DAMOP07-2007-000209

Abstract for an Invited Paper
for the DAMOP07 Meeting of
the American Physical Society

Orbital phases of the lattice p-band bosons

W. VINCENT LIU, University of Pittsburgh

Motivated by rapid developments in optical lattices, in this talk, I will introduce a new model system, which might previously have seemed academic or excessively special but now seems experimentally accessible. It is a system of ultracold bosonic atoms in the optical lattice p-band, which has also been studied by several other groups independently. I will discuss three aspects of the system: (a) the p-band lifetime, (b) novel order, and (c) detectable signatures. For (a), I will suggest ideas on how to keep the p-band population from decaying to the lowest s-band. For (b), the system will be shown to display interesting phases that I believe are new in both condensed matter and atomic physics, including a phase of non-zero momentum Bose-Einstein condensation and transversely staggered orbital current order in a cubic lattice and a phase of quantum orbital stripe order in a frustrated triangular optical lattice. In the triangular case, an orbital angular momentum moment is formed on each site exhibiting a stripe order both in the superfluid and Mott-insulating phases. For (c), unique signatures of each of the new phases will be predicted, which I believe can be proved or disproved by possible future experiments such as the time-of-flight.