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Universal Hall Response with Strongly Interacting Fermions

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The Hall effect, originating from the motion of charged particles in magnetic fields, has deep consequences for the description of materials, extending far beyond condensed matter where it was initially observed.

Understanding such an effect in interacting systems represents a formidable challenge, even for small magnetic fields.

Using an atomic quantum simulator where the motion of ultracold fermions in two-leg ribbons threaded by artificial magnetic fields can be tracked, we measure [1], through controllable quench dynamics, the Hall response for a range of synthetic tunneling and atomic interaction strength. We unveil a universal interaction-independent behavior above an interaction threshold, in agreement with theoretical analyses [2,3].

[1] T.-W. Zhou, G. Cappellini, D. Tusi, L. Franchi, J. Parravicini, C. Repellin, S. Greschner, M. Inguscio, T. Giamarchi , M. Filippone, J. Catani, and L. Fallani arXiv:2205.13567 , to be published in Science (2023).
[2] S. Greschner, M. Filippone, and T. Giamarchi
Phys. Rev. Lett. 122, 083402 (2019) -
[3] M. Buser, S. Greschner, U. Schollwöck, and T. Giamarchi Phys. Rev. Lett. 126, 030501 (2021)

Primary author: GIAMARCHI, Thierry (University of Geneva)

Co-authors: ZHOU, T.-W.; CAPPELLINI, G.; TUSI, D.; FRANCHI, L.; PARRAVICINI, J.; REPELLIN, C.; GRESCHNER, S.; INGUSCIO, M.; FILIPPONE, M.; CATANI, J.; FALLANI, L.

Presenter: GIAMARCHI, Thierry (University of Geneva)

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