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Majorana fermions in alkaline-earth-like one-dimensional gases LEONARDO MAZZA, Ecole Normale Suprieure, Paris, FERNANDO IEMINI, ICTP, Trieste, Italy, LEONARDO FALLANI, LENS, Florence, Italy, PETER ZOLLER, IQOQI, Innsbruck, Austria, ROSARIO FAZIO, MARCELLO DALMONTE, ICTP, Trieste, Italy — We show how angular momentum conservation can stabilize a symmetry-protected quasi-topological phase of matter supporting Majorana quasi-particles as edge modes in a one-dimensional cold-atom gas. Differently from typical scenarios, where such quasi-particles require the presence of superconductivity, we investigate a number-conserving Hubbard model with spin and orbital degrees of freedom in the presence of spin-orbit coupling. The latter reduces the global spin symmetry to an angular momentum parity symmetry, which provides an extremely robust protection mechanism that does not rely on any coupling to additional models systems. The emergence of Majorana edge modes is elucidated using field theory techniques, and corroborated with advanced numerical simulations. Our results pave the way towards the observation of Majorana edge modes with alkaline-earth-like (Ytterbium) fermions in optical lattices, where the basic ingredients for our recipe - spin-orbit coupling and strong inter-orbital interactions - have been engineered and observed over the last two years.

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