New study reveals topological charge-entropy relation in kagome Chern magnet
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Topological charge-entropy scaling in kagome Chern magnet TbMn$_6$Sn$_6$. Credit: Xu Xitong

RMn$_6$Sn$_6$ (R=rare earth element) is a new family of topological magnets. The pure Mn kagome lattice they hosted enabled a modelized study on its quantum transport.

In this research, motivated by their advance in rare-earth engineering of the Chern gap in this material family, the team carried out comprehensive studies of electric, thermal and thermoelectric transport in TbMn$_6$Sn$_6$.

They found that all known measurable bulk crystal quantum transport processes, including angular quantum oscillations, anomalous Hall, anomalous Nernst, and anomalous thermal Hall effect, could be described by a simple yet fundamental Chern-gapped Dirac model, which was unprecedented in any known quantum material.

In particular, they discovered for the first time a topological charge-entropy scaling relation that goes well beyond the conventional electron behavior expected by the Mott relation and Wiedemann-Franz law.

"This could have vast implications," said Dr. Xu Xitong, first author of the study, "this points to a direct transport visualization of Chern gapped Dirac fermions, and has the potential to become a seminal work in understanding the quantum transport in topological magnets."


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