Finite Temperature Phase Transition in Interacting Boson System

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Thermodynamical properties of an interacting system of scalar bosons at finite temperatures and zero chemical potential are studied within the framework of the Skyrme-like and field-theoretical models containing the attractive and repulsive self-interaction terms. Self-consistency relations between the effective mass and thermodynamic functions are derived in the mean-field approximation. It is shown that for a sufficiently strong attractive interaction a first-order phase transition is developed in the system via the formation of Bose-Einstein condensate. The thermodynamical characteristics of the system are calculated for the liquid-gas and condensed phases. The energy density exhibits a jump at the critical temperature. An interesting prediction of both models is that the condensed phase appears within a finite temperature interval and is characterized by a constant density or scalar density of particles.

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