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P-wave superfluid in a quasi-two-dimensional dipolar Bose-Fermi quantum gas mixture[1] BEN KAIN, College of the Holy Cross, HONG LING, Rowan University — The p-wave ($p_x + ip_y$) superfluid has attracted significant attention in recent years mainly because its vortex core supports a Majorana fermion which, due to its non-Abelian statistics, can be explored for implementing topological quantum computation (TQC). Mixing in bosons may lead to p-wave pairing in a Fermi gas. In a dipolar condensate, the dipole-dipole interaction represents a control knob inaccessible to nondipolar Bosons. Thus, mixing dipolar bosons with fermions opens up new possibilities. We consider a mixture of a spin-polarized Fermi gas and a dipolar Bose-Einstein condensate in a quasi-two-dimensional trap setting. We take the Hartree-Fock-Bogoliubov mean-field approach and develop a theory for studying the stability of the mixture and estimating the critical temperature of the p-wave superfluid. We use this theory to identify the experimentally accessible parameter space in which the mixture is stable against phase separation and the p-wave superfluid pairing can be resonantly enhanced. An enhanced p-wave superfluid order parameter can make the fault tolerant TQC less susceptible to thermal fluctuations. This work aims to stimulate experimental activity in creating dipolar Bose-Fermi mixtures.

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