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Engineering Superfluidity in Bose-Fermi Mixtures of Ultracold Atoms[1] D.-W. WANG, M.D. LUKIN, E. DEMLER, Physics Department, Harvard University, Cambridge, MA — We investigate many-body phase diagrams of atomic boson-fermion mixtures loaded in the two-dimensional optical lattice. Bosons mediate an attractive, finite-range interaction between fermions, leading to fermion pairing phases of different orbital symmetries. Specifically, we show that by properly tuning atomic and lattice parameters it is possible to create superfluids with s-, p-, and d-wave pairing symmetry as well as spin and charge density wave phases. These phases and their stability are analyzed within the mean-field approximation for systems of ^{40}K-^{87}Rb and ^{40}K-^{23}Na mixtures. For the experimentally accessible regime of parameters, superfluids with unconventional fermion pairing have transition temperature around a percent of the Fermi energy.

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