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Critical tunneling currents in disordered quantum hall bilayers at $\nu_{tot} = 1$[1] DMYTRO PESIN, ALLAN MACDONALD, The University of Texas at Austin, Austin, TX — Recent experiments on semiconductor Quantum Hall bilayers in the regime of $\nu_{tot} = 1$ give strong support for the existence of critical currents in tunneling experiments [L. Tiemann et al., Phys. Rev. B **80**, 165120 (2009)]. However, estimates [J. J. Su, A. H. MacDonald, in preparation] based on typical experimental parameters predict critical currents several orders of magnitude larger than those observed. In this work we argue that the presence of disorder dramatically affects the magnitude of the critical current. We propose that the relevant disorder stems from the presence of charged vortex-like excitations (merons) in the ground state of the system, and even a low-density of merons can degrade the critical current by a large factor. We discuss the role of thermal and quantum fluctuations in the present context. Finally, we show that in a disordered bilayer the parallel magnetic field dependence of the critical current deviates significantly from the naively expected Fraunhofer-type pattern. We argue the underlying physics may also be relevant to experimentally observed parallel magnetic field dependence of the zero-bias tunneling conductance peak [I. B. Spielman et al., Phys. Rev. Lett.**87**, 036803 (2001)].

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