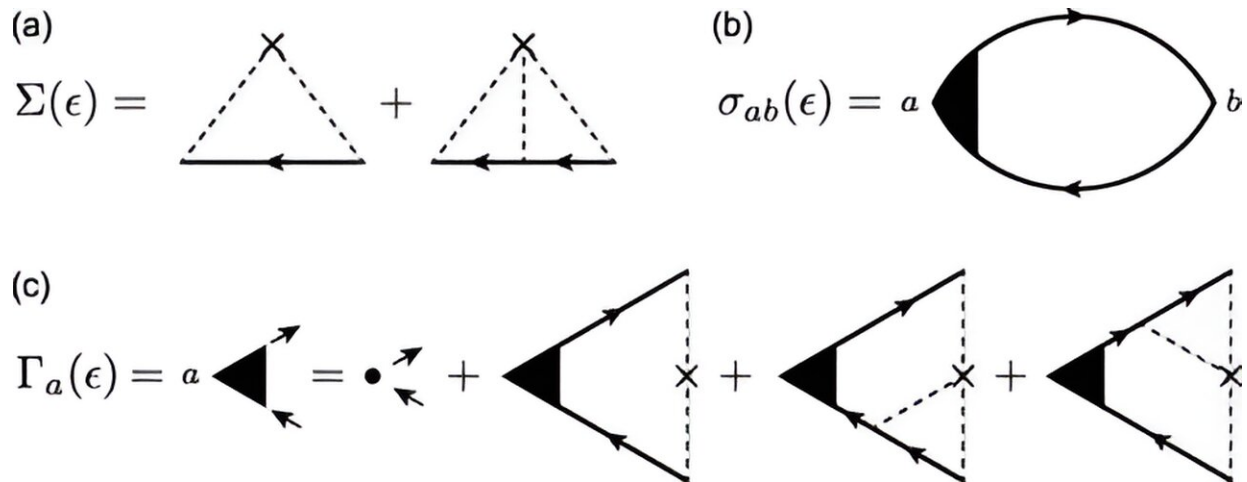


Quantum question about the anomalous Hall effect answered

August 17 2023



Diagrammatic representations for the conductivity. Credit: *Physical Review B* (2023). DOI: 10.1103/PhysRevB.107.L201116

A mysterious magnetic effect that causes the path that electrons take through a material to bend—called the anomalous Hall effect—has been elucidated in a new mathematical analysis by two RIKEN physicists. Their work has been published in the journal *Physical Review B*.

First discovered nearly a century and a half ago by American physicist Edwin Hall, the conventional Hall effect is a well-understood electrical and magnetic phenomenon. When just an [electric field](#) is applied to a conducting material, the electrons will move in a straight line that is

parallel to that field. But when a [magnetic field](#) is added too, it causes the electrons' path to curve.

The anomalous Hall effect is a related phenomenon that happens in some magnetic materials. In this case, no [external magnetic field](#) needs to be applied since the material supplies the magnetic field.

But the cause of the anomalous Hall effect seems to vary between materials. "The difficulty is that there are many possible mechanisms but no unifying explanation," says Hiroki Isobe of the RIKEN Center for Emergent Matter Science, who co-authored the analysis with RIKEN colleague Naoto Nagaosa. "This makes it very complicated, even for specialists."

More information: Hiroki Isobe et al, Anomalous Hall effect from a non-Hermitian viewpoint, *Physical Review B* (2023). [DOI: 10.1103/PhysRevB.107.L201116](#)

Provided by RIKEN

Citation: Quantum question about the anomalous Hall effect answered (2023, August 17) retrieved 28 April 2024 from <https://phys.org/news/2023-08-quantum-anomalous-hall-effect.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--