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Majorana Doublets, Flat Bands, and Dirac Nodes in s-Wave Superfluids HAIPING HU, FAN ZHANG, CHUANWEI ZHANG, Department of Physics, The University of Texas at Dallas, CONDENSED MATTER THEORY TEAM — Time-reversal-invariant topological superfluids are exotic states of matter possessing Majorana Kramers pairs (MKPs), yet their realizations have long been hindered by the requirement of unconventional pairing. We propose to realize such a topological superfluid by utilizing s-wave pairing and emergent symmetries in two coupled 1D ultracold atomic Fermi gases with spin-orbit coupling. By stacking such systems into 2D, we discover topological and Dirac-nodal superfluids hosting distinct MKP flat bands. We show that the MKPs and their flat bands are stable against pairing fluctuations that otherwise annihilate paired Majoranas. Exploiting new experimental developments, our scheme provides a unique platform for exploring MKPs and their applications in quantum computation.

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