middle and lower plots, respectively.