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Superfluid-Insulator transition of quantum Hall domain walls in bilayer graphene[1] H.A. FERTIG, Indiana University, VICTORIA MAZO, CHIA-WEI HUANG, EFRAT SHIMSHONI, Bar Ilan University, SAM CARR, University of Kent — We consider the zero-filled quantum-Hall ferromagnetic state of bilayer graphene subject to a kink-like perpendicular electric field, which generates domain walls in the electronic state and low-energy collective modes confined to move along them. In particular, it is shown that two pairs of collective helical modes are formed at opposite sides of the kink, each pair consisting of modes with identical helicities. We derive an effective field theoretical model of these modes in terms of two weakly coupled anisotropic quantum spin-ladders, with parameters tunable through control of the electric and magnetic fields. This yields a rich phase diagram, where due to the helical nature of the modes, distinct phases possess very different charge conduction properties. Most notably, this system can potentially exhibit a transition from a superfluid to an insulating phase.

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