Fermi surface and Berry Phase in a newly proposed triply degenerate topological semimetal

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Introduction

Various types of topological states and compounds have been proposed and some have received experimental support where the topological nature of the carriers are probed via sophisticated measurements such as ARPES and Quantum oscillation study. In addition to topological insulators, three-dimensional topological semimetals have attracted large interest due to their unusual boundary states, which may stimulate novel directions in electronics and spintronics separate from topological insulators. Recently, the cubic compound Pd3Pb, hosting a novel triply degenerate node fermionic phase, having no high energy counterparts, has been proposed [1]. In addition to the triple points the proposed compound Pd3Pb were also shown to host an unusual flat band near the Fermi level. Clearly, this new compound is rich in topological features that requires thorough study of its physical properties as well as Fermi surface topology and we have attempted to do so in Quantum oscillation measurements at pulse field facility.

Experimental

We have measured quantum oscillation through contactless transport (Shubnikov-de Haas) measurements through a Proximity detector oscillation technique. We saw oscillations and the frequencies extracted can be seen in Fig.1. Further measurement through torque magnetometry are planned.

Results and Discussion

The result of the Fast Fourier transformations are seen in Fig.1 (a-b) for various orientation of the magnetic field with respect to *a*-axis. Two prominent frequencies are identified and in Fig. 1c, the theoretical Fermi surface projected on to first Brillouin zone is shown. Here the *R*-point electron pocket is identified as the 1560 T frequency and Fig.1d shows the effective mass estimated from the temperature dependence of the frequency oscillations.

Conclusions

We have successfully conducted Quantum oscillations study of proposed topological compound Pd_3Pb. In the next magnet schedule we aim to measure quantum oscillations through torque magnetometry and investigate the existence of Berry phase in this compound.

Acknowledgements

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References

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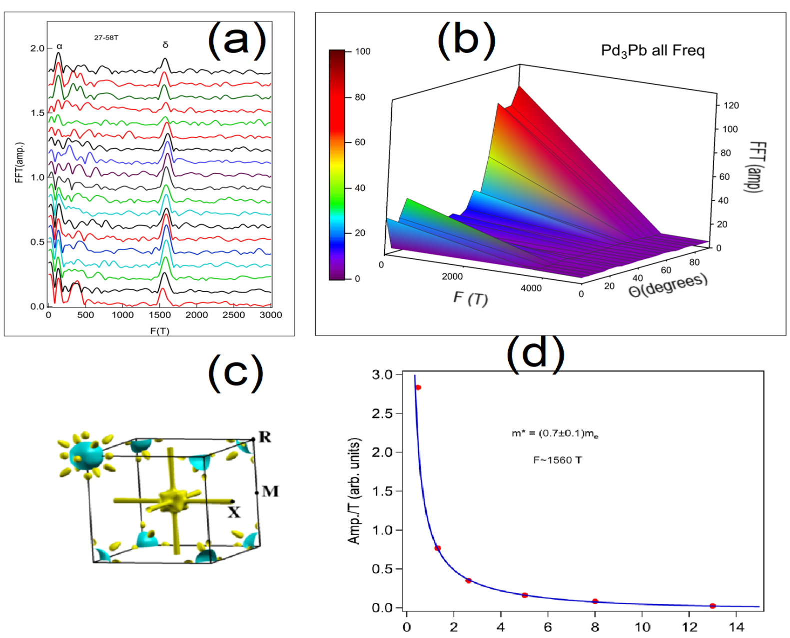

Figure 1. (a-b) Frequencies extracted via Fast Fourier Transformation from the oscillation up to 60 T. (c) Fermi surface projected onto first Brillouin zone. (d) Effective mass of the 1560 T frequency.