2023 年物理系学术论坛系列报告

报告题目：Einstein meets Anderson: Emergent space-time meets emergent quantum phenomena in a material

摘要: Poincare and Einstein's special relativity says that any physics law in a vacuum takes identical form in any two inertial frames. On the opposite direction, P.W. Anderson's " More is different " says that various macroscopic quantum or topological phenomena emerge in a material which contains enormous number of interacting particles. In contrast to the relativistic quantum field theory, there is always a reservoir which can exchange energy and the particles with a material. It remains an outstanding problem to apply Einstein's special relativity to Anderson's " More is different ". Here we address this outstanding problem and find that the combination leads to many new effects. We demonstrate these new effects by studying one of the simplest quantum phase transitions (QPT): Superfluid (SF)-Mott transitions of interacting bosons in a square lattice in a sample moving with a constant velocity. It is the moving which mixes the space and time, then leads to a emergent space-time near the QPT. It is the existence of reservoir which makes crucial differences between a moving sample and a moving inertial frame. We also stress the important roles played by the underlying lattice. The experimental detection of these dramatic new effects in some materials or cold atoms loaded in an optical lattice are discussed. The lecture is very pedagogical, so should be access to undergraduate students with very basic knowledges on quantum mechanics and statistical mechanics.

报告人：叶锦武

报告人单位：Great Bay University/ Mississippi State University

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报告人简介：Prof. Ye received his Ph.D. from Yale University. Now he is a Professor at Mississippi state university. Currently, he is a visiting professor at the newly found Great Bay university in Dongguan, Guangdong, China. He is a condensed matter theorist working on the interdisciplinary field of condensed matter, quantum optics, cold atoms, non-relativistic quantum field theory, Turbulence and conformal field theory. Recently, he has been particularly interested to explore possible deep connections among quantum/topological phases, Sachdev-Ye-Kitaev models and quantum black holes from material's point of views.