Strong and weak 2D topological superconductors with spin-orbit coupling

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We study pairing symmetries of superconducting states in a centrosymmetric system with quasi-one dimensional bands and spin-orbit coupling. When the spin-orbit coupling is weak, we mainly find even-parity pairing which is topologically trivial. When the spin-orbit coupling is (moderately) strong, the paring is dominantly p-wave, which is an odd-parity pairing. Depending on the interaction parameters, we find two different odd-parity pairing states. One has $p+ip$ pairing with nonzero strong topological invariants, which breaks time reversal symmetry and possesses gapless chiral Majorana modes. The other has $p+ip$ pairing for spin-up electrons but $p-ip$ pairing for spin-down electrons, which preserves time reversal symmetry and hosts nontrivial weak $Z_2$ topological invariants. In the weak topological superconductors, there are gapless modes associated with lattice dislocations. Possible applications to the recent discovered BiS-based superconductors will be discussed.