# 武汉物数所理论交叉学术交流系列报告

**(第一四〇期)**

# Deterministic quantum simulators with cold atoms

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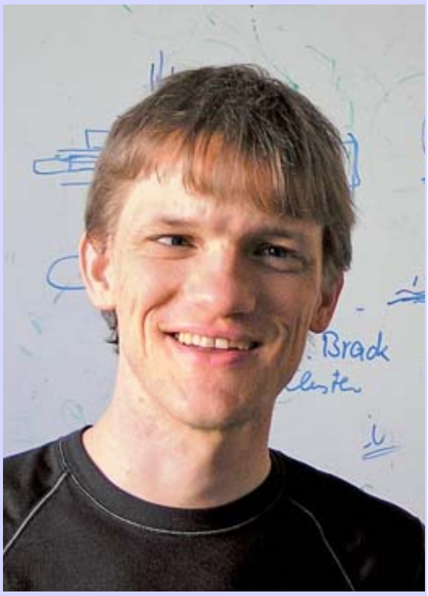
频标楼4楼报告厅




**About the speaker**:

1996-1997: Studies at the University of California, Berkeley and San Francisco State University
2000: Diplom in physics, Ruprecht-Karls-Universität Heidelberg
2000-2004: PhD studies at the Max-Planck-Institut für Kernphysik, Heidelberg and at the Leopold-Franzens-Universität Innsbruck with the title "Bose-Einstein Condensation of Molecules"
2004-2006: Postdoc at IBM Zurich Research Laboratory
2006: Visiting Scientist, James-Franck-Institute, University of Chicago
2006-2009: Juniorprofessor at the Ruprecht-Karls-Universität, Heidelberg and theMax-Planck-Institut für Kernphysik, Heidelberg
since 2009: Professor for experimental Physics at Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg

**Professor Jochim has published 30 papers in Science, Natur and Phys. Rev. Lett. etc. Recently, include**

1, From Few to Many: Observing the Formation of a Fermi Sea One Atom at a Time, **Science** 342, 457 (2013);
2, Deterministic Preparation of a Tunable Few-Fermion System, **Science** 332, 336 (2011);
3, Radio-Frequency Association of Efimov Trimers, **Science** 330, 940 (2010).

**Abstract:**

Experiments with ultracold gases have been extremely successful in studying many body physics, such as Bose Einstein condensates or fermionic superfluids. These are deep in the regime of statistical physics, where adding or removing an individual particle does not matter. An essential challenge for current experiments is to reach low enough entropies to observe low-temperature phases such as magnetically ordered states. In our work we deterministically prepare generic model systems containing a precise number of few ultracold fermionic atoms with tunable interaction. We have started the exploration of such few-body systems with a two-particle system that can be described with an analytic theory. As we increase the system size atom by atom, we have been working in a one-dimensional framework allowing us to describe the system as a Heisenberg spin chain at strong repulsion. This allowed us to deterministically prepare a finite antiferromagnetically ordered state. It is our vision to use our tunable few-body systems as microscopic building blocks to assemble deterministic quantum systems that allow for the simulation of complex many-body models close to zero temperature.

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