Angular-momentum-flavored Majorana zero modes

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The search for Majorana particles [1] is important both for fundamental understanding and possible topological quantum computation [2]. Since Majorana particles are an equal superposition of particle and antiparticle, they are naturally sought in superconductors, in the form of Majorana zero modes (MZMs). From Kitaev's seminal paper [3], the quest to engineer devices capable of hosting MZMs is still ongoing. The search for new compounds hosting robust MZMs, however, requires a deeper understanding of these states. Fu and Kane [4] showed that a MZM can emerge in the vortex-core states of an s-wave superconductor on top of a three-dimensional strong topological insulator (TI). We study a d+id superconductor placed on a TI (d+id + Dirac model) [5] and show that the vortex-core MZMs can carry a nontrivial angular momentum. This establishes new *flavors* of Majorana modes, independent of the Chern number and classified with respect to the windings of the order parameter and underlying normal state. Contextually, we assess the stability and topological protection of these MZMs, as well as possible experimental signatures. The possibility of having different flavors of MZMs opens new directions for advancing the study of Majorana modes.

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