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Waves, Disorder and Interactions: a Physicist's Perspective

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As discovered in the seminal paper of P. W. Anderson in 1958 when an equation such as the Schroedinger equation (and other related wave equations) is subjected to a random potential the nature of the solutions changes drastically going from plane waves to localizes states.

This phenomenon, the so-called Anderson localization indicates that a single quantum particle in such random landscape would be localized. An important question is what happens to this phenomenon when instead of looking at the properties of one single particle one wants to deal with a large number of interacting quantum particles, as is relevant for several experimental realizations.

I will give in this talk an overview of this class of phenomena and point towards some of the challenges in the field. Since it is a talk given by a physicist, there will unfortunately be no theorems but a set of unproven" results, some of which could perhaps be calledconjectures", and which hopefully will stimulate the curiosity of a more rigorously inclined audience

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