Room-temperature anomalous planar Hall effect from topological nodal-lines in PtBi2

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Résumé

Geometric phase effects are at the origin of some of the most striking macroscopic signatures of
quantum effects. They are also deeply related to the classification of topological phases, which are
difficult to evidence experimentally at three dimensions as they coexist with trivial bulk states.
Here we report a new mechanism to induce strong non-compensated Berry curvature in Dirac-
nodal-line semimetals under infinitesimal external magnetic fields. We experimentally observe a
manifestation of this mechanism in the Weyl semimetal PtBi2, which was recently reported to host
intrinsically superconducting Fermi arcs. We observe a strong dissipative planar Hall effect and,
importantly, a non-dissipative anomalous planar Hall effect in PtBi2 nanostructures directly associ-
ated with non-compensated Berry curvature due to bulk Dirac nodal lines above the Fermi energy.
This effect is visible at magnetic fields as low as 3T and is robust up to room temperature. Our work
opens a new route to engineer strong Berry curvature in the large family of Dirac nodal line systems
and paves the way to find new materials coupling strong topological features to superconductivity.

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