Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

$U(1) \times Z_2$ transition from the Mott insulator to $p_x + ip_y$ Bose-Einstein superfluid phase XIAOPENG LI, Department of Physics and Astronomy, University of Pittsburgh, ERHAI ZHAO, Department of Physics and Astronomy, George Mason University, W. VINCENT LIU, Department of Physics and Astronomy, University of Pittsburgh — Motivated by the recent experiment on p-band bosons in optical lattices [arXiv:1006.0509 (2010)], we study theoretically the quantum phases and phase transition of a two-dimensional extended Bose-Hubbard model with p-orbital degrees of freedom. The system features a novel superfluid phase with transversely staggered orbital current at weak interaction, and a Mott insulator phase with antiferro-orbital order at strong coupling and commensurate filling. We derive an effective theory from a microscopic model to describe the quantum phase transition from Mott to superfluid phase. We also calculate the excitation spectra near quantum critical point and find two gapless modes away from the Mott tip but four gapless modes at the tip point. We describe how the phase coherence builds up in the Mott regime when approaching the critical point.

Xiaopeng Li
Department of Physics and Astronomy, University of Pittsburgh

Date submitted: 18 Nov 2010 Electronic form version 1.4