北京大学量子材料科学中心
International Center for Quantum Materials, PKU

Seminar

Entanglement Entropy Scaling Laws and Eigenstate Thermalization in Many-Particle Systems

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Time: 4:00pm, July 8, 2015 (Wednesday)
时间：2015年7月8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

While entanglement entropy of ground states usually follows the area law, violations do exist, and it is important to understand their origin. In 1D they are found to be associated with quantum criticality. Until recently the only established examples of such violation in higher dimensions are free fermion ground states with Fermi surfaces, where it is found that the area law is enhanced by a logarithmic factor. In Ref. [1], we use multi-dimensional bosonization to provide a simple derivation of this result, and show that the logarithimic factor has a 1D origin. More importantly the bosonization technique allows us to take into account the Fermi liquid interactions, and obtain the leading scaling behavior of the entanglement entropy of Fermi liquids. The central result of our work is that Fermi liquid interactions do not alter the leading scaling behavior of the entanglement entropy, and the logarithmic enhancement of area law is a robust property of the Fermi liquid phase. In sharp contrast to the fermioic systems with Fermi surfaces, quantum critical (or gapless) bosonic systems do not violate the area law above 1D (except for the case discussed below). The fundamental difference lies in the fact that gapless excitations live near a single point (usually origin of momentum space) in such bosonic systems, while they live around an (extended) Fermi surface in Fermi liquids.

Reference:

[1] Entanglement Entropy of Fermi Liquids via Multi-dimensional Bosonization, Wenxin Ding, Alexander Seidel, Kun Yang, Phys. Rev. X 2, 011012 (2012).

About the speaker

Dr. Yang received his Ph.D. in Condensed Matter Theory from Indiana University in 1994. After spending three years as a postdoc at Princeton and two years as Sherman Fairchild Senior Research Fellow at Caltech, he joined the faculty of FSU in 1999. His research interest focuses on strongly correlated electronic systems, including quantum Hall systems, unconventional superconductors, and disordered quantum magnets.