Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Superconducting Topological Surface States in Noncentrosymmetric Bulk Superconductor $PbTaSe_2$ TIEN-MING CHUANG, Institute of Physics, Academia Sinica, SYU-YOU GUAN, Department of Physics, National Taiwan University, PENG-JEN CHEN, Nano Science and Technology Program, Taiwan International Graduate Program, MING-WEN CHU, Center for Condensed Matter Sciences, National Taiwan University, RAMAN SANKAR, Institute of Physics, Academia Sinica, FANGCHENG CHOU, Center for Condensed Matter Sciences, National Taiwan University, HORNG-TAY JENG, Department of Physics, National Tsing Hua University, CHIA-SENG CHANG, Institute of Physics, Academia Sinica
— The search for topological superconductors (TSCs) is one of the most exciting problems in condensed matter systems. Within each vortex core of TSCs, there exist the zero energy Majorana bound states, which are predicted to exhibit non-Abelian statistics and to form the basis of the fault-tolerant quantum computation. So far, no stoichiometric bulk material exhibits the required topological surface states (TSSs) at E_F combined with fully gapped bulk superconductivity. Here, we report atomic scale visualization of the TSSs of the noncentrosymmetric superconductor, PbTaSe2. Our quasiparticle scattering interference imaging shows two TSSs with a Dirac point at E˜1.0eV, of which the inner TSS and partial outer TSS cross E_F, on the Pb-surface of this fully gapped superconductor. Our results reveal PbTaSe2 as a promising candidate as a TSC.

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Date submitted: 13 Nov 2016 Electronic form version 1.4