Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Ground-State of the Bose-Hubbard Model J.D. MANCINI, Kingsborough Community College, V. FESSATIDIS, Fordham University, S.P. BOWEN, Chicago State University, R.K. MURAWSKI, Drew University, J. MALY, Kingsborough Community College — The Bose-Hubbard Model represents a s simple theoretical model to describe the physics of interacting Boson systems. In particular it has proved to be an effective description of a number of physical systems such as arrays of Josephson arrays as well as dilute alkali gases in optical lattices. Here we wish to study the ground-state of this system using two disparate but related moments calculational schemes: the Lanczos (tridiagonal) method as well as a Generalized moments approach. The Hamiltonian to be studied is given by (in second-quantized notation):

$$H = -t \sum_{<i,j>} b_i^{\dagger} b_j + \frac{U}{2} \sum_i n_i \left(n_i - 1\right) - \mu \sum_i n_i .$$

Here i is summed over all lattice sites, and $< i, j >$ denotes summation over all neighbhoring sites i and j, while $b_i^{\dagger}$ and b_i are bosonic creation and annihilation operators. $n_i = b_i^{\dagger} b_i$ gives the number of particles on site i. Parameter t is the hopping amplitude, describing mobility of bosons in the lattice. Parameter U describes the on-site interaction, repulsive, if $U > 0$, and attractive for $U < 0$. μ is the chemical potential. Both the ground-state energy and energy gap are evaluated as a function of t, U and μ.

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Date submitted: 04 Nov 2015 Electronic form version 1.4