

科学前沿报告会 (314)

Probe of non-equilibrium quantum behavior (in organic molecules)

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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 enables engineering technology to probe work-fluctuation relations in the dynamics of complex systems. Specifically, I will highlight the characteristic function of the work distribution for a non-equilibrium quantum ensemble of a general quantum system can be extracted from Ramsey interferometry of a single probe qubit. The scheme provides a framework for the full characterization of non-equilibrium processes in a variety of quantum systems ranging from single particles to many-body atomic and molecular systems. One potential application is the experimental extraction of the free energy profile of complex biomolecules. 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 of the system with its environment). I will present single organic molecule spectroscopy experiments that are currently underway in our laboratory to obtain a better understanding of quantum effects in biomolecules. Finally, I will explain how these experiments can be both quantum coherence and a thermodynamical property 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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