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Topological superfluidity with repulsive fermionic atoms in optical superlattice[1] LEONID ISAEV, JOHANNES SCHACHENMAYER, JILA, NIST and Dept. of Physics, University of Colorado at Boulder, GERARDO ORTIZ, Dept. of Physics, Indiana University at Bloomington, ANA MARIA REY, JILA, NIST and Dept. of Physics, University of Colorado at Boulder — We present a novel route to fermionic superfluidity in repulsive systems, that employs local kinetic-energy fluctuations as a "pairing glue" between the fermions. In a system with two bands, one itinerant and one localized, we show how quantum fluctuations in the latter mediate an attractive interaction between the itinerant fermions. In the spin-polarized case, this mechanism gives rise to a topological p-wave superfluid state in 1D, and a chiral $p_x + \mathrm{i}p_y$ superfluid in 2D. We derive an effective low-energy model and demonstrate stability of these states against charge-density wave formation and phase separation. We also propose to observe this phenomenon with alkaline-earth atoms, e.g. Yb or Sr, in an optical superlattice, and discuss several probes for characterizing the topological superfluid state, including momentum-resolved RF spectroscopy and an analog of the Edelstein magneto-electric effect.

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