Experimental signature of topologically protected surface states in a new-type centrosymmetric superconductor PdBi2

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Topological superconductors (TSCs) is a novel quantum phase of matter characterized by a fully gapped bulk state and gapless boundary states hosting exotic Majorana fermions. [1] The prospect of harboring vortex confined Majorana zero mode (MZM) for potential applications in quantum computation has attracted considerable experimental research interest. Recently, topologically protected surface states in a centrosymmetric layered superconductor, β-$PdBi_2$ was confirmed by Sakano et al,[2] and the corresponding possible spin triplet superconducting phases were examined and reported by Sun et al. [3]

In this work, we demonstrate how high-quality $PdBi_2$ samples growing layer-by-layer to the bulk phase by molecular beam epitaxy (MBE) and measured the atomic and electronic structures by scanning tunnelling microscopy (STM) and angle-resolved photoemission spectroscopy (ARPES) for comparison with first principles calculations. As compared to the β-$PdBi_2$ bulk single crystal hosting a topologically protected surface Dirac cone band with the binding energy of the Dirac point around 2.4 eV below Fermi level. Our results shift the Dirac point up to ~1.1 eV is an important step towards realizing MBS in this robust system.

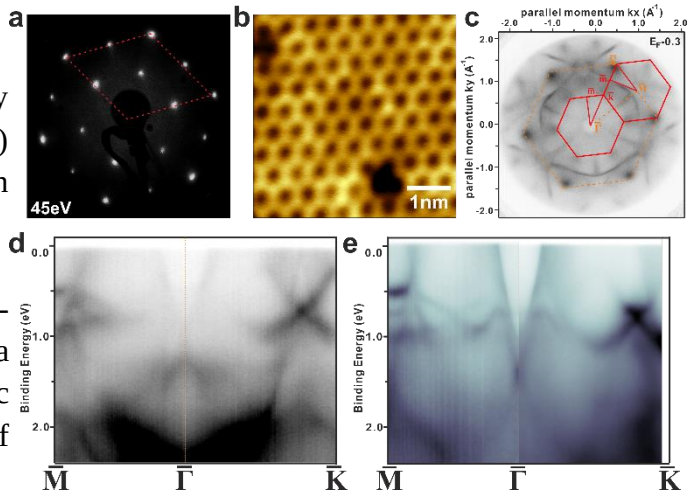

Figure 1. Epitaxial growth of $PdBi_2$ thin film(4 bilayer for (a-d) and 9 bilayer without Au background for (e)) on Au(111). **a**: (2x2)LEED pattern (45 eV). **b**: Atomic resolution STM image after Pd deposition. **c**: the constant energy contour cut at 0.3eV below Fermi level with the hexagonal surface Brillouin zones for Au(111)(yellow-dash) and $PdBi_2$ (red) thin film overlaid, respectively. **d-e**: band dispersions along Au(111) high-symmetry directions(yellow marks in (c)).

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[2] M. Sakano *et al*., Nat. Commun. **6**, 8595 (2015).
[3] Z. Sun et al., Nat. Commun. **6**, 6633 (2015).

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