Abstract

Many-Body Systems

Andreas Deuchert (IST Austria)

Gross-Pitaevskii Limit of a Homogeneous Bose Gas at Positive Temperature

Joint with Robert Seiringer

We consider a dilute, homogeneous Bose gas at positive temperature. The system is investigated in the Gross-Pitaevskii (GP) limit, where the scattering length a is so small that the interaction energy is of the same order of magnitude as the spectral gap of the Laplacian, and for temperatures that are comparable to the critical temperature of the ideal gas. We show that the difference between the specific free energy of the interacting system and the one of the ideal gas is to leading order given by $4\pi a(2\rho^2-\rho_0^2)$. Here ρ denotes the density of the system and ρ_0 is the expected condensate density of the ideal gas. Additionally, we show that the one-particle density matrix of any approximate minimizer of the Gibbs free energy functional is to leading order given by the one of the ideal gas. This in particular proves Bose-Einstein condensation with critical temperature given by the one of the ideal gas to leading order. One key ingredient of our proof is a novel use of the Gibbs variational principle that goes hand in hand with the c-number substitution.