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Symmetry protected Luttinger liquids on the surface of Quantum Hall Nematics.

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Quantum Hall Ferromagnets are a unique platform to study the confluence of symmetry-broken order parameter and topological physics. Recent experiments by Feldman et al.[1] observe clear signatures of valley-polarized Quantum Hall Ferromagnets on the surface of Bi(111) in the presence of strong magnetic fields. The tunneling conductance shows a discrete spectrum indicating the formation of Landau levels while individual nematic Landau level orbits pinned to impurities indicate selective occupation of certain valleys. Further recent experiments[2] observe domain wall states between such nematic domains. Curiously, these domain walls appear to host low energy excitations that appear to be gapped/gapless depending on the filling fraction of the nematic quantum Hall states. We explain[3] these observations both qualitatively and quantitatively by highlighting the role of interactions and symmetries in engendering such exotic Luttinger liquids.

[1] B. Feldman et al., Science 2016
[2] M. T. Randeria, KA et al., Nature 2019
[3] KA et al., ArXiv:1807.10293

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