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Unusual robust phase coherence in a coupled boson-fermion system[1] MACIEJ MASKA, Institute of Physics, University of Silesia, NANDINI TRIVEDI, The Ohio State University — We consider a coupled boson-fermion model in two dimensions, that describes itinerant fermions hybridizing with localized bosons composed of pairs of tightly bound opposite-spin fermions. We trace out the fermionic degrees of freedom and perform a Monte Carlo simulation for the effective classical Hamiltonian of boson phases. We find that the fermions not only generate an effective long-range temperature-dependent boson-boson coupling that generates a finite phase stiffness, but remarkably the phase stiffness is considerably more robust than that described by the XY model. Our analysis further shows that the inter-vortex interaction in the effective model is a power law rather than logarithmic as in the XY model. As one of the possible explanations for this persistent phase stiffness we consider the long range Berry phases carried by the itinerant fermions. Our results are relevant for resonance superfluids in the BCS-BEC crossover regime and also certain aspects of the high temperature superconductivity.

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