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Quantum Antiferromagnetism of Fermion in Optical Lattices with Half-filled p -band HUI ZHAI, UC Berkeley, KAI WU, Center for Advanced Study, Tsinghua University — We study Fermi gases in a three-dimensional optical lattice with five fermions per site, i.e. the s -band is completely filled and the p -band with three-fold degeneracy is half filled. We show that, for repulsive interaction between fermions, the system will exhibit spin-3/2 antiferromagnetic order at low temperature. This conclusion is obtained in strong interaction regime by strong coupling expansion which yields an isotropic spin-3/2 Heisenberg model, and also in weak interaction regime, by Hartree-Fock mean-field theory and analysis of Fermi surface nesting. We show that the critical temperature for this antiferromagnetism of a p -band Mott insulator is about two orders of magnitudes higher than that of an s -band Mott insulator, which is close to the lowest temperature attainable nowadays.

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