

Abstract Submitted  
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**Orbital ordering in an atomic Mott insulator of p-band fermions**

ERHAI ZHAO, W. VINCENT LIU, University of Pittsburgh — We derive the low energy effective model describing the orbital degrees of freedom of strongly interacting spinless p-orbital fermionic atoms in 2D optical lattices. Virtual hopping processes of  $p_x$  and  $p_y$  fermions give rise to direct and multi-particle orbital exchanges in the strong coupling regime. For the square lattice, we show that the effective orbital Hamiltonian is equivalent to a quantum spin-1/2 XXZ model. In the limit where the transverse hopping is much smaller than the longitudinal hopping, the XXZ model reduces to an antiferromagnetic Ising model. Thus the atomic Mott insulator is antiferro-orbitally ordered. We also present results for other simple 2D lattices and discuss the experimental signatures of various orbital ordering.

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