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Detecting 3d Non-Abelian Anyons via Adiabatic Cooling SEIJI YAMAMOTO, National High Magnetic Field Lab and FSU Dept of Physics, MICHAEL FREEDMAN, Microsoft Research, Station Q, KUN YANG, National High Magnetic Field Lab and FSU Dept of Physics — Majorana fermions lie at the heart of a number of recent developments in condensed matter physics. One important application is the realization of non-abelian statistics and consequently a foundation for topological quantum computation. Theoretical propositions for Majorana systems abound, but experimental detection has proven challenging. Most attempts involve interferometry, but the degeneracy of the anyon state can be leveraged to produce a cooling effect, as previously shown in 2d. We apply this method of anyon detection to the 3d anyon model of Teo and Kane. Like the Fu-Kane model, this involves a hybrid system of topological insulator (TI) and superconductor (SC). The Majorana modes are localized to anisotropic hedgehogs in the order parameter which appear at the TI-SC interface. The effective model bears some resemblance to the non-Abelian Higgs model with scalar coupling as studied, for example, by Jackiw and Rebbi. In order to make concrete estimates relevant to experiments, we use parameters appropriate to Ca doped Bi_2Se_3 as the topological insulator and Cu doped Bi_2Se_3 as the superconductor. We find a temperature window in the milli-Kelvin regime where the presence of 3d non-abelian anyons will lead to an observable cooling effect.

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