Monte Carlo Ground State Energy for Trapped Boson Systems
ETHAN RUDD, N.P. MEHTA, None — Diffusion Monte Carlo (DMC) and Green’s Function Monte Carlo (GFMC) algorithms were implemented to obtain numerical approximations for the ground state energies of systems of bosons in a harmonic trap potential. Gaussian pairwise particle interactions of the form $V_0e^{-|r_i-r_j|^2/r_0^2}$ were implemented in the DMC code. These results were verified for small values of $V_0$ via a first-order perturbation theory approximation for which the $N$-particle matrix element evaluated to $\left(\begin{array}{c}N \\ 2 \end{array}\right)\frac{V_0}{(1+1/r_0^2)^{1/2}}$. By obtaining the scattering length from the 2-body potential in the perturbative regime ($\frac{V_0}{\hbar\omega} \ll 1$), ground state energy results were compared to modern renormalized models by P.R. Johnson et. al, New J. Phys. 11, 093022 (2009).