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Non-abelian topological phases and unconventional criticality in a model of interacting anyons CHARLOTTE GILS, ETH Zurich, SIMON TREBST, Microsoft Research, Station Q, MATTHIAS TROYER, ETH Zurich, ANDREAS LUDWIG, UC Santa Barbara, ALEXEI KITAEV, Caltech — Non-abelian topological phases have recently attracted considerable interest in the context of fault-tolerant quantum computation. However, such phases have only been established in a small set of microscopic models, one of which involves interacting spin-1/2 degrees of freedom on a honeycomb lattice (Levin, Wen 2005). In particular, this model supports quasiparticle excitations that can be described as so-called Fibonacci anyons. We have reformulated this model in terms of anyonic degrees of freedom and consider the case of interacting anyonic quasiparticles by adding a magnetic field term to the Hamiltonian. Our analysis of a quasi-one-dimensional ladder model not only shows the (extended) stability of the topological phase when perturbed by such local terms, but also demonstrates the role of topology in determining the exact nature of these phases. Interestingly, the magnetic field can drive a phase transition between two distinct topological phases. Numerically, we establish that this critical point can be described by a conformal field theory with central charge c=14/15. This observation has lead to an analytical understanding of this critical point which can be mapped to an exactly solvable transfer matrix representation in terms of a restricted-solid-on-solid (RSOS) model.

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