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The ground state of Bose gases with repulsive interaction: A quantum Monte Carlo study WIRAWAN PURWANTO, College of William and Mary, Virginia, SHIWEI ZHANG, College of William and Mary, Virginia — The capability of Feshbach resonances to experimentally tune the atomic interaction in trapped gases provides a rich opportunity to better understand the properties of strongly-correlated systems. We report results from many-body ground-state calculations of interacting Bose gases in 3D with repulsive interactions. We characterize the effect of many-body correlations as a function of atom-atom scattering length a_s. Calculations were done for both trapped atomic gases and bulk fluids at different densities. We use a recently developed Quantum Monte Carlo method[1], which gives a very good approximation to the true ground state. We put the bosons on a discrete mesh and model the interatomic interaction by an on-site, δ-function potential parametrized by a_s. Results will be presented for the energetics, density profile, momentum distribution, condensate fraction, and correlation functions. We analyze the deviations of the standard Gross-Pitaevskii and Bogoliubov approaches from our results as the system becomes more strongly interacting, and discuss their implications.

[1]Phys. Rev. E 70, 056702 (2004)

Wirawan Purwanto
College of William and Mary, Virginia

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