人工微结构和介观物理国家重点实验室

State Key Laboratory For Artificial Microstructure and Mesoscopic Physics

科学前沿报告会(314)

Probes of non-equilibrium quantum behaviour (in organic molecules)

Prof. Vlatko Vedral

Department of Physics, University of Oxford, UK

Time: 3:00pm, November 05, 2015 (Thursday)

Venue: Room M215, School of Physics, Peking University

报告摘要

I will present a wide range of research aimed at understanding quantum physics of large objects and their dynamical and thermodynamical behavior in the far-from-equilibrium domain. I will present a general scheme that uses existing technology to probe work-fluctuation relations in the dynamics of complex systems. Specifically, I will show that the characteristic function of the work distribution for a non-equilibrium quench of a general quantum system can be extracted from Ramsey interferometry of a single probe qubit. The scheme paves the way for the full characterisation of non-equilibrium processes in a variety of quantum systems ranging from single particles to many-body atomic and molecular systems. One potential use is the experimental extraction of the free energy profile of complex bio-molecules.

I will discuss how techniques from information theory, quantum and statistical physics, can all be combined to elucidate the physics of macroscopic objects. This question is of fundamental importance to the development of future quantum technologies, whose behavior takes place invariably in the macroscopic non-equilibrium quantum regime.The main challenge is to experimentally obtain a handful of parameters believed to be important for describing the interplay between coherence (within the system) and noise (arising due to the interaction or the system with its environment). I will present single organic molecule spectroscopy experiments we are currently undertaking in our laboratory to obtain a better understanding of quantum effects in biomolecules. Finally, I will explain how to set up experiments to test both quantum coherence as well as thermodynamical properties of energy transport.

报告人简介

Prof. Vlatko Vedral is a professor of quantum information theory at the University of Oxford and professor of physics at the National University of Singapore (where he is a PI at the Centre for Quantum Technologies). He is currently a Chair Professor at the IIIS at Tsinghua. He is the Director of the Oxford Martin School institute on “bio-inspired quantum technologies”. This explores the exciting possibility that living systems are subject to useful quantum effects, with a view to deriving and reverse-engineering architectures to inspire future quantum technologies that will help address serious challenges facing humanity in the 21st century. He has received numerous awards in recognition for his contribution to the development of the field, including the Royal Society Wolfson Research Merit Award and the World Scientific Medal and Prize. He has over 260 publications on quantum physics and collaborates in many inter-disciplinary international networks.

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