

Universality of quantum few-and many-body systems; investigating solids and the universe by cold atoms

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Abstract:

Motions of microscopic particles, such as electrons, protons and neutrons, are governed by the quantum mechanics. Their equation of motion, the Schrodinger equation, is rather formidable to solve accurately, but it is a very important problem for understanding electrons' motion in solid devices, chemical reactions, and nuclear reactions which are keys for the origin of the elements in the universe. Recently, there has been growing interest in a so-called "quantum simulation": trying to know an answer to a quantum problem by investigating a different quantum system. In this lecture, I will give an overview of recent progress in quantum simulation research using cold atoms, extremely low temperature gases of atoms. I also introduce a concept of the universality of the quantum system. In the latter half of this lecture, I specifically talk about quantum simulations of few-body (3-body, 4-body) quantum systems with cold atoms, and how we can understand neutron rich nuclei and neutron star physics with cold atoms.



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