复旦大学物理系物质科学报告

Physics Department Colloquium

Equilibration, Thermalization, and Entanglement in Quantum Many-Body Systems

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Abstract: The most familiar fact of physics in our experience is that physical systems spontaneously tend to reach equilibrium, and to thermalize. This very basic fact has always been at odds with the fundamental laws of physics that are time-reversal. In particular, quantum dynamics in an isolated system is unitary, reversible and no entropy can increase. For a long time, it has been speculated that observable quantities could thermalize even if the global system is in a pure state away from equilibrium. One of the mechanisms for this to happen is the Eigenstate Thermalization Hypothesis (ETH) that states that thermalization happens at the level of single eigenstates. Recently, people have understood that entanglement is at the root of this phenomenon, and these phenomena have become experimentally relevant in the setting of ultracold atom gases. Moreover, there is a strong interest in those systems that refuse to thermalize. In fact, interesting things happen away from equilibrium. After all, there is no way one can extract work (without other changes) -to give an example- from an equilibrium state. Such states that refuse to thermalize are either fine tuned or are those called Many-Body Localized states. In this talk, I will present a current review of all these notions, and put forward some new problems and tentative direction of solutions. In particular, even though we know that entanglement is involved in thermalization and ETH, its role is not completely understood, namely because entanglement is very strong even in systems that do not thermalize. I will show some new results on the study of entanglement spectrum, suggesting that entanglement level statistics may contain the relevant information as to how ETH is obeyed or not.

Time：2:00pm, Tuesday, 09 Dec., 2014
Location：Physics Building, Room 221B
(Cookies and coffee will be served from 1:30 pm)