Fermi Surface of FeS

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Introduction

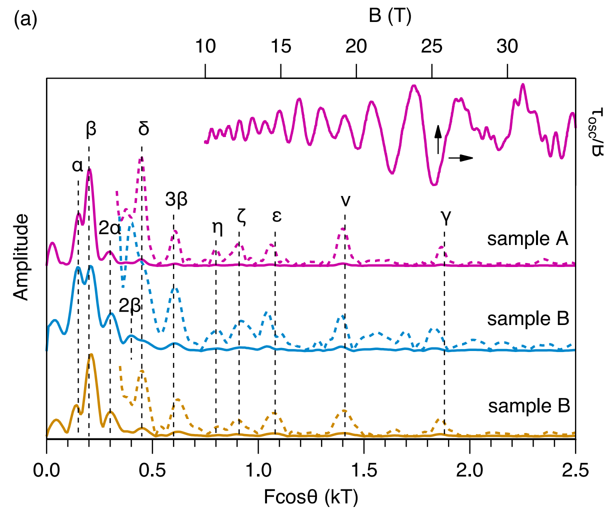
Tetragonal FeS has the same PbO-type structure as FeSe. Unlike FeSe, FeS does not exhibit nematicity. It becomes superconducting below T_c = 5 K [1]. FeS is thus a "normal" reference compound when studying exotic FeSe. It is also interesting on its own: there is a debate whether the superconducting gap is full or nodal.

In this work, we determine the Fermi surface in FeS accurately based on quantum oscillation measurements and quasiparticle self-consistent *GW* (*QSGW*) calculations [2].

Experimental

We have performed magnetic torque measurements on FeS single crystals synthesized with a hydrothermal method [3] using the 45-T hybrid or a 35-T resistive magnet and a 3He refrigerator at the NHMFL, Tallahassee.

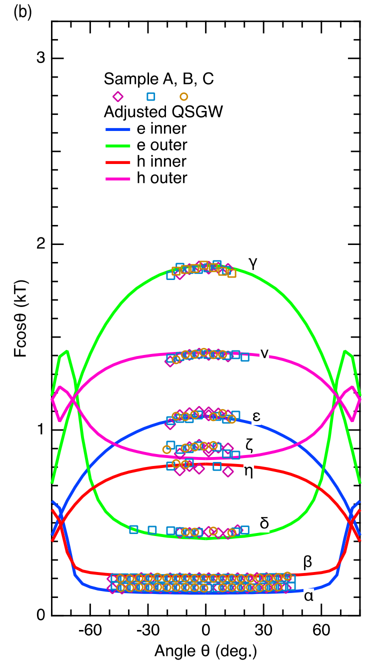
(a)



Results and Discussion

The upper right inset of Fig. 1 (a) shows an example of quantum oscillations in the magnetic torque for a field direction near *B* // *c*. The main part of Fig. 1(a) shows Fourier transforms of oscillations for three samples. Eight fundamental frequencies α, β, δ, η, ζ, ε, ν, and γ are consistently observed (the labels δ, ε, ν, and γ are after [4]). Fig. 1(b) shows the field-angle dependence of the experimental frequencies (marks). It can be explained very well by QS*GW* calculations (lines) when small band-energy adjustments of less than 100 meV are included. The number of hole cylinders in thus determined Fermi surface [Fig. 1(c)] is two (not three), which is favorable for formation of a nodal gap.

(b)



Conclusions

We have determined the Fermi surface in FeS accurately. For details, see [5].

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 work was supported by JSPS KAKENHI Grants No. JP17K05556, No. JP17J06088, No. JP16H04021, and No. JP16H01081. The work in Nanjing University is supported by National Natural Science Foundation of China (NSFC) with the projects: A0402/11534005, A0402/11190023; the Ministry of Science and Technology of China (Grant No. 2016YFA0300404, 2012CB821403).

(c)

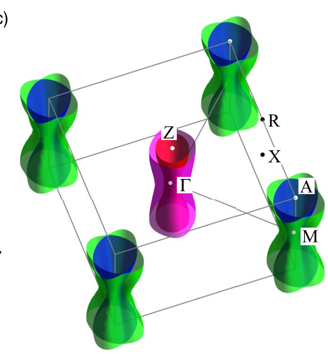


Fig. 1. (a) Magnetic torque quantum oscillations in FeS (upper inset) and Fourier transforms of oscillations for three samples. (b) Field-angle dependence of experimental frequencies compared to QS*GW* calculations with band-energy adjustments. Note that the vertical axis is *F*cos*θ*. (c) Determined Fermi surface.

References

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[5] Terashima, T., *et al.*, arXiv: 1809.06527.