

Analytical description of a trapped semi-ideal Bose-Gas

One focus of research on dilute gas Bose-Einstein condensates is the study of thermodynamic quantities such as the transition temperature to Bose-Einstein condensation, and the condensate fraction. In particular, for the dilute gas Bose condensates, the weak interactions between particles and their low density allows for an accurate theoretical description of the effect of interactions in a many-body system starting from a microscopic understanding of two-particle collisions. In collaboration with Martin Naraschewski, a member of our group (DMS-K) explored the effect of interactions on a trapped partially condensed gas using an intuitive and accessible description of the interactions between the condensed and non-condensed atoms [1]. In this "semi-ideal" picture, interactions between condensed atoms are treated by the simple and verified Thomas-Fermi approximation, while the non-condensed fraction is treated as an ideal gas for which the trapping potential and the chemical potential are altered by repulsion from the condensate. This led to analytical expressions for the condensate fraction and for the density of the trapped gas, which can be used directly in the comparison between theory and experimental data.

1. M. Naraschewski and D.M. Stamper-Kurn, Phys. Rev. A **58**, 2423 (1998).