**Investigation of an Itinerant Antiferromagnet in High Magnetic Fields**

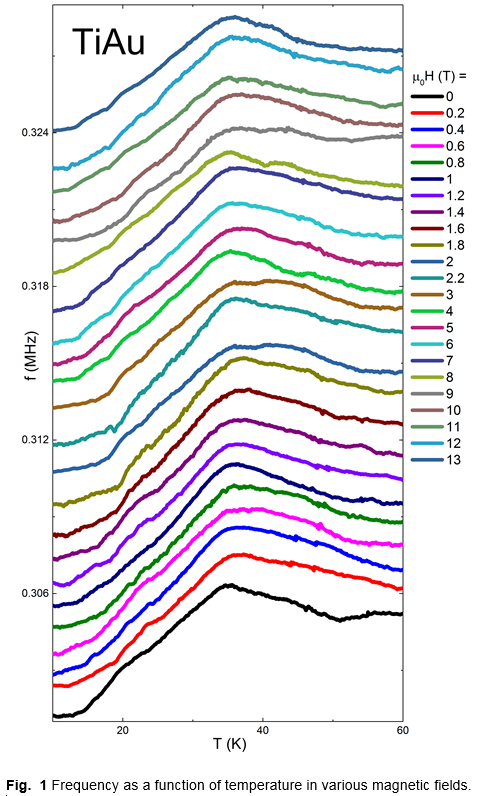
Svanidze, E. (Rice University, Physics); Chikara, S.; Zapf, V.S.; Singleton, J. (NHMFL-PFF) and Morosan, E. (Rice University, Physics)

**Introduction**

The tunnel diode oscillator (TDO) technique is widely used to investigate condensed matter systems due to the great precision and high sensitivity with which frequency of an LC-tank circuit can be measured [1, 2]. In particular, it has been suggested that this technique can differentiate between systems with local and itinerant magnetic moments [3]. While the TDO analysis of ferromagnetic materials has been done before [3], the discovery of the first itinerant antiferromagnetic metal composed of nonmagnetic constituents TiAu [4] allows testing whether this technique works for antiferromagnets.

**Experimental**

The pulsed-field magnetization experiments, described in detail in Ref. [5], were performed on rod-shaped samples of polycrystalline TiAu. The magnetic field was supplied by a 65 T short-pulse magnet at NHMFL. The susceptometer was placed in a 3He cryostat providing temperatures down to 0.4 K.

**Results and Discussion**

The itinerant magnet TiAu, composed of non-magnetic elements, displays antiferromagnetism below the Neel temperature *T*N = 36 K [4]. The oscillator frequency shift *f* as a function of temperature *T* is shown in **Fig.** 1. The µ0*H* = 0 (black) data are in stark contrast with that of a local moment antiferromagnet SmAgSb2 [6], for which no peak is observed. Further field-dependent experiments are needed to compare the frequency response of SmAgSb2 and TiAu.

On the other hand, a comparison with ferromagnetic ZrZn2 [6] reveals another distinct feature: while the peak corresponding to the ordering temperature at *T* = 28 K is suppressed in ZrZn2 with µ0*H* = 0.05 T, the *T* = 36 K feature in TiAu remains unchanged as the external magnetic field is increased up to µ0*H* = 13 T (**Fig.** 1).

**Conclusions**

It was shown that the TDO technique is able to differentiate between local and itinerant moment antiferromagnets. Moreover, the field-dependent data can be used to identify ferro- or antiferromagnetic materials.

**Acknowledgements**

The work at Rice was supported by NSF DMR 0847681 (E.M. and E.S.). A portion of this work was performed at the NHMFL, which is supported by NSF Cooperative Agreement No. DMR-1157490 and the State of Florida.

**References**

[1] Degrift, C.T. Review of Scientific Instruments **46**, 599-607 (1975).

[2] Srikanth, H. *et. al.* Review of Scientific Instruments **70**, 3097- 3101(1999)

[3] Vannette, M.D. *et. al.* Journal of Applied Physics **103**, 07D302 1-3 (2008)

[4] Svanidze, E. *et. al.* Nature Communications **6**, 7701 1-7 (2015)

[5] Goddard, P. A. et. al. New Journal of Physics 10, 083025 1-11 (2008)

[6] Vannette, M.D. *et. al.* Journal of Magnetism and Magnetic Materials **320**, 354-363 (2008)