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Pairing and density-wave phases in Fermion-Boson mixtures at fixed filling FILIPPOS KLIRONOMOS, SHAN-WEN TSAI, University of California, Riverside — We study a mixture of fermionic and bosonic cold atoms on a two-dimensional optical lattice, where the fermions are prepared in two hyperfine (isospin) states and the bosons have Bose-Einstein condensed (BEC). The coupling between the fermionic atoms and the bosonic fluctuations of the BEC has similarities with electron-phonon couplings in crystals. We study the phase diagram for this system at fixed fermion density of one per site (half-filling). We find that tuning of the lattice parameters and interaction strengths (for fermion-fermion, fermion-boson and boson-boson interactions) drives the system to undergo antiferromagnetic ordering, s-wave and d-wave pairing superconductivity or a charge density wave phase. We use functional renormalization group analysis where retardation effects are fully taken into account by keeping the frequency dependence of the the interaction vertices and self-energies. We calculate response functions and also provide estimates of the energy gap associated with the dominant order, and how it depends on different parameters of the problem.

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