

Institute Lecture

Quantum Mechanics Without Particles



Professor Subir Sachdev
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Tuesday, 21st January, 2014, Time: 6.00 PM, Venue: L-17,
Lecture Hall Complex

Abstract

Quantum mechanics provides a thorough understanding of the physical properties of most common metals, insulators, and superconductors. Even though we cannot solve the Schrödinger equation for 10^{23} particles, we are able to make progress because the electrons move essentially independent of each other. However, in many modern materials, and particularly in the high temperature superconductors, there are important regimes where the independent-electron paradigm breaks down, and we have to deal with wave functions in which all the electrons are entangled with each other in a non-local manner. Understanding such quantum states, in which no particle-like excitations can be identified, is a major theoretical challenge. In this talk, we will describe recent progress in this field using quantum field theory, string theory, and computer simulations. These advances shed light on many of the puzzling features of phase diagrams of the high temperature superconductors.

About the speaker

Prof. Subir Sachdev is a distinguished condensed matter physicist. He is very well known for his research on quantum phase transitions, and its application to a variety of quantum materials, such as the high temperature superconductors. His book "Quantum Phase Transitions" (Cambridge University Press) has formed the basis of much subsequent research. More recently, he pioneered the application of string theory to the study of quantum phase transitions in condensed matter physics, such as the superfluid-insulator transition of bosons moving in a lattice. These methods of string theory have since been extended by Prof. Sachdev and others, to novel metallic states of interacting fermions similar to those found in many modern materials.

Prof. Sachdev was educated in India and studied for one year at IIT Delhi, before attending MIT and Harvard, where he obtained his Ph.D. degree in theoretical physics. He held professional positions at Bell Labs (1985–1987) and at Yale University (1987–2005), where he was a Professor of Physics, before returning to Harvard. He received LeRoyApker Award in 1982. He is a Fellow of the American Physical Society and has several other honors. He held Lorentz Chair, Instituut-Lorentz, Leiden University in 2012; Distinguished Research Chair, Perimeter Institute for Theoretical Physics since 2009. He became John Simon Guggenheim Memorial Foundation Fellow in 2003 and Alfred P. Sloan Foundation Fellow in February 1989.

Tea at 5.45 PM

All interested are welcome.

Ajit Kumar Chaturvedi
Dean of Research and Development
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