Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Topological superfluids with finite-momentum pairing and Majorana fermions CHUNLEI QU, Department of Physics, The University of Texas at Dallas, ZHEN ZHENG, Key Laboratory of Quantum Information, University of Science and Technology of China, MING GONG, Department of Physics, The Chinese University of Hong Kong, YONG XU, LI MAO, Department of Physics, The University of Texas at Dallas, XUBO ZOU, GUANGCAN GUO, Key Laboratory of Quantum Information, University of Science and Technology of China, CHUANWEI ZHANG, Department of Physics, The University of Texas at Dallas — Majorana fermions (MFs), quantum particles that are their own antiparticles, are not only of fundamental importance in elementary particle physics and dark matter, but also building blocks for fault-tolerant quantum computation. Recently MFs have been intensively studied in solid state and cold atomic systems. These studies are generally based on superconducting pairing with zero total momentum. On the other hand, finite total momentum Cooper pairings, known as Fulde-Ferrell (FF) Larkin-Ovchinnikov (LO) states, were widely studied in many branches of physics. However, whether FF and LO superconductors can support MFs has not been explored. Here we show that MFs can exist in certain types of gapped FF states, yielding a new quantum matter: topological FF superfluids/superconductors. We demonstrate the existence of such topological FF superfluids and the associated MFs using spin-orbit-coupled degenerate Fermi gases and derive their parameter regions. The implementation of topological FF superconductors in semiconductor/superconductor heterostructures is also discussed.

Chunlei Qu
Univ of Texas, Dallas

Date submitted: 06 Nov 2013 Electronic form version 1.4