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Bond Order Solid of Two-Dimensional Dipolar Fermions SATYAN BHONGALE, George Mason University, LUDWIG MATHEY, University of Hamburg, SHAN-WEN TSAI, University of California, Riverside, CHARLES CLARK, NIST, JQI, ERHAI ZHAO, George Mason University — Cold atoms provide a promising platform to solve problems that, although computationally infeasible, are of immense importance to condensed matter physics and material science. Ultracold bosonic atoms have been quite successful in emulating the Bose-Hubbard model. Experiments are now underway towards mapping out the unknown phase diagram of the Fermi-Hubbard model. Recent experimental advances in cooling dipolar gases to quantum degeneracy provide an unprecedented opportunity to engineer Hubbard-like models with long range interactions. Here, with the aid of functional renormalization group technique, we show that two new and exotic types of order emerge generically in dipolar fermion systems: bond order solids of p- and d-wave symmetry. Similar, but manifestly different, phases of two-dimensional correlated electronic systems have previously only been hypothesized. Our results suggest that these phases can be constructed flexibly with dipolar fermions, using currently available experimental techniques, providing detectable experimental signatures.

Satyan Bhongale
George Mason University

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