量子材料科学中心
International Center for Quantum Materials

Seminar

In Search of Perfect Fluidity in Strongly Interacting Fermi Gases: An Ultracold Quantum Simulator for Condensed and Nuclear Matter

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- **Time: 4:00pm, Apr. 12, 2011 (Tuesday)**
- **时间： 2011年4月12日（周二）**
- **Venue: Room 607, Conference Room A , Science Building 5**
- **地点： 理科五号楼607会议室**

Abstract

Strongly interacting Fermi gases provide a paradigm system to explore intriguing many-body physics in a wide range of exotic systems, including high-temperature superconductors, neutron stars, the quark-gluon plasma, and black holes in string theory. All those systems have universal thermodynamics and hydrodynamics governed by the nature of unitary strong interactions. In such sense, a table-top experiment with laser-cooled and trapped Fermionic atoms is an ideal ultracold quantum simulator for the condensed matter and nuclear physics. In this talk, I will review my experimental work including all-optical method for producing degenerate and strongly interacting Fermi gases, probing the universal thermodynamics by implementing the first model-independent thermodynamic measurement, obtaining the thermometry of strongly interacting Fermi gases experimentally and thus determining the critical temperature of Fermi condensation, and the first study of the quantum viscosity behavior in the unitary regime. My focus is in search of a so-called perfect fluid that has exceedingly low shear viscosity and possible existed in strongly interacting systems. Unlike a superfluid, such perfect fluid is not in a single quantum state but a many-body quantum phenomenon which could connect to string theory. Our results from both thermodynamic and hydrodynamic measurements confirm that a strongly interacting Fermi gas enters into the perfect fluidity regime and is very close to the estimation data from the quark-gluon plasma. Also, in this talk I will present my vision of using trapped atoms, ions and photons for the potential applications in quantum simulation, control and information.

About the Speaker

罗乐,杜克大学物理学博士硕士, 北京大学光学硕士, 中山大学物理学学士。多年来在实验原子分子光物理领域有着活跃的学术研究，涉及冷原子物理，囚禁离子量子计算，原子光子量子网络，空腔电子电动力学,超快光学等多个前沿领域。所获奖项包括美国联合量子研究所第一个实验物理方向上的JQI Postdoc Fellowship, Fritz London 博士研究生奖，中国政府海外优秀自费留学生奖，王大珩光学奖学生奖。在重要期刊上发表过超过二十篇论文，其中多篇发表在Nature和Physics Review Letters，并以“费米气体热力学”和“原子光子量子网络”为主题发表两个长篇综述。目前的学术兴趣包括两个方面，一方面以超冷量子气体为实验工具探索在多体和少体量子物理领域具有普适性的问题，实现凝聚态与核物理领域一些基础问题的冷原子量子模拟,并探索进行拓扑量子计算的可能性。另一方面以囚禁离子为工具，实现大规模的量子纠缠和量子逻辑，实现大空间尺度可拓展的原子光子量子网络，为最终实现量子信息处理奠定物理的基础。