北京大学海外名家讲座

Flat band physics in Fock space: from quantum spinons to many-body cages

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Time: 10:30 am, Nov.4, 2025 (Tuesday)

时间：2025年11月4日（周二）上午10:30

Venue: Room w563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

We identify the many-body counterpart of flat bands, which we call many-body caging, as a general mechanism for non-equilibrium phenomena such as a novel type of glassy eigenspectrum order and many-body Rabi oscillations in the time domain. We focus on constrained systems of great current interest in the context of Rydberg atoms and synthetic or emergent gauge theories. We find that their state graphs host motifs which produce flat bands in the many-body spectrum at a particular set of energies. Basis states in Fock space exhibit Edwards-Anderson type parameters in the absence of quenched disorder, with an intricate, possibly fractal, distribution over Fock space which is reflected in a distinctive structure of a non-vanishing post-quench long-time Loschmidt echo, an experimentally accessible quantity. In general, phenomena familiar from single-particle flat bands manifest themselves in characteristic many-body incarnations, such as a reentrant `Anderson' delocalisation, offering a rich ensemble of experimental signatures in the abovementioned quantum simulators. The notion of flat bands in Flock space also provides an elegant, approximate yet accurate, resolution of the problem of a fractionalised quasiparticle interacting with its gauge field.
Tom Ben-Ami, Markus Heyl, Roderich Moessner, arXiv:2504.13086
M. Udagawa, R. Moessner, arXiv:2510.11134

About the speaker

Roderich Moessner教授是世界著名的理论物理学家，在凝聚态物理多个领域作出了重要的贡献。他以其对“自旋冰”材料中演生磁单极子的开创性预言而闻名于世，其一系列理论工作深刻影响了该领域的发展，包括预言量子霍尔体系中的电荷密度波相、揭示了烧绿石晶格上的经典自旋液体相、发现三角晶格量子二聚体模型中的共振价键自旋液体态，并提出新型时空有序相——π自旋玻璃（即离散时间晶体），后者已在谷歌“悬铃木”量子计算机上获实验验证。此外，他与伯克利Joel Moore院士合著的《Topological Phases of Matter》已成为该领域的经典著作。作为一位杰出的导师，他培养了一代理论物理学者，其众多中国学生博后如今已在国内外顶尖学府承担科研工作。

Roderich Moessner教授于牛津大学赫特福德学院完成本科学习，并在同校师从John Chalker教授获得理论物理博士学位。在普林斯顿大学完成博士后研究后，他先后任职于法国国家科学研究中心、牛津大学萨默维尔学院与理论物理系。现任德国马克斯·普朗克复杂系统物理研究所所长及马克斯·普朗克学会科学会员。其卓越成就荣获了包括欧洲物理学会奖（2012）和德国研究联合会莱布尼茨奖（2013）在内的多项国际顶级奖项。

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