Abstract Submitted
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Topological qubits in graphene-like systems LUIZ SANTOS, Dept. of Physics, Harvard University, SHINSEI RYU, Dept. of Physics, U.C. Berkeley, CLAUDIO CHAMON, Physics Dept., Boston University, CHRISTOPHER MUDRY, CMT group, Paul Scherrer Institute, Switzerland — The fermion-doubling problem can be an obstacle to getting half-a-qubit in two-dimensional fermionic tight-binding models in the form of Majorana zero modes bound to the core of superconducting vortices. We argue that the number of such Majorana zero modes is determined by a $Z_2 \times Z_2$ topological charge for a family of two-dimensional fermionic tight-binding models ranging from noncentrosymmetric materials to graphene. This charge depends on the dimension of the representation (i.e., the number of species of Dirac fermions – where the doubling problem enters) and the parity of the Chern number induced by breaking time-reversal symmetry. We show that in graphene there are as many as 10 order parameters that can be used in groups of 4 to change the topological number from even to odd.

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