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Topological Superconductivity in Ferromagnetic Metal Chains: Part I JIAN LI, Princeton University, HUA CHEN, University of Texas at Austin, ILYA DROZDOV, ALI YAZDANI, BOGDAN BERNEVIG, Princeton University, ALLAN MACDONALD, University of Texas at Austin — Recent experiments have demonstrated superconductivity induced in ferromagnetic atomic chains as a new route to the research of Majorana physics. In this talk we discuss the theory behind these experiments. We will first present a generic picture for how superconductivity is induced in ferromagnetic metal chains through coupling to a superconductor with strong spin-orbit coupling, and explain why this hybrid system is a plausible new platform in searching for topological superconductivity. We will then present a tight-binding model associated with the existing experiments. We reveal a new chain magnetic symmetry that is able to stabilize multiple Majorana end modes in the absence of disorder, resulting in a one-dimensional crystalline topological superconductor. We show phase diagrams in terms of such topological phases and point out their relevance to the existing experiments. In the last part of this talk we will briefly discuss some other directions of research based on the new platform, including braiding Majorana quasi-particles in ferromagnetic chains, as well as realizing topological superconductivity in two-dimensional ferromagnetic thin films.

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