



universität
uulm

Physikalisches Kolloquium
Einladung

Physics Colloquium
Invitation

Monday, 24 April 2023

Lecture Hall N24/H13, at 16:15

Coffee and cookies will be served in front of the lecture hall from 16:00

Ultracold Fermi gases: Superfluids, polarons, and novel mixtures

Prof. Dr. Rudolf Grimm

University of Innsbruck and IQOQI,
Austrian Academy of Sciences Innsbruck, Austria

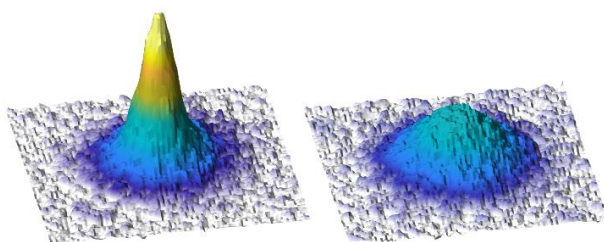
 www.ultracold.at



Twenty years ago, major breakthroughs in preparation and control of ultracold Fermi gases opened up the door to an exciting research field. Since then, fermion systems with tunable interactions have provided us with many exciting adventures in the laboratory and led to new insights on the many-body physics of strongly interacting quantum matter. I will first present a short historical review how the field emerged in the first few years, before I will discuss two specific research topics from our laboratories in Innsbruck.

Landau's Fermi-liquid theory, a cornerstone of quantum many-body physics, describes strongly interacting fermion systems in terms of quasiparticles and their mediated interactions. We realize a model system where impurity atoms (K) are immersed in a Fermi sea (Li-6 atoms) and their interaction can be controlled by a Feshbach resonance. At low impurity concentration, we find the observed energy spectrum of the quasiparticles (called "Fermi polarons") to agree well with theory. At higher impurity concentration, mediated interactions between the polarons become important. Our observations confirm a remarkable sign reversal depending on the impurity quantum statistics.

Motivated by the prospect of creating novel, symmetry-broken superfluid states in ultracold fermion mixtures with mass imbalance, we have introduced a novel mixture of Dy and K atoms. After studying the complex interaction properties resulting from a whole zoo of Feshbach resonances, we are now able to create bosonic molecules composed of the two fermionic species. We can trap the molecules optically and achieve present conditions near quantum degeneracy. Our experiments are approaching the conditions for a Bose-Einstein condensation of heteronuclear molecules.



Host: Prof. Dr. Johannes Hecker Denschlag, Institute of Quantum Matter

Organisation: Prof. Dr. Jens Michaelis, Institute of Biophysics, jens.michaelis@uni-ulm.de, +49-731-50-23050