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Detecting π-phase superfluids with p-wave symmetry in a quasi-1D optical lattice[1] BO LIU, Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, PA 15260, USA, XIAOPENG LI, Condensed Matter Theory Center and Joint Quantum Institute, University of Maryland, College Park, MD 20742, USA, RANDALL G. HULET, Department of Physics and Astronomy and Rice Center for Quantum Materials, Rice University, Houston, TX 77005, USA, W. VINCENT LIU, Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, PA 15260 — We propose an experimental protocol to create a p-wave superfluid in a spin-polarized cold Fermi gas tuned by an s-wave Feshbach resonance. A crucial ingredient is to add an anisotropic 3D optical lattice and tune the fillings of two spins to the s and p band, respectively. The pairing order parameter is confirmed to inherit p-wave symmetry in its center-of-mass motion. We find that it can further develop into a state of unexpected π-phase modulation in a broad parameter regime. Experimental signatures are predicted in the momentum distributions, density of states and spatial densities for a realistic experimental setup. The π-phase p-wave superfluid is reminiscent of the π-state in superconductor-ferromagnet heterostructures but differs in symmetry and physical origin. The spatially-varying phases of the superfluid gap provide a novel approach to synthetic magnetic fields for neutral atoms. It would represent another example of p-wave pairing, first discovered in He-3 liquids.

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