



Weekly Seminar

Grüneisen Parameters: origin, identity and quantum refrigeration

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Time: 4: 00 pm, March. 20, 2019 (Wednesday)

时间: 2019年3月20日 (周三) 下午4:00

Venue: Room W563, Physics building, Peking University

地点: 北京大学物理楼, 西563会议室

Abstract

In solid state physics, the Grüneisen parameter (GP), originally defined as a derivative of the crystal lattice frequency with respect to the volume of the system, can be widely used to quantify the spectrum properties induced by external potential changes. However, the GP is very little known for quantum gases with interactions.

In this talk, we will present general results of the GPs on its origin, new identity and applications in quantum gases of ultracold atoms. We prove that the scaling invariance of the entropy leads to a surprisingly simple identity among the volume, magnetic field and interaction driven GPs, quantifying universal scalings of quantum fluctuations and interaction driven magnetocaloric effect in quantum gases. We also find that the entropy accumulation near a quantum phase transition leads to a rapid reduction of temperature through an adiabatic change of either interaction or magnetic field. Thus the interaction ramp-up and -down provide a promising protocol of quantum refrigeration in addition to the adiabatic demagnetization cooling. Using exactly Bethe ansatz solutions, we further present a rigorous study of these GPs, quantum heat engine and refrigeration in one-dimensional Bose and Fermi gases.

About the speaker

管习文教授1998年吉林大学博士毕业后到2002年期间在德国和巴西从事博士后研究。2003-2012期间在澳大利亚国立大学物理与工程研究院任研究员、高级研究员，2012年10月以优秀海外人才被引进中科院武汉物理与数学研究所，2014年10月晋升为二级研究员。美国哈佛大学、洛斯阿拉莫斯国家实验室等国际研究机构的高级访问学者，清华大学高等研究院客座教授，香港中文大学杨振宁访问学人。中国自然科学基金重点项目及科技部重点专项的首席专家，《Journal of Physics A》的Advisory Panel成员。

管习文长期从事冷原子少体和多体物理系统和自旋系统的严格解研究，取得了一系列在国际上颇具影响力的研究成果。至今发表100余篇SCI论文，包括顶尖期刊《Review of Modern Physics》、《Advance in Physics》、《Nature Communications》、《Physical Review Letters》等。