北京大学量子材料科学中心

International Center for Quantum Materials, PKU

Seminar

High order correlations and what we can learn about the solution for many body problems from experiment

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Time: 4:00pm, Dec. 22, 2017 (Friday)

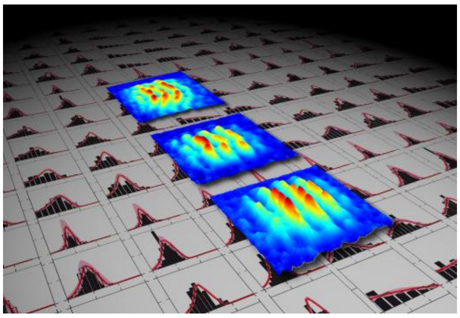
时间：2017年12月22日 （周五）下午4:00

Venue: Room W563, Physics building, Peking University

地点：北京大学物理楼，西563会议室

Abstract

The knowledge of all correlation functions of a system is equivalent to solving the corresponding quantum many-body problem. If one can identify the relevant degrees of freedom, the knowledge of a finite set of correlation functions is in many cases sufficient to determine a sufficiently accurate solution of the corresponding field theory. Complete factorization is equivalent to identifying the relevant degrees of freedom where the Hamiltonian becomes diagonal. I will give examples how one can apply this powerful theoretical concept in experiment.



A detailed study of non-translation invariant correlation functions reveals that the pre-thermalized state a system of two 1-dimensional quantum gas relaxes to after a splitting quench [1], is described by a generalized Gibbs ensemble [2]. This is verified through phase correlations up to 10^{th} order.

Interference in a pair of tunnel-coupled one-dimensional atomic super-fluids, which realize the quantum Sine-Gordon / massive Thirring models, allows us to study if, and under which conditions the higher correlation functions factorize [3]. This allowed us to characterize the essential features of the model solely from our experimental measurements: detecting the relevant quasi-particles, their interactions and the different topologically distinct vacuum-states the quasi-particles live in. The experiment thus provides a comprehensive insights into the components needed to solve a non-trivial quantum field theory.

Our examples establish a general method to analyse quantum systems through experiments. It thus represents a crucial ingredient towards the implementation and verification of quantum simulators.

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[1] M. Gring et al., Science, **337,** 1318 (2012);
[2] T. Langen et al., Science **348** 207-211 (2015).
[3] T. Schweigler et al., Nature **545**, 323 (2017), arXiv:1505.03126

About the speaker

Jörg Schmiedmayer has been a professor at the Institute of Atomic and Subatomic Physics at the Vienna University of Technology since 2007, where he also received his PhD degree in 1987. He went to Harvard and MIT (Cambridge, USA) as a postdoc, and then to Innsbruck. He subsequently held the position of Professor for Experimental Physics at Heidelberg University. He was a guest professor at Peking University and at the National Institute for Informatics (NII) in Tokyo. Prof. Schmiedmayer is a leading experimentalist in ultracold atoms, with a large number of works published in top journals such as Nature and Science, and has an h index >52. He is a full member of Austrian Academy of Sciences. He has been awarded numerous prizes - including the Wittgenstein-Prize (from the Austrian Academy of Sciences, 2006).