# Exploring Topological Semimetals in High Magnetic Fields

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The experimental realization of topological semimetals within the past decade has stimulated a great deal of research owing to the observation of new quantum phenomena, some which may persist to temperatures approaching room temperature (300K). *This robustness arises from topological protection and allows one to envision future quantum devices that become part of our everyday technology*.

The key to understanding topological materials lies in determining how the electrons behave in the crystal structure and how they interact with one another. These experiments examined the quantum transport behavior and Fermi surface of the electrons in $SrZnSb_2$. *The MagLab's high magnetic fields enabled the shape of the Fermi surface to be measured along with the electron effective mass, which indicates the degree of influence of electron-electron interactions in the material*. From these results, MagLab users determined that two of the four observed electron orbits on the Fermi surface are topologically non-trivial, likely because these charge carriers are Dirac quasiparticles.

This study combined extensive experimental work with first-principles calculations to determine if $SrZnSb_2$ is a topological material. Each new topological material studied puts the scientific community closer to the goal of room temperature quantum devices.

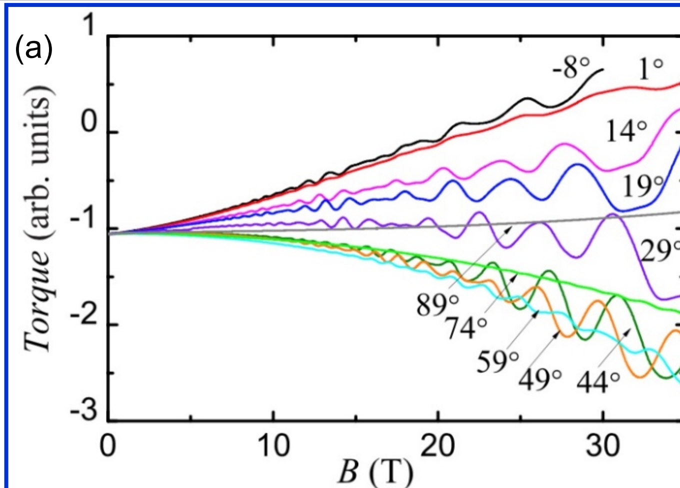
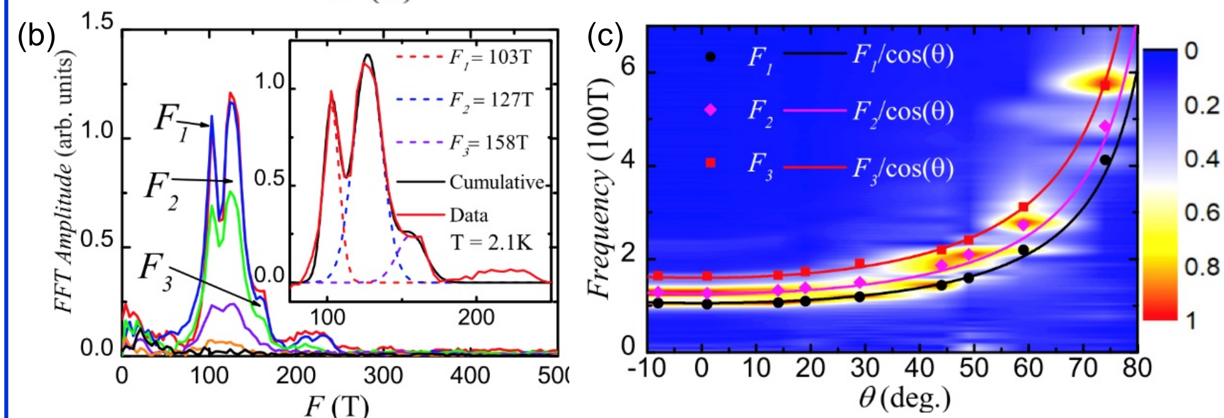



Figure: (a) Raw quantum oscillation data as the applied magnetic field is tilted away from the a-axis.

(b) Fast Fourier transform (FFT) of the raw data in (a) showing the three orbits versus temperature.

(c) Angular dependence of the three main orbits.




**Facilities and instrumentation used:** DC Field Facility, 35 T (cell 12), 9 T (SCM6).
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