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Exploring the possibility of Universal Edge Physics in the Fractional Quantum Hall States[1] ZI-XIANG HU, RAVIN BHATT, XIN WAN, Princeton University, KUN YANG, Florida State University — The edge of a fractional quantum Hall (FQH) droplet is described by the chiral Luttinger liquid theory which predicts a universal power-law behavior in the current-voltage (I-V) characteristics when electrons tunneling into the FQH edge through a barrier, e.g., from a three-dimensional Fermi liquid. However, this university has not been unambiguously observed in transport experiments in two-dimensional electron gases based on GaAs/GaAlAs heterostructures or quantum wells. One plausible cause is reconstruction of the fractional quantum Hall edge, which introduces non-chiral edge modes. The coupling between counterpropagating edge modes can modify the exponent of the I-V characteristics. By comparing the fractional quantum Hall states at the filling factor $\nu = 1/3$ in modulation-doped semiconductor devices and in graphene devices, we show that the GaAs-based FQH experiments are always in the edge reconstruction regime, whereas graphene-based systems have an experimental accessible parameter region where edge reconstruction can be avoided. This regime offers the possibility of the exploration of the universal edge tunneling exponent predicted by the chiral Luttinger liquid theory.

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