NEW YORK CITY COLLEGE OF TECHNOLOGY
Physics Department
Center of Theoretical Physics

Many-Body Anderson Localization of Bosons

Presented by:

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Abstract

Localization of the eigenfunctions of quantum particles in a random potential was discovered by P.W. Anderson more than 50 years ago. In spite of its respectable maturity and rather intensive theoretical and experimental studies this field is by far not exhausted. Anderson localization was originally discovered in connection with spin relaxation and charge transport in disordered conductors. Later this phenomenon was observed for light, microwaves, sound, and more recently for cold atoms. Moreover, it became clear that the domain of applicability of the concept of localization is much broader. We will discuss current understanding of the Anderson localization and its manifestation in different physical situations.

In particular, we will see that the ideas developed for understanding quantum mechanics of a single particle can be extended to attack many-body problems that include disorder. As an example we will discuss weakly interacting bosons in one-dimensions (1D) in the presence of a random potential. It is commonly accepted that there are no phase transitions in one-dimensional (1D) systems at a finite temperature T, because long-range correlations are destroyed by thermal fluctuations. It turns out, however, that the 1D gas of short-range interacting disordered bosons undergoes a finite T phase transition between two distinct states: fluid and insulator. None of these states has long-range spatial correlations, but this is a true albeit non-conventional phase transition: transport properties are singular at the transition point. In the fluid phase the mass transport is possible, whereas in the insulator it is completely blocked even at T>0.

Light refreshments will be served.