Using 75T pulsed magnetic fields to detect Chern pockets with large orbital moments in CsV_3Sb_5

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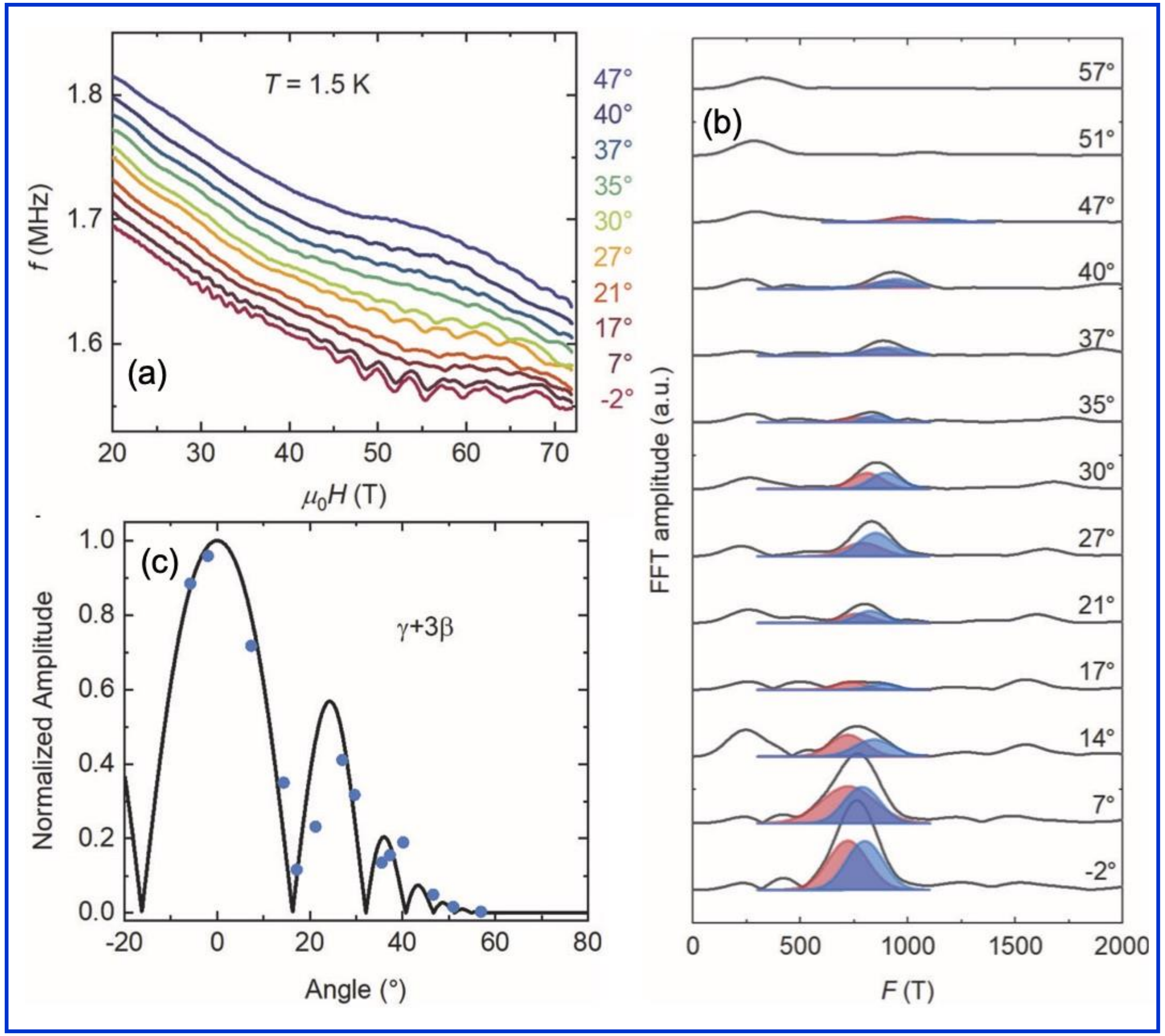
The kagome metal CsV_3Sb_5 has attracted considerable attention because it is thought to host small Chern Fermi pockets that possess spontaneous orbital currents and large orbital magnetic moments. Unfortunately, the pockets align antiferromagnetically, so that it has, until now, proven impossible to detect their presence definitively. However, *in this MagLab user collaboration, the Chern pockets are revealed via magnetic breakdown, an effect in which large magnetic fields cause quasiparticles to tunnel between different Fermi-surface sections*.

Magnetic breakdown orbits between the Chern pockets (labeled β) and a conventional Fermi-surface section (ɣ) give rise to Shubnikov-de Haas (SdH) oscillations in the conductivity, detected here as the frequency *f* of a proximity-detector oscillator (**Fig. a). Fig. (a)** also reveals that the SdH oscillations vary in amplitude with the angle of the CsV_3Sb_5 crystal in the magnetic field. The variation is even more visible in the Fourier transform of the SdH oscillations, as **Fig. (b)** shows for the ɣ+2β (red) and ɣ+3β (blue) breakdown orbits.

Such an angle-dependent amplitude variation of magnetic quantum oscillations **(Fig. c)** is known as the *spin-zero effect;* normally, it is caused by the Zeeman splitting of the Landau levels. By contrast, here it is due to Chern pockets with oppositely directed large orbital moments. *Such Berry-curvature-generated orbital moments are almost always concealed. In CsV_3Sb_5, however, magnetic breakdown in intense pulsed magnetic fields allows them to be visibly manifested in SdH oscillations*, a remarkable example of the interplay between electronic correlations and more conventional electronic bands in quantum materials.



Facilities and instrumentation used: 65T and 75T pulsed magnets, proximity-detector oscillator, and 3D printed rotator at the NHMFL Pulsed-Field Facility, Los Alamos.

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