Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Existence of Roton Excitations in Bose Einstein Condensates: Signature of Proximity to a Mott Insulating Phase ZAIRA NAZARIO, DAVID I. SANTIAGO, Stanford University — Within the last decade, artificially engineered Bose Einstein Condensation has been achieved in atomic systems. Bose Einstein Condensates are superfluids just like bosonic Helium is and all interacting bosonic fluids are expected to be at low enough temperatures. One difference between the two systems is that superfluid Helium exhibits roton excitations while Bose Einstein Condensates have never been observed to have such excitations. The reason for the roton minimum in Helium is its proximity to a solid phase. The roton minimum is a consequence of enhanced density fluctuations at the reciprocal lattice vector of the stillborn solid. Bose Einstein Condensates in atomic traps are not near a solid phase and therefore do not exhibit roton minimum. We conclude that if Bose Einstein Condensates in an optical lattice are tuned near a transition to a Mott insulating phase, a roton minimum will develop at a reciprocal lattice vector of the lattice. Equivalently, a peak in the structure factor will appear at such a wavevector. The smallness of the roton gap or the largeness of the structure factor peak are experimental signatures of the proximity to the Mott transition.

Zaira Nazario
Stanford University

Date submitted: 15 Jan 2006 Electronic form version 1.4