

# Observation of fractional charges via anyon-trions

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## Abstract

Fractionalization of the electron charge is one of the most striking phenomena arising from strong electron-electron interactions. A celebrated example is the emergence of anyons with fractionally charged excitations in fractional quantum Hall effect (FQH) states. Recently, fractional quantum anomalous Hall effect (FQAH), a lattice analog of the FQH realized at zero magnetic field, has been demonstrated (1). FQAH provides a unique platform to investigate anyons, yet their detection remains a challenge. In this talk, I will first present transport measurements that establish FQAH in twisted MoTe<sub>2</sub> bilayer (1-2). I will then show how  $\sim 1$  eV photons can be used to probe fractional excitations that are three orders of magnitude lower in energy (3). The results include observation of an abundant Jain sequence of fractional states and a new type of quasi-particle complex, anyon-trions (4). Observation of the FQAH and associated phenomena pave the way for exploring charge fractionalization and anyonic physics at zero magnetic field.

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## References

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- [1] Observation of Fractionally Quantized Anomalous Hall Effect, Heonjoon Park, et al, *Nature* 622, 74 (2023);
- [2] Observation of dissipationless fractional Chern insulator, Heonjoon Park, et al, *Nature Physics* <https://doi.org/10.1038/s41567-025-03167-2> (2026).
- [3] Signatures of Fractional Quantum Anomalous Hall States in Twisted MoTe<sub>2</sub> Bilayer, Jiaqi Cai et al, *Nature* 622, 63 (2023);
- [4] Signatures of fractional charges via anyon-trions in twisted MoTe<sub>2</sub>, Weijie Li et al, *Nature* <https://doi.org/10.1038/s41586-026-10101-w> (2026)