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Theory of Activated Transport in Bilayer Quantum Hall Systems[1]
BAHMAN ROOSTAEI, University of Oklahoma, HERBERT FERTIG, Indiana University, KIERAN MULLEN, University of Oklahoma, STEVEN SIMON, Alcatel Lucent — We analyze the transport properties of bilayer quantum Hall systems at total filling factor $\nu = 1$ in drag geometries as a function of interlayer bias, in the limit where the disorder is sufficiently strong to unbind meron-antimeron pairs, the charged topological defects of the system. We compute the typical energy barrier for these objects to cross incompressible regions within the disordered system using a Hartree-Fock approach, and show how this leads to multiple activation energies when the system is biased. We then demonstrate using a bosonic Chern- Simons theory that in drag geometries, current in a single layer directly leads to forces on only two of the four types of merons, inducing dissipation only in the drive layer. Dissipation in the drag layer results from interactions among the merons, resulting in very different temperature dependences for the drag and drive layers, in qualitative agreement with experiment. We conclude with predictions for future experiments.

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