



# 复旦大学物理系 物质科学报告

Time: 2:00pm, Tuesday, 2019.9.17

Location: Room C108, Jiangwan Physics Building

Title: Statistical physics in ultracold atoms: From Boltzmann to Haldane

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Abstract: There are fundamental differences between the properties of bosons and fermions, which obey Bose-Einstein (BE) or Fermi-Dirac (FD) statistics, respectively. The question is often asked "whether are they the only possible forms of quantum statistics in nature"? Now we know that in two dimensions particles can have anyonic statistics which interpolate between the BE and FD statistics. To further extend, Haldane formulated a description of fractional exclusion statistics (FES) that continuously interpolates between the two in arbitrary spatial dimensions.

In this talk, we present discussions on the outreach of the FES and its experimental observations of such FES in one and two-dimensional ultra-cold Bose gases. We show that the thermodynamic properties of interacting bosons, including entropy per particle, density and pressure, are essentially equivalent to those of ideal gases with FES. We establish a mapping between the interacting bosons and ideal particles with FES that reveals the FES nature of matters in the quantum critical regime. We find that unitary Bose gases reach full fermionization in one dimension, while they exhibit incomplete fermionization in two dimensions.

**管习文**，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月提升为二级研究员。美国哈佛大学、洛斯阿拉莫斯国家实验室等世界一流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，也是《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110余篇SCI论文，包括世界顶尖期刊《Review of Modern Physics》、《Advance in Physics》、《Nature Communications》、《Physical Review Letters》。