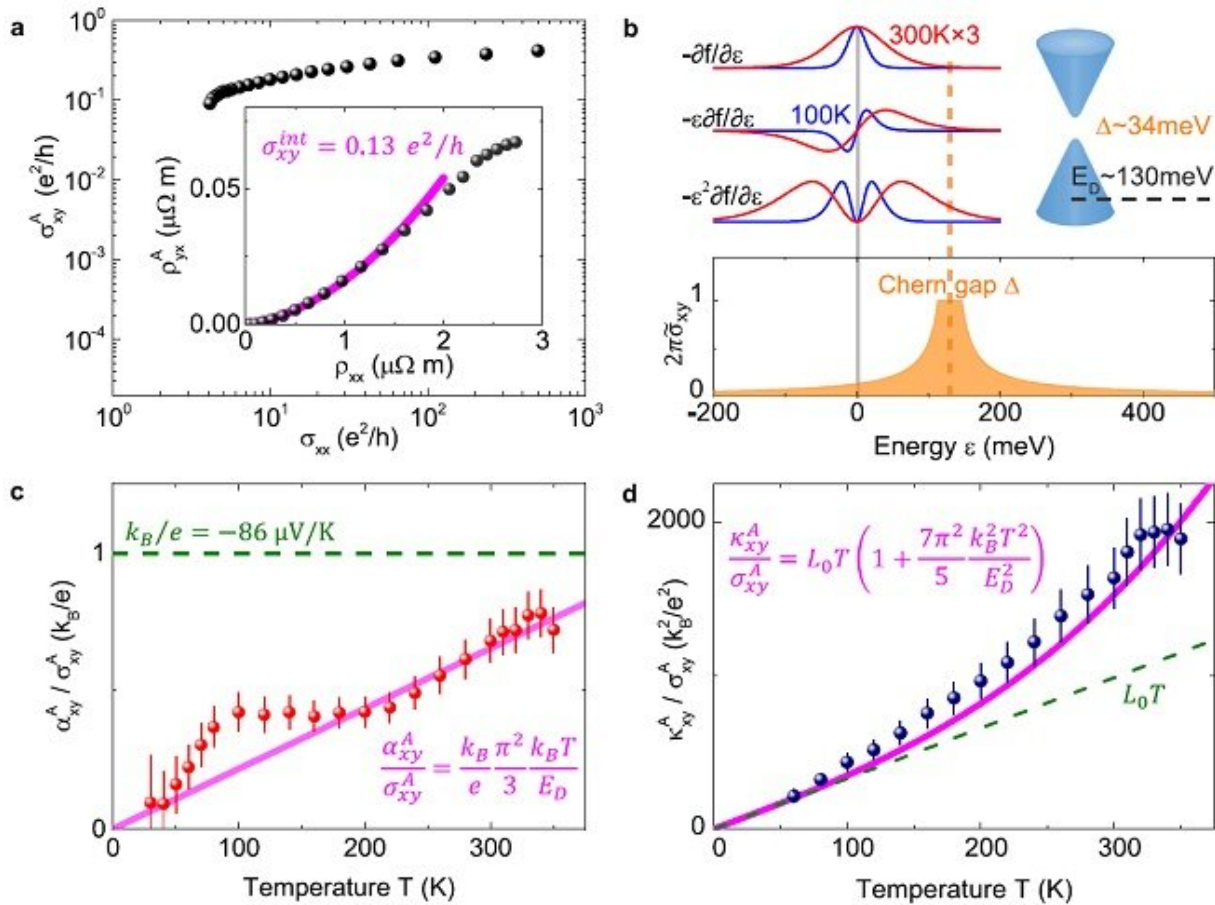


New study reveals topological charge-entropy relation in kagome Chern magnet

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Topological charge-entropy scaling in kagome Chern magnet $TbMn_6Sn_6$. Credit: Xu Xitong

Topological charge-entropy scaling relation was proved in the kagome

Chern magnet, a kind of magnet predicted to support intrinsic Chern quantum phases, according to a study published on *Nature Communications*.

This [research](#) was conducted by a collaborated team led by Prof. Qu Zhe from the Hefei Institutes of Physical Science (HFIPS) of the Chinese Academy of Sciences and Prof. Jia Shuang from Peking University. According to Prof. Qu, this study has promoted understanding on the transport properties of magnetic topological materials.

Magnetic topological materials have become a research hotspot because of their potential to realize a variety of new quantum states. However, the basic description of how electrons conduct electricity and heat, namely the relationship between charge and entropy, remains elusive due to the complexity of the quantum fields generated by topological quasiparticles.

RMn_6Sn_6 (R=[rare earth element](#)) is a new family of topological magnets. The pure Mn kagome lattice they hosted enabled a modeled 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_6Sn_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."

More information: Xitong Xu et al, Topological charge-entropy scaling in kagome Chern magnet TbMn₆Sn₆, *Nature Communications* (2022). [DOI: 10.1038/s41467-022-28796-6](https://doi.org/10.1038/s41467-022-28796-6)

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