Universal edge currents in interacting $2d$ topological insulators

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Abstract: Two-dimensional quantum systems display remarkable transport properties. The paradigmatic example is the integer quantum Hall effect: the bulk transverse conductivity of gapped quantum systems exposed to strong magnetic fields only takes quantized values. A dual aspect of the quantization of bulk transport is the emergence of gapless edge modes, carrying dissipationless edge currents. This phenomenon is called the bulk-edge correspondence. The last decade witnessed important mathematical progress in the understanding of the quantization of the bulk Hall conductivity for many-body quantum systems. In contrast, much less is known about the bulk-edge duality, beyond the single-particle approximation.

In this talk, I will present a theorem establishing the bulk-edge correspondence for a class of two-dimensional many-body quantum systems, displaying single-mode edge currents. Our result provides the first rigorous justification of the celebrated chiral Luttinger liquid theory of quantum Hall edge states. If time permits, the extension to interacting time-reversal invariant systems will also be discussed.

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