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Weak Topological Insulators and Composite Weyl Semimetals: β-Bi_4X_4 (X=Br, I) FAN ZHANG, CHENG-CHENG LIU, Univ of Texas, Dallas, JIN-JIAN ZHOU, YUGUI YAO, Beijing Institute of Technology — While strong topological insulators (STI) have been experimentally realized soon after their theoretical predictions, a weak topological insulator (WTI) has yet to be unambiguously confirmed. A major obstacle is the lack of distinct natural cleavage surfaces to test the surface selective hallmark of WTI. With a new scheme, we discover that Bi_4X_4 (X=Br, I), stable or synthesized before, can be WTI with two natural cleavage surfaces, where two anisotropic Dirac cones stabilize and annihilate, respectively. We further find four surface state Lifshitz transitions under charge doping and two bulk topological phase transitions under uniaxial strain. Near the WTI-STI transition, there emerges a novel Weyl semimetal phase, in which the Fermi arcs generically appear at both cleavage surfaces whereas the Fermi circle only appears at one selected surface.

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