Energetics and structural properties of bosonic three-dimensional clusters near threshold\(^1\) D. BLUME, G. J. HANNA — We treat three-dimensional bosonic clusters with up to \(N=40\) atoms, interacting additively through two-body van der Waals potentials, in the near-threshold regime using the diffusion quantum Monte Carlo method. Our study focuses on super-Borromean systems with \(N\) atoms for which all subsystems are unbound. We determine the energetics and structural properties such as the expectation value of the interparticle distance as a function of the coupling strength. It has been shown that the coupling strength \(g^*_{N}\), for which the \(N\)-body system becomes unbound, is bounded by the coupling constant \(g^*_{N-1}\), for which the next smaller system with \(N-1\) atoms becomes unbound. By fitting our numerically determined ground state energies to a simple functional form with three fitting parameters, we determine the relationship between \(g^*_{N}\) and \(g^*_{N-1}\).

\(^1\)Supported by the NSF.

Doerte Blume
Washington State University

Date submitted: 27 Jan 2006

Electronic form version 1.4