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Theory of Bose-Einstein condensation in trapped gases

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ABSTRACT

The phenomenon of Bose-Einstein condensation of dilute gases in traps is reviewed from a theoretical perspective. Mean-field theory provides a framework to understand the main features of the condensation and the role of interactions between particles. Various properties of these systems are discussed, including the density profiles and the energy of the ground-state configurations, the collective oscillations and the dynamics of the expansion, the condensate fraction and the thermodynamic functions. The thermodynamic limit exhibits a scaling behavior in the relevant length and energy scales. Despite the dilute nature of the gases, interactions profoundly modify the static as well as the dynamic properties of the system; the predictions of mean-field theory are in excellent agreement with available experimental results. Effects of superfluidity ...g the existence of quantized vortices and the reduction of the moment of ... discussed, as well as the consequences of coherence such as the

Josephson effect and interference phenomena. The review also assesses the accuracy and limitations of the mean-field approach.

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