SHUBNIKOV DE HAAS EFFECT IN HIGH QUALITY SINGLE CRYSTALS OF $SR_4RU_3O_{10}$

L. Balicas, Y.J. Jo (NHMFL); N. Kikugawa (U. St. Andrews, Physics); K. Storr (Prairie View A&M U., Physics); Z.Q. Mao (Tulane U., Physics)

Introduction

$Sr_4Ru_3O_{10}$ is the triple-layered member of the Rudlesden-Poper series with $n = 3$. Although this material has not been as widely studied as the other ruthenates in the series, earlier work by Cao *et al* [1] revealed that its ground state has intriguing characteristics. When the field is applied along the *c*-axis typical ferromagnetic behavior occurs, while for field applied along the in-plane direction a first-order metamagnetic transition accompanied by critical fluctuations is observed. One possible way to understand its metamagnetic behavior within a mean-field theory is by considering the eventual proximity of its Fermi level to a van Hove singularity.

Experimental

We performed a detailed electrical transport study at low temperatures using the hybrid magnet in high quality single crystals of the tri-layered ferromagnetic metal $Sr_4Ru_3O_{10}$. We observed Shubnikov de Haas oscillations for several frequencies.

Results and Discussion

The most prominent orbits have two-dimensional character and display frequencies F_α = 9959 T, F_β = 3949 T, F_γ = 1877 T corresponding respectively to 73.5, 29.2 and 13.9% of the area of the orthorhombic first Brillouin zone (FBZ). Several additional orbits, mostly with frequencies below 2 kT have also been identified, whose spectral weight and frequencies are shifted by a metamagnetic transition induced by an in-plane field component.

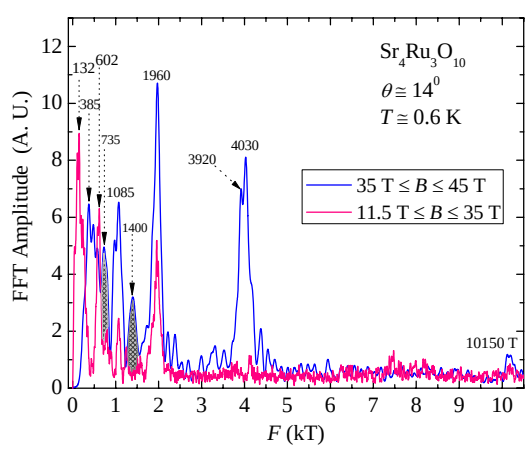

Fig. 1. The FFT spectrum of the Shubnikov de Haas signal of a $Sr_4Ru_3O_{10}$ single crystal for two ranges of magnetic field, i.e., above and below a metamagnetic transition. Shaded areas indicate the existence of peaks in the FFT spectrum that are not seen at lower fields.

Conclusions

Our results indicate the reconstruction of the Fermi surface at the metamagnetic transition. The mechanism remains to be determined.

Acknowledgements

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References

Cao, G., *et al*., Phys. Rev. B, **68**, 174409 (2003).