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Parafermion supporting platform based on ferromagnetic transitions in the fractional quantum Hall effect regime TAILUNG WU, ALEKSANDR KAZAKOV, Department of Physics and Birck Nanotechnology Center, Purdue University, KENNETH WEST, LOREN PFEIFFER, Department of Electrical Engineering, Princeton University, LEONID ROKHINSON, ZHONG WAN, Department of Physics and Birck Nanotechnology Center, Purdue University — Promise of fault tolerant quantum computing sparked research in Majorana excitations, yet their rotational symmetry group is not dense enough to allow universal qubit operations. Formation of higher order non-Abelian excitations requires even more complex system compared to the challenging task to support Majorana fermions: addition of strong interactions that fractionalize charge excitations. We propose a new platform based on ferromagnetic transitions in the fractional quantum Hall effect regime, where superconductivity induced in helical domain walls should support parafermion excitations. In this work we will present results on gate control of ferromagnetic transitions at filling factor $\nu = 2/3$ and deterministic formation of domain walls (DWs) in multi-gate devices. Transport characteristics of domain walls and their length dependence will be discussed. Reconfigurable network of such DWs, couple to superconducting contacts, can be used to demonstrate non-Abelian statistics of parafermionic excitations and realize topological qubits.

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