Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

From Normal Insulator to Topological Insulator in Plumbene
XIANG-LONG YU, JIANSHENG WU, South University of Science and Technology of China, Shenzhen — Plumbene, similar to silicene, has a buckled honeycomb structure with a larger band gap ($\sim$ 400 meV). However, all previous studies have shown that it is a normal insulator. Here, we perform first-principles calculations and employ a sixteen-band tight-binding model with nearest-neighbor and next-nearest-neighbor hopping terms to investigate electronic structures and topological properties of plumbene monolayer. We find that it can become a topological insulator with a large bulk gap ($\sim$ 200 meV) through electron doping, and the nontrivial state is very robust with respect to external strain. Plumbene can be an ideal candidate for realizing quantum spin Hall effect at room temperature. By investigating effects of external electric and magnetic fields on electronic structures and transport properties of plumbene, we present two rich phase diagrams with and without electron doping, and propose a theoretical design for a four-state spin-valley filter.

Jiansheng Wu
South University of Science and Technology of China, Shenzhen

Date submitted: 11 Nov 2016 Electronic form version 1.4