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Multiband superfluidity and superfluid-insulator transition of strongly interacting fermions in an optical lattice ANTON BURKOV, University of Waterloo, ARUN PARAMEKANTI, University of Toronto — We study the multiband superfluid phase and superfluid-insulator transition of strongly interacting fermionic cold atoms in an optical lattice at a filling of two fermions per lattice site. Our mean-field approach includes both Hartree and pairing correlations and thus differs from previous approaches to this problem. We point out a very significant discrepancy between the mean-field theory result for the critical lattice depth of the superfluid-insulator transition and its experimental value. We show that this discrepancy is due to a very small superfluid stiffness of the paired fermion superfluid in a deep optical lattice. We also present new experimentally testable results on the modulated components of the superfluid order parameter, quasiparticle gap,and band occupation as a function of the lattice depth.

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