Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

QE

Quantum Efficiency
Seminar und Colloquium

STEFAN PALZER

Physikalisches Institut
Albert-Ludwigs-Universität Freiburg

How to fermionize a Bose gas

Recent years have seen a wide range of fundamental physics being studied using Bose-Einstein condensates of dilute, ultracold atoms. One longstanding goal of these efforts is the experimental simulation of condensed matter systems. Solid state systems play a crucial role in modern day technology, for example in ever smaller and more complicated computer chips or nanowires. Nevertheless, the fundamental processes governing the properties of these devices are not well understood. The decreasing size and the increasing influence of quantum mechanics in these devices make it impossible to simulate their properties using standard computer simulation.

The experimental simulation of these systems can be achieved by applying especially designed potentials to an ultracold atomic cloud. In this scenario the atoms take on the role of electrons under certain conditions. In a one dimensional atomic cloud it is even possible to make bosons behave as non-interacting fermions, if the atoms exhibit repulsive interactions. The transport properties of such a system resemble those of a single mode nanowire.

In the experiment presented here such a system is experimentally realized with ultracold Rubidium atoms and the transport properties are investigated using a novel in-situ technique. Very complex nonequilibrium dynamics, including the emergence of large density fluctuations in the remaining Bose gas, and multiple scattering events leading to dissipation of the impurity's motion have been observed. Further analysis of the data revealed a density dependent force exerted on the impurity atoms by the rest of the atoms. The results add to understanding the behaviour of particles confined to one-dimension in non nonequilibrium situations. The genuine quantum dynamics observed gives insight in some of the properties of single mode nanowires.

Date:	**Tuesday, February 12th, 2013 14:15**
Location:	**Lecture Hall 1, Hermann-Herder-Str. 3, Freiburg**

Contact: Andreas Buchleitner, Institute of Physics, Quantum Optics and Statistics
T +49 761 203 5821 F +49 761 203 5967 E buchleitner_office@physik.uni-freiburg.de
www.physik.uni-freiburg.de