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Emergence of unconventional spin density waves in dipolar Fermi gases S. G. BHONGALE, George Mason University, LUDWIG MATHEY, University of Hamburg, SHAN-WEN TSAI, University of California, Riverside, CHARLES W. CLARK, NIST, JQI, and University of Maryland, ERHAI ZHAO, George Mason University — Motivated by experiments on Fermi gases of dipolar molecules and dysprosium, we study the competing quantum phases of two- component (pseudo-spin 1/2) dipolar fermions on a two-dimensional optical lattice. The anisotropic, long-range dipole-dipole interaction leads to the occurrence of numerous exotic many-body states, e.g. supersolid, nematic, and topological superfluid. Here, using unbiased functional renormalization group approach, we discover that another quantum phase of matter, spin density wave (SDW) with p-wave orbital symmetry, emerges in this system when the dipoles are tilted at intermediate angles with respect to the lattice plane. This phase can be viewed as the particle-hole analogue of p-wave superconductors. We present the phase diagram of the system and show that the order parameter of the unconventional SDW is a vector quantity in spin space, and, moreover, is defined on lattice bonds rather than on lattice sites.

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