



# 复旦大学物理系 Colloquium

Time: 14:00, Tuesday, 2022.5.10

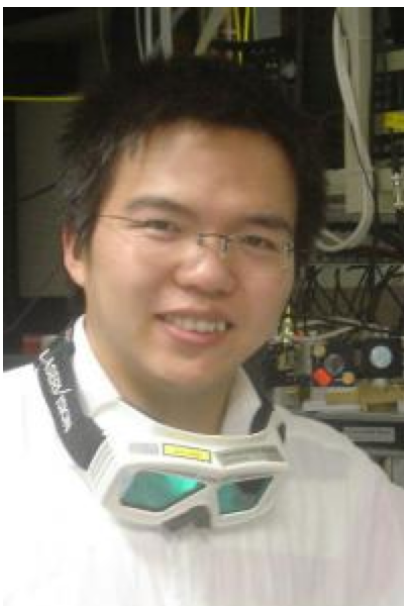
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## Universal critical dynamics of a unitary Fermi gas

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**Abstract:** Understanding quantum many-body systems with strong interaction and the unconventional phases therein is one of the most challenging problems in physics nowadays. Due to the universality, strongly interacting Fermi gas at unitarity provides an ideal platform to provide insights into many-body physics by bringing the system to the vicinity of a scattering resonance. In this talk, I will mainly present recent experimental results showing the critical dynamics of a unitary  $6\text{Li}$  gas. On the one hand, we study the annihilation dynamics of a large number of vortices and Anti-vortices generated by thermally quenching a fermionic superfluid of  $6\text{Li}$  atoms in an oblate optical geometry from BEC to BCS crossover. Universal algebraic scaling laws in both time and space are revealed in all the experiments and further found to agree with a Glauber dynamics in Monte Carlo simulation of the classical XY model and with field-theoretical calculations. Decay dynamics of the vortices through the BEC-BCS crossover is studied. On the other hand, we prepare a homogeneous unitary  $6\text{Li}$  superfluid in a box trap, and develop a novel Bragg scattering technique with high energy resolution and low wave number. Second sound attenuation in the high-resolution density response spectra is observed and the thermal conductivity is determined. We further observe a precursor of critical divergence in both the  $D_1$ ,  $D_2$  and  $\kappa$ , and surprisingly find a large critical region of the unitary Fermi gas. This opens the way to understand the critical phenomena with unprecedented controllability and tunability.



**个人简介:** 陈宇翱，中国科学技术大学教授、物理学院执行院长、美国光学学会会士(OSA Fellow)，物理学会会士 (APS Fellow)。长期从事量子物理基础实验研究，致力发展光与冷原子量子调控技术并系统地应用于量子通信、量子计算和精密测量等多个量子信息研究方向，取得了一系列重要研究成果，并获得广泛的关注。作为项目工程总师，陈宇翱教授和同事们一起完成了国家发改委量子保密通信京沪干线工程，结合量子科学实验卫星，实现了目前世界上空间尺度最大、规模最大的星地广域量子通信网络。主持和参与的研究成果两次入选欧洲物理学会“年度物理学亮点”，两次入选美国物理学会“年度物理学重大事件”，六次入选两院院士评选的“年度中国科技十大进展新闻”。获欧洲物理学会菲涅尔奖，中国科学院“青年科学家奖”，求是杰出青年学者奖，国家自然科学基金（第三完成人），陈嘉庚青年科学家奖，国家杰出青年科学基金，国际纯粹与应用物理联合会原子分子物理分会青年科学家奖，科学探索奖，长江学者特设岗位。