Universal correlations of the one-dimensional delta Bose gas in a non-uniform trapping potential

Jerome Dubail*[1]

[1]CNRS – CNRS : UMR7198 – France

Abstract

Many large-scale, universal, effects in one-dimensional systems at quantum critical points can be tackled with a combination of methods from solvable lattice models and from field theory, usually conformal field theory (CFT) and Luttinger liquid ideas. Yet, the applicability of such tools in condensed matter physics is often limited to situations in which the bulk is uniform: CFT, in particular, describes low-energy excitations around some energy scale, assumed to be constant throughout the system. However, in many experimental contexts, such as quantum gases in trapping potentials and in many out-of-equilibrium situations, systems are strongly inhomogeneous. We will argue that standard CFT methods can nevertheless be extended to deal with such 1D situations, and we will illustrate the main idea with the example of the delta Bose gas. The method we develop can be thought of as the Local Density Approximation (LDA) on steroids: while standard LDA allows to calculate density profiles (more generally, expectation values of local operators), here we use LDA to extract the position-dependent parameters that enter the field theory action, such as the components of the metric tensor. Then, once the action has been fixed, all correlation functions follow; this strategy will be illustrated with new results about entanglement entropies in trapped one-dimensional gases.

*Speaker