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Self-Organized Topological State with Majorana Fermions MOHAMMAD VAZIFEH, MARCEL FRANZ, The University of British Columbia — A topological superconductor phase with a pair of localized spatially separated Majorana fermions can be achieved in semiconductor wires with strong spin-orbit interactions, however, it requires subtle fine tuning of the chemical potential of the order of 1meV. This makes it difficult to access the desired topological phase in experiments. We find that, remarkably, this fine tuning is not required for a magnetic chain of adatoms placed on top of an s-wave superconductor. Using a simple model, we show that for a wide range of the chemical potential the magnetic moments self-organize into a spiral state with a wave-vector that corresponds to the perfect configuration to achieve the topological superconductor phase for electrons. The local coupling between magnetic moments and electronic spins effectively plays the role of the spin-orbit interaction required for the topological phase and the phase remains stable against spin fluctuations at experimentally accessible temperatures.

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