Formation of helical channels in quantum Hall effect regime

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Development of a two-dimensional systems with reconfigurable one-dimensional topological superconductor channels became primary direction in experimental branch of Majorana physics. Such systems should allow to probe and confirm non-Abelian properties of Majorana quasiparticles and realize the ultimate goal of Majorana research - topological qubit for topologically protected quantum computations. I will describe development of a new platform based on spin transitions in integer and fractional quantum Hall effect regime, where reconfigurable network of helical domain walls can be defined using electrostatic gates. Such domain walls are formed from two counter-propagating chiral edge channels with opposite spin polarization. Theoretically, if superconductivity is induced into such domain walls from an s-wave superconductor, Majorana fermions or higher order parafermions can be formed at the boundary of topologically trivial and non-trivial phases in integer and fractional quantum Hall effect regimes respectively.

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