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Synthetic p-wave interaction and topological superfluids in s-wave quantum gases HAN PU, Rice University, BIN WANG, ZHEN ZHENG, XUBO ZOU, GUANGCAN GUO, Univ. of Science and Techonoly of China — P-wave interaction in cold atoms may give rise to exotic topological superfluids. However, realization of p-wave interaction in cold atom system is experimentally challenging. Here we propose a simple scheme to synthesize effective p-wave interaction in conventional s-wave interacting quantum gases. The key idea is to load atoms into spin-dependent optical lattice potential. Using two concrete examples involving spin-1/2 fermions, we show how the original system can be mapped into a model describing spinless fermions with nearest neighbor p-wave interaction, whose ground state can be a topological superfluid that supports Majorana fermions under proper conditions. Our proposal has the advantage that it does not require spin-orbit coupling or loading atoms onto higher orbitals, which is the key in earlier proposals to synthesize effective p-wave interaction in s-wave quantum gases, and may provide a completely new route for realizing p-wave topological superfluids.

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