

Unconventional Integer and Fractional Chern Insulators in High Chern Number Flatbands

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Abstract

Moiré flatbands with high Chern numbers ($C > 1$) offer opportunities to study the fractional quantum anomalous Hall effects that could go beyond the Landau level paradigm with $C = 1$; however, it remain unexplored. Here, we design a new moiré system with high Chern number flatbands, i.e. twisted rhombohedral trilayer-bilayer graphene (tRTBG) [1], and observe Chern insulators with quantized anomalous Hall effects ($C = 3$) at both $\nu = 1$ and $\nu = 3$. In particular, by fractionally filling the high Chern number flat band, we observe fractional quantum anomalous Hall effects (fQAHE) with $C = -6/5$ at $\nu = 12/5$ [1]. Our results demonstrate the tRTBG as a novel platform for hosting unconventional correlated topology in the ultra-strong correlated regime that is beyond the paradigm of the fractional phases with $C < 1$.

References

- [1] J. Dong, et al., Observation of integer and fractional Chern insulators in high Chern number flatbands, arXiv: arXiv:2507.09908 (2025).

Figures

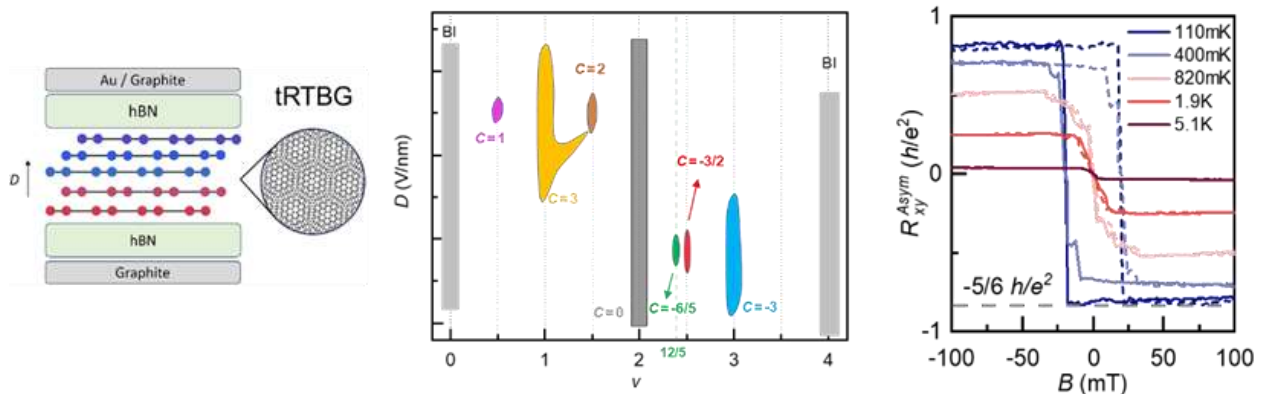


Figure 1: Device structure, phase diagram, and the fQAHE with $C = -6/5$ at $\nu = 12/5$