Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Three-Dimensional Majorana Fermions in Chiral Superconductors[1] VLADYSLAV KOZII, JORN VENDERBOS , LIANG FU, Massachusetts Institute of Technology — Through a systematic symmetry and topology analysis we establish that three-dimensional chiral superconductors with strong spin-orbit coupling and odd-parity pairing generically host low-energy nodal quasiparticles that are spin-non-degenerate and realize Majorana fermions in three dimensions. By examining all types of chiral Cooper pairs with total angular momentum J formed by Bloch electrons with angular momentum j in crystals, we obtain a comprehensive classification of gapless Majorana quasiparticles in terms of energy-momentum relation and location on the Fermi surface. We show that the existence of bulk Majorana fermions in the vicinity of spin-selective point nodes is rooted in the non-unitary nature of chiral pairing in spin-orbit-coupled superconductors. We address experimental signatures of Majorana fermions, and find that the nuclear magnetic resonance spin relaxation rate is significantly suppressed for nuclear spins polarized along the nodal direction as a consequence of the spin-selective Majorana nature of nodal quasiparticles. Furthermore, Majorana nodes in the bulk have nontrivial topology and imply the presence of Majorana bound states on the surface that form arcs in momentum space.

[1]This work is supported by DOE Office of Basic Energy Sciences, Division of Materials Sciences and Engineering under Award de-sc0010526 (LF and VK), and the Netherlands Organization for Scientific Research (NWO) through a Rubicon grant (JV).

Vladyslav Kozii
Massachusetts Institute of Technology

Date submitted: 10 Nov 2016 Electronic form version 1.4