Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Ground-state properties of a Tonks-Girardeau gas in a periodic potential BO-BO WEI, SHI-JIAN GU, HAI-QING LIN, Department of Physics and Institute of Theoretical Physics, The Chinese University of Hong Kong — We investigate the ground-state properties of a bosonic Tonks-Girardeau (TG) gas confined in a one-dimensional periodic potential. The single-particle reduced density matrix is computed numerically for systems up to N=265 bosons. Scaling analysis of the occupation number of the lowest orbital shows that there are no Bose-Einstein condensation (BEC) for the periodically trapped TG gas in both commensurate and incommensurate cases. We find that, in the commensurate case, the scaling exponents of the occupation number of the lowest orbital, the amplitude of the lowest orbital and the zero-momentum peak height with the particle numbers are 0, 0.5 and 1, respectively, while in the incommensurate case, they are 0.5, 0.5 and 1.5, respectively. These exponents are related to each other in a universal relation.

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Date submitted: 01 Dec 2009 Electronic form version 1.4