Quantum Oscillations in CoP

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Introduction

Iron pnictide superconductors have shown high transition temperatures and competition between magnetism and superconductivity, all thought to stem from the FeAs layers common among the varied structure types [1]. But interesting behavior has been seen even in simpler binary transition metal pnictides. CrAs and MnP superconduct at 1 and 9 GPa, respectively, after suppression of antiferromagnetism [2]. The resistance of CrAs depends quasi-linearly on magnetic field at certain pressures, indicative of potential quantum criticality [3]. We have proposed investigating isostructural Fe and Co pnictides, as well as substituted compounds, in the search for interesting phenomena.

Experimental

Measurements were made at the DC Field Facility on the 35 T magnets in Cells 8 and 12. We conducted field sweeps at multiple angles and temperatures for several compounds, measuring both magnetic torque and electrical resistance. Presented here are the results for CoP, which showed de Haas-van Alphen quantum oscillations.

Results and Discussion

The magnetic torque of CoP as a function of field at different angles is shown in Fig. 1. The change in oscillatory behavior indicates a significant difference in Fermi surface character between the *bc* and *ac* planes. Fast Fourier transforms of the same data (Fig. 2) highlight the prominent oscillation frequencies. The temperature dependence of oscillation amplitude allows to us to calculate effective carrier mass in different pockets through the Lifshitz-Kosevich relation. Different frequencies in Fig. 2 are labeled with the corresponding masses obtained through an L-K fit.

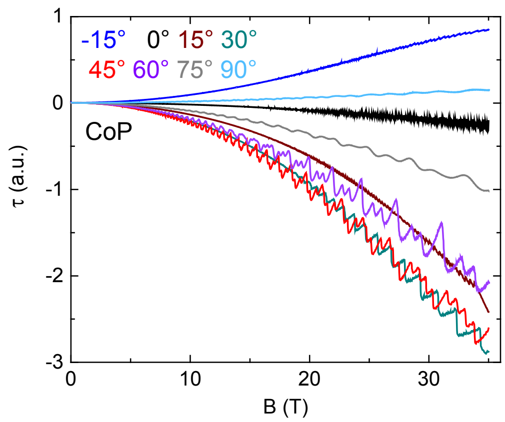

Fig.1 Magnetic torque of CoP between **B** || *a* (0°) and **B** || *b* (90°) at about 0.5 K, showing the evolution of quantum oscillations with angle.

Conclusions

The angular dependence of quantum oscillations in CoP indicates a complicated, three dimensional Fermi surface with multiple pockets. However, effective masses are close to the electron rest mass, indicating a lack of strong correlations. This fits with CoP's position as a nonmagnetic counterpart to isostructural, magnetically ordered FeP, FeAs, CrAs, and MnP.

Acknowledgements

The National High Magnetic Field Laboratory is supported by the National Science Foundation through NSF/DMR-1157490/1644779 and the State of Florida. This research was also supported by National Science Foundation Division of Materials Research award no. DMR-1610349 and the Gordon and Betty Moore Foundation's EPiQS Initiative through grant no. GBMF-4419.

References

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[2] Cheng, J., *et al.*, J. Phys.: Condens. Mat., **29**, 38 (2017).
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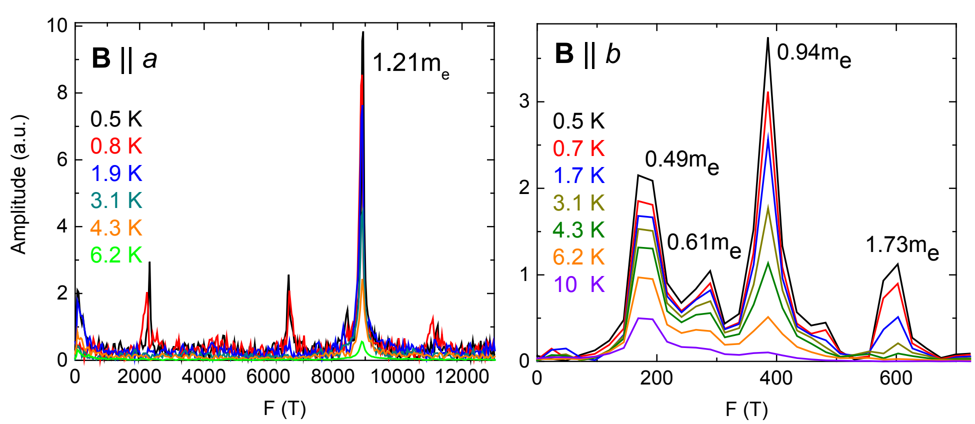

Fig. 2 FFTs of the oscillatory torque of CoP at two angles and multiple temperatures. Labels on peaks indicate calculated effective masses.