Iranian Journal of Physics Research, Vol. 12, No. 1, 2012

The ground state energy of ^{3}He droplet in the LOCV framework

M Modarres[1] S Motahari[2] and A Rajabi[2]

1. Department of Physics, University of Tehran, North-Kargar Ave., 1439955961, Tehran, Iran.
2. Department of Physics, Shahid Rajaei Teacher Training University, 16788, Tehran, Iran.
E-mail: mmodares@ut.ac.ir

(Received 25 April 2011 ; in final form 17 January 2012)

Abstract

The (extended) lowest order constrained variational ((E) LOCV) method was used to calculate the ground state energy of liquid helium 3 (^{3}He) droplets at zero temperature. Different types of density distribution profiles, such as the Gaussian, the Quasi-Gaussian and the Woods-Saxon were used. It was shown that at least, on average, near 20 ^{3}He atoms are needed to get the bound state for ^{3}He liquid droplet. Depending on the choice of the density profiles and the atomic radius of ^{3}He, the above estimate can increase to 300. Our calculated ground state energy and the number of atoms in liquid ^{3}He droplet were compared with those of Variational Monte Carlo (VMC) method, Diffusion Monte Carlo (DMC) method and Density Functional Theory (DFT), for which a reasonable agreement was found.

Keywords: normal liquid helium 3, helium 3 droplets, LOCV, ELOCV, ground state energy, density distribution profile, Gaussian distribution profile, quasi-Gaussian distribution profile, Wood-Saxon distribution profile, Lennard-Jones potential

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