A gate-tunable quantum Hall interferometer in graphene

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In the quantum Hall regime, current is carried by 1D chiral edge channels that are prototypical systems to perform electron interferometry experiments using quantum point contacts (QPC) acting as beamsplitters. Such experiments were successfully investigated in semiconductors heterostructures in the last decades. They have revealed exciting properties of charge carriers in both integer and fractional quantum Hall regime as well as intriguing interaction phenomena. High mobility monolayer graphene heterostructures have shown to exhibit a rich quantum Hall physics owing to the additional valley degree of freedom. Performing quantum Hall interferometry in these systems, however, have long been challenging due to the difficulty to realize QPC arising from the gapless band structure of monolayer graphene. Recently, we demonstrated that using a split gate in high mobility encapsulated monolayer graphene heterostructures one can create a gate-tunable QPC operating both in the integer and fractional quantum Hall regime. [1] Using this key building block, we fabricate a split-gate defined quantum Hall Fabry-Pérot interferometer operating in the Aharonov-Bohm regime in graphene and demonstrate that it offers a new and versatile tool for in-depth study of coherent transport and electron quantum optics in graphene heterostructures.

References

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