Topology and magnetism in the kagome lattice

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Recent theoretical developments suggest that the combination of unusual magnetism, spin-orbit coupling, and geometric frustration in Kagome metal possibly lead to a wide range of novel topological physics, such as fractional quantum Hall effect and intrinsic anomalous Hall effect. In these phenomena, a major role is played by the topologically nontrivial flat bands and massive Dirac cones, both of which are predicted to exist from the unique geometrical hopping pathways of Kagome lattice. Despite these predictions, the experimental band structure of Kagome compounds has long remained unreported.

In this talk, I will report on the experimental band structure of bilayer Kagome compound Fe_3Sn_2, measured by high-resolution angle-resolved photoemission spectroscopy. We clearly observe a pair of quasi-2D Dirac cones near the Fermi level, with a 30 meV spin-orbit gap that serves as a singular source of Berry curvature. Combined with ferromagnetism in the Kagome plane, this fermiology supports the emergence of intrinsic anomalous Hall conductivity, unambiguously observed by transport measurement over a wide temperature range (0.6 K ~ 400 K). Thus, our experiments establish the first direct link between the electronic structure and emergent topological transport in a correlated Kagome metal.

References

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