Multi-frequency Shubnikov-de Haas oscillations in topological semimetal Pt_2HgSe_3

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Monolayer jacutingaite (Pt_2HgSe_3 has been recently identified as a candidate quantum spin Hall system with a 0.5 eV band gap, but no transport measurements have been performed so far on this material, neither in monolayer nor in the bulk. By using a dedicated high-pressure technique, we grow crystals enabling the exfoliation of 50-100 nm thick layers and the realization of devices for controlled transport experiments. Magnetoresistance measurements indicate that jacutingaite is a semimetal, exhibiting Shubnikov-de Haas (SdH) resistance oscillations with a multi-frequency spectrum. We adapt the Lifshitz-Kosevich formula to analyze quantitatively the SdH resistance oscillations in the presence of multiple frequencies, and find that the experimental observations are overall reproduced well by band structure ab-initio calculations for bulk jacutingaite. Together with the relatively high electron mobility extracted from the experiments (~2000 $cm^2V{\cdot}s$, comparable to what is observed in WTe_2crystals of the same thickness), our results indicate that monolayer jacutingaite should provide an excellent platform to investigate transport in 2D quantum spin Hall systems.

References

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