

Thermodynamic Properties of Bosons in Symmetric Double-well Potentials

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We study the thermodynamic properties and the Bose-Einstein condensation (BEC) for a finite number N of identical non-interacting bosons in the field of a deep symmetric double-well potential (SDWP). The temperature dependence of the heat capacity $C(T)$ at low temperatures is analyzed, and we derive several generic results which are valid when the energy difference between the first two excited states is sufficiently large. We also investigate numerically the properties of non-interacting bosons in three-dimensional superpositions of deep quartic SDWP's. At low temperatures, we find that $C(T)$ displays microstructures which are sensitive to the value of N and the thermal variation of the condensate fraction shows a characteristic plateau. The origin of these features is discussed, and some general conclusions are drawn.

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