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Dirac Fermions in Optical Lattices THOMAS DAVIS, University of British Columbia, MARCEL FRANZ, University of British Columbia — Two dimensional interacting Dirac fermions arise in many different contexts in condensed matter physics and are simmultaneously of great interest in elementary particle physics. We propose methods of constructing Dirac fermions in atomic gas systems in the presence of optical lattices. At the mean field level, the effective Hamiltonian admits a 'chiral symmetry breaking' phase transition between a gapped antiferromagnet and a gapless semimetal when the on-site Hubbard interaction is varied. We show that this transition will have an epxerimental signature in the density-density correlation spectrum. Close to the criticality, the nontrivial exponents of this quantum phase transition can be experimentally probed.

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