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Competing Orders in a Dipolar Bose - Fermi Mixture on a Square Optical Lattice: Mean-Field Perspective[1] HONG LING, Department of Physics and Astronomy, Rowan University, Glassboro, NJ 08028, USA, JASEN SCARAMAAZZA, Department of Physics and Astronomy, Rutgers University, Piscataway, NJ 08854, USA, BEN KAIN, Department of Physics, College of the Holy Cross, Worcester, Massachusetts 01610, USA — We study superfluid pairings of two-component fermions interacting by exchanging virtual phonons of a dipolar condensate in an optical lattice that preserves the symmetry of D4. We construct, within the Hartree-Fock-Bogoliubov theory, the matrix representation of the linearized gap equation in the irreducible representations of D4. We find that each matrix element, which is a four-dimensional (4D) integral in momentum space, can be put in a separable form involving a 1D integral, which is only a function of temperature and the chemical potential, and a pairing-specific "effective" interaction, which is an analytical function of the parameters that characterize Fermi-Fermi interactions. We analyze the critical temperatures of various competing orders (superfluids with s-, $d_{x^2-y^2}$-, d_{xy}-, and g-wave symmetries and density waves) as functions of different system parameters in both the absence and presence of the dipolar interaction. We find that tuning a dipolar interaction can dramatically enhance various unconventional pairings.

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