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A 3D quantum state with zero Hall effect (IRG-1)

S. Liang *et al.*, *Princeton University*

In conventional metals, the Hall effect of electrons accelerating in an electric field can never vanish, except at isolated values of the magnetic field *B*. Princeton MRSEC members, **Cava**, **Bernevig** and **Ong**, recently identified the first material (KHgSb) that exhibits a Hall effect that remains stuck at zero over a broad interval in *B* [1]. The Hall conductivity* σ_{xy} decreases rapidly to zero with temperature *T* (Fig. 1). At the lowest *T* (red curve), σ_{xy} is pinned to zero between 45 and 63 Tesla. This novel behavior arises from double Quantum Spin Hall surface states [2]. These unusual states exist because the lattice has glide symmetry: it looks the same if reflected across the mirror plane (shaded blue in inset) *and* translated vertically by *c*/2, half the lattice spacing.

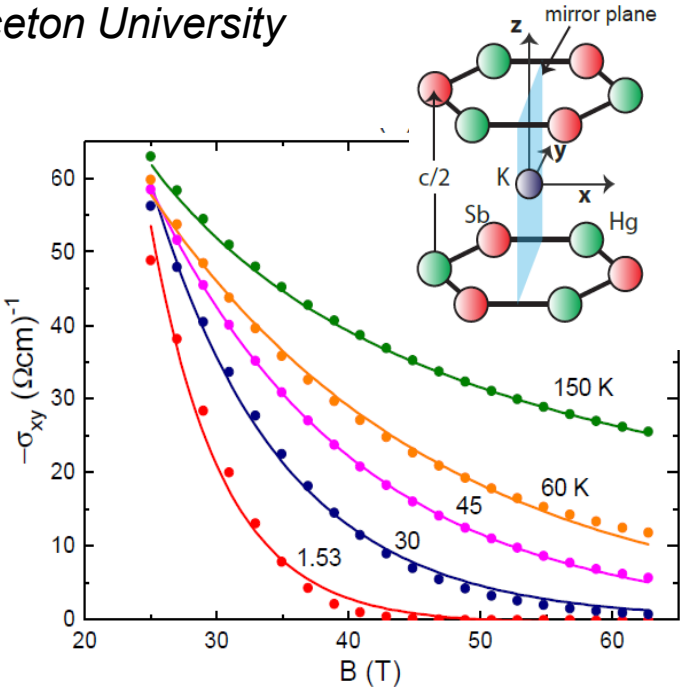

Figure 1. Curves of σ_{xy} vs. *B* at selected temperatures *T* in KHgSb. At the lowest *T* (red curve), σ_{xy} remains pinned to zero from 40 to 63 T. Inset shows the crystal lattice of KHgSb.

1. S. Liang, S. Kushwaha, T. Gao, *et al.*, *Nature Materials* (2019)
2. Z.J. Wang[1], A. Alexandradinata[1,2], R. J. **Cava**[1] and B. A. **Bernevig**[1], *Nature* **532**, 189 (2016).
[1]Princeton University, [2]Yale University

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