Observation and applications of non-Hermitian topology in a multi-terminal quantum Hall device

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One of the simplest examples of non-Hermitian topology is encountered in the Hatano-Nelson (HN) model, a one-dimensional chain where the hopping in one direction is larger than in the opposite direction. We present here the first experimental observation of non-Hermitian topology in a quantum condensed-matter system. The measurements are done in a multi-terminal quantum Hall device etched in a high mobility GaAs/AlGaAs two-dimensional electron gas ring (Fig. 1). The conductance matrix that connects the currents flowing from the active contacts to the ground with the voltage of the active contacts is topologically equivalent to the HN Hamiltonian.

In our device, we directly measure and evidence the non-Hermitian skin effect. We also compute for our experimental device two topological invariants that are found to be more robust than the Chern number. We finally use the unique properties of our system and continuously tune the system configuration between open and periodic boundary conditions [1].

In this talk, we present the latest developments with regard to the application of the devices with these topological properties.

References

[1] K. Ochkan *et al.*, Observation of non-Hermitian topology in a multi-terminal quantum Hall device (under review at Nature Physics)

Figures

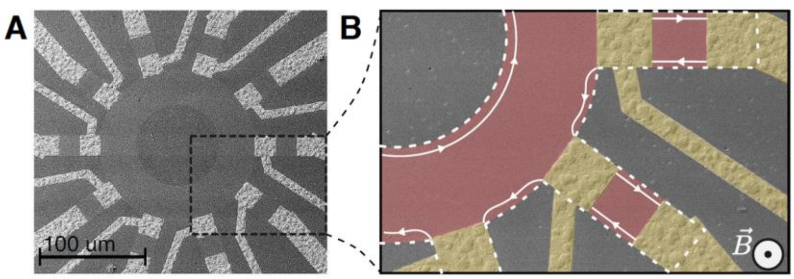

Figure 1: (**A**) Scanning electron microscopy (SEM) image of the AlGaAs 2DEG device. (**B**) Zoomed-in false-color SEM image. White lines indicate the edge quantum Hall states in the presence of a perpendicular magnetic field at filling factor v = 1. The 2DEG and ohmic contacts are highlighted in red and yellow, respectively. White dashed lines show the boundaries of the 2DEG.