# Combined Theory and Experiment Identify Topological Dirac Nodal Line in a Type-I Superconductor

## Scientific Achievement

A CINT User Team combined ab initio density functional theory calculations and quantum oscillation measurements to confirm the topological Dirac nodal line in a Type-I superconductor $YbSb_2$ in the normal state.

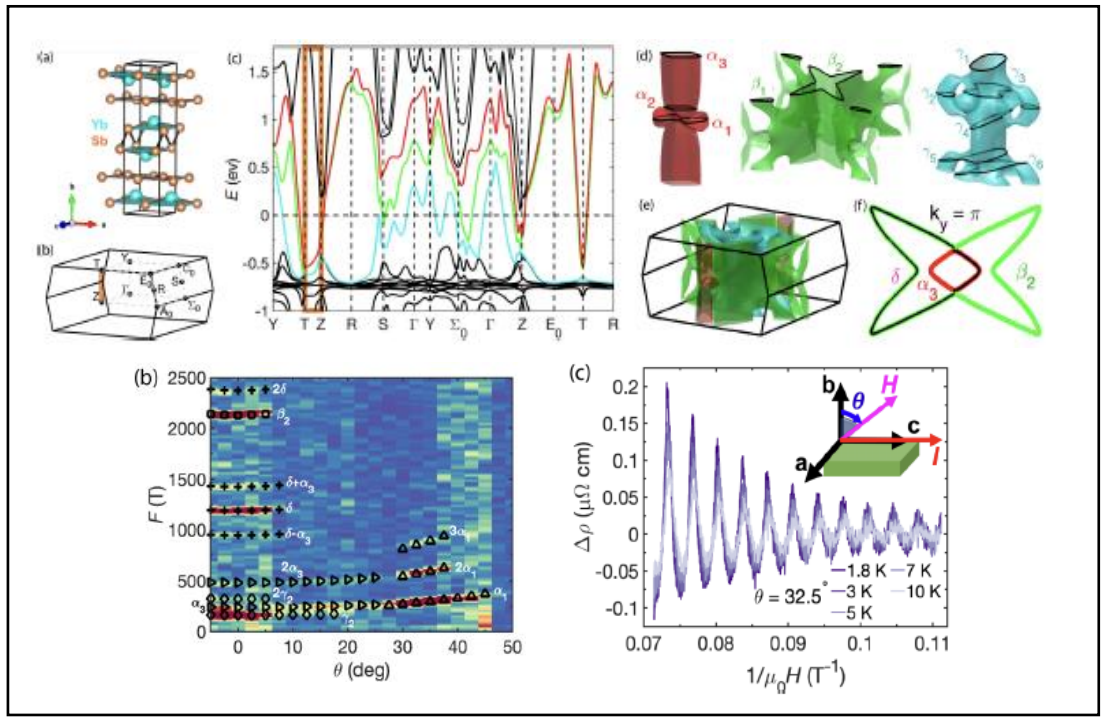


**Figure:** (Top row) Density functional theory calculations of electronic band dispersion and Fermi surface of $YbSb_2$. (Bottow row) Fast Fourier transform spectra of Shubnikov-de Haas(SdH) oscillation and SdH oscillation at different temperatures.

## Significance and Impact

This work establishes $YbSb_2$ as a candidate material platform to explore the interplay between topology and superconductivity, which has implications for topological quantum computing development .

## Research Details

- Ab initio density function theory calculates the band structure and Fermi surface topology.
- Magnetic quantum oscillation and magneresistance measurements were performed to understand the Fermi surface topology in the normal state of $YbSb_2$.


Work was performed, in part, at the Center for Integrated Nanotechnologies.



Gao, Y.; Allen, K.; Mustaf, R. A.; Zhang, Y.; Mishra, S.; Lane, C.; Zonno, M.; Gorovikov, S.; Zhu, J.-X.; Yi, M.; Morosan, E. Quantum Oscillations and Anisotropic Magnetoresistance in the Quasi-Two-Dimensional Dirac Nodal Line Superconductor. *Physical Review B.* 2026.