A magnetic topological semimetal $Sr_{1-y}Mn_{1-z}Sb_2$ (y,z < 0.1)

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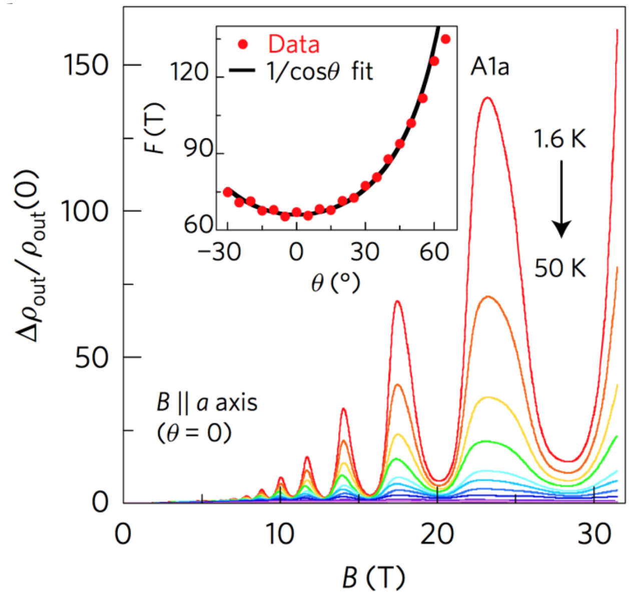
Dirac semimetals (DSMs) can be viewed as three-dimensional (3D) analogues of two-dimensional graphene that are characterized by a linear energy–momentum dispersion near the Fermi level *along all three momentum directions*. The linear band crossing point, that is, the Dirac point, is protected against energy gap formation by crystal symmetry. The resulting unique band structure of DSMs can produce peculiar, exotic properties such as high bulk carrier mobility and large linear magnetoresistance. A Weyl semimetal (WSM) is a variant of a DSM that occurs when either time reversal or space-inversion symmetry is broken. *Weyl semimetals offer the tantalizing possibility of new quantum devices operating at relatively high temperatures due to their topological nature,* a strategy that could fundamentally alter the design and function of electronic devices.

The authors report a new type of magnetic semimetal $Sr_{1-y}Mn_{1-z}Sb_2$ (y, z<0.1) with nearly massless relativistic fermion behavior (effective mass $m^* = 0.04-0.05$ m_0, where m_0 is the free-electron mass). This material exhibits ferromagnetic order for 304K < T < 565K, but transitions to canted antiferromagnetic order with a ferromagnetic component at temperatures below 304K. *This combination of relativistic fermions coupled with ferromagnetism offers a rare opportunity to investigate their interaction with spontaneously broken time reversal symmetry.*



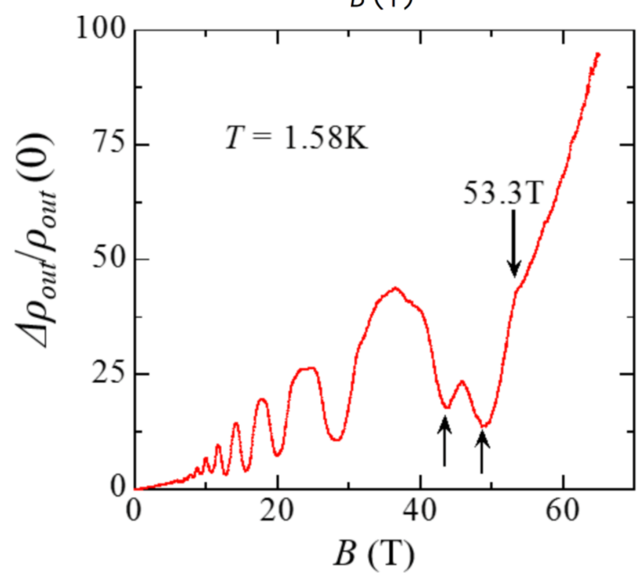


Figure at top: Out-of-plane magnetoresistivity (top) as a function of magnetic field, showing strong quantum oscillations. The angular dependence of the oscillation frequency (inset) corresponds to a quasi-2D Fermi surface. **Bottom panel:** Out-of-plane magnetoresistivity measured up to 65T in pulsed magnetic fields. The upward arrows mark the Zeeman splitting in the electronic band at ultra-high fields. The sharp shoulder at 53.3T is not currently understood.

Facilities: DC Facility Cell 12, 35T resistive magnet & Pulsed Field 65 T pulsed magnet.

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