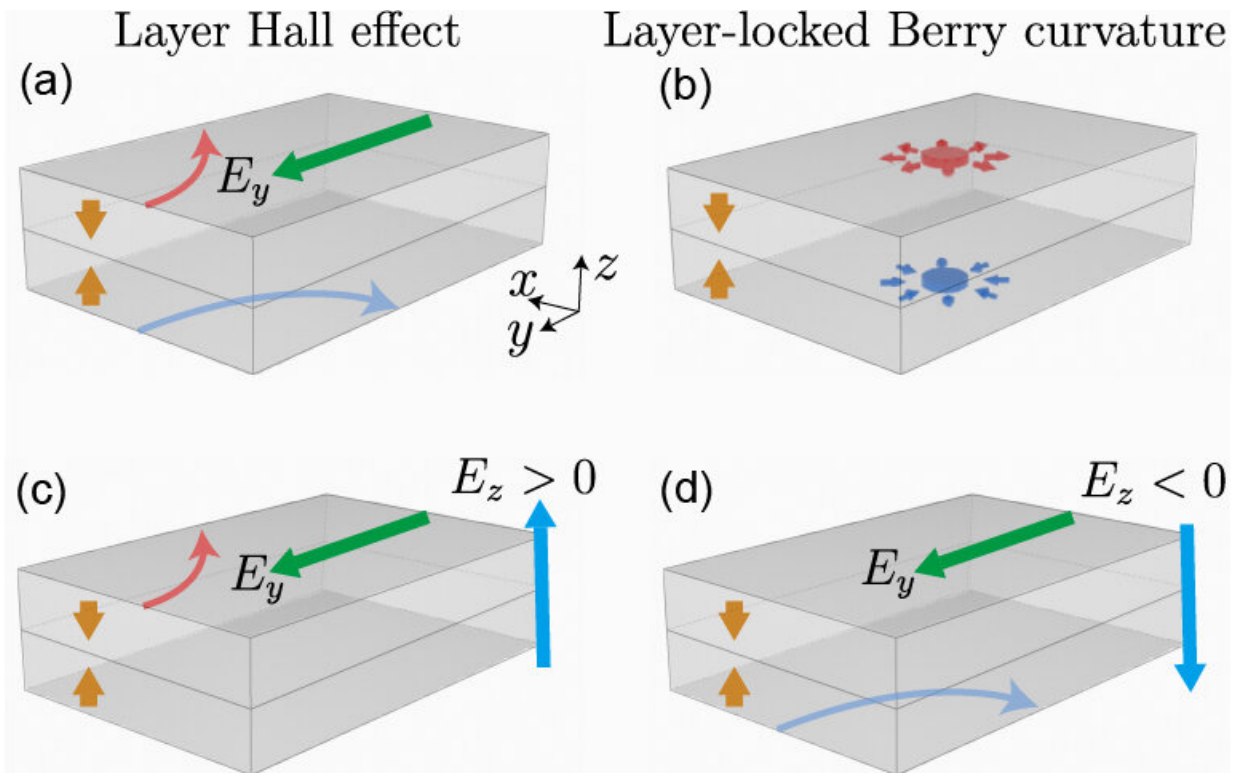


Layer Hall effect and hidden Berry curvature in antiferromagnetic insulators

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Schematics of the layer Hall effect (a) and layer-locked hidden Berry curvature (b) in a two-layer antiferromagnetic insulator. In the layer Hall effect, electrons are spontaneously deflected to opposite sides at different layers (the red and blue arrowed curves) due to the layer-locked hidden Berry curvature. (c)-(d) When a perpendicular electric field (the cyan arrow) is applied, the system shows layer-locked anomalous Hall effects tunable by the electric-field direction. The yellow arrows specify the antiferromagnetic configurations. The green arrows denote the in-plane electric field E_y for the Hall measurement. Credit: Science China Press

Every time a new Hall effect is discovered, a wave of research is inspired. The first experiment on a new type of Hall effect, the layer Hall effect, had been reported by Xu's group at Harvard University. In the layer Hall effect, electrons from the top and bottom layers are deflected in opposite directions and were measured by applying an out-of-plane electric field to break the PT symmetry, where P and T represent inversion symmetry and time-reversal symmetry, respectively.

The authors proposed a universal picture in terms of hidden Berry curvature for the layer Hall effect. They show that the existence of the layer Hall effect is irrelevant to the [electric field](#), which is similar to the valley/spin Hall effect. Therefore, they also proposed an alternative approach, the nonlocal measurement, to identify the layer Hall effect, without applying the electric field.

The authors revealed three distinct features to enhance the layer Hall effect in PT-symmetric antiferromagnetic insulators. Moreover, the authors proposed more material candidates for the layer Hall effect, which will inspire more experimental explorations. The hidden physics can be generalized to many degrees of freedom, including spin, orbital, and circular polarizations in the future.

The research was published in *National Science Review*, and the study was led by Prof. Hai-Zhou Lu and Prof. Qihang Liu (Shenzhen Institute for Quantum Science and Engineering and Department of Physics, Southern University of Science and Technology).

More information: Rui Chen et al, Layer Hall effect induced by hidden Berry curvature in antiferromagnetic insulators, *National Science Review* (2022). [DOI: 10.1093/nsr/nwac140](https://doi.org/10.1093/nsr/nwac140)

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