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Ground-state properties of spin-imbalanced Fermions in three-dimensional optical lattices PETER ROSENBERG, SIMONE CHIESA, SHI-WEI ZHANG, College of William and Mary — The past two decades have seen remarkable progress in cold atom physics. Novel experimental techniques have made it possible to simulate many condensed matter models. One system that has received considerable focus is ultra-cold atoms in an optical lattice with unequal populations of two hyperfine states. This system is an ideal candidate for the experimental realization of the elusive Fulde-Ferrell-Larkin-Ovchinnikov phase. We investigate the phase diagram of this system using Hartree-Fock-Bogoliubov theory. Detailed numerical calculations are performed to determine the ground-state properties systematically for different values of density, spin polarization and interaction strength. We first consider the high density and low polarization regime, in which the effect of the optical lattice is most evident. We then proceed to the low density and high polarization regime where the effects of the underlying lattice are less significant and the system begins to resemble a continuum Fermi gas. We explore the effects of density, polarization and interaction on the character of the phases in each regime and highlight the qualitative differences between the two regimes.

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