Welcome to the website for BEC2! In this space you will find our latest experimental results on ultracold fermionic Li-6, highlights of our lab's history, and more. We will continuously update this site!

For an overview of the work of the Ketterle group, please go to Alkali Quantum Gases @ MIT. Follow the links to other labs in Ketterle group: BEC3 "The Science Chamber" and BEC4/5 "The Rubidium/Lithium Boson Lab". We are part of the Center for Ultracold Atoms, which is a National Science Foundation Physics Frontier Center for ultracold atoms and quantum gases research.
BEC2 team (October 2015, Wujie’s graduation). From left to right: Sean Burchesky, Furkan Cagri Top, Boris Shteynas, Wolfgang Ketterle, Wujie Huang, Junru Li.
BEC2 team (April 2012) from left to right: Wujie Huang, Wolfgang Ketterle, Edward Su, Christian Sanner, Jonathon Gillen and Aviv Keshet.

**Latest Results**

**January 23, 2017**: Our paper on the observation of the supersolid stripe phase got accepted by *Nature 543*, 91!


**August 9, 2011**: Our recent spin fluctuation measurements on a repulsive Fermi gas indicate that the itinerant ferromagnetism doesn't occur in such a system. *Phys. Rev. Lett. 108*, 240404 (2012)


**Latest News**

We have built a state of art machine for ultracold fermionic experiments. Here’s an overview of our progress:

**Jan. 2017**: Our results on the direct observation of the supersolid stripe phase gets published on *Nature 543*, 91!
Our results on the direct observation of the supersolid stripe phase is now on arXiv: 1610.08194


We obtain the first Bragg signal of the long-predicted supersolid stripe phase in a spin-orbit coupling bose-einstein condensate.

We setup the Bragg scattering and detect the lattice supersolidity in our superlattice system.

Postdoc Jeongwon Lee joins the lab.

We stabilize the system and collect the data to demonstrate the single-particle physics for spin-orbit coupling in optical superlattices. Moving towards the stripe phase.

Wujie Huang is graduated! Congratulations, Dr. Huang!

We obtained the first signal of Spin-orbit coupling in an optical superlattice!

We observed the anti-ferromagnetic spin texture in the optical superlattice.

We setup the superlattice by combining 1064nm and 532nm lattice.

We start preparing experiment for realizing Spin-orbit coupling with optical superlattices.

Graduate student Furkan Top joins our lab!

Edward Su is graduated! Congratulations, Dr. Su!

We have Superfluid - Mott insulator Transition!

We have 3D optical lattices!

New UROP student Sean Burchesky joined our lab!

New graduate student Boris Shteynas joined our lab!

We are optimizing Li MOT and sympathetically cooling Li with Na atoms!

We have loaded Na BEC into optical dipole trap!

New graduate student Junru Li joined our lab!

Aviv Keshet is graduated! Congratulations, Dr. Keshet!

We have made Na BEC in the new machine!

Christian Sanner is graduated! Best of luck to your life back at Germany, Dr. Sanner!

Na-Li dual MOT in the new machine.

Optical lattice emulator

We are currently part of the DARPA Optical Lattice Emulator program, which seeks to use fermionic atoms in optical lattices to model crystalline solids. We have chosen the 3-D Fermi-Hubbard model as our model Hamiltonian, and are working towards creating an anti-ferromagnetically ordered state of atoms in the optical lattice. See this popular article for an overview of the OLE program.

Mott-insulating and anti-ferromagnetic states

We are trying to create an anti-ferromagnetically (AFM) ordered state of repulsively interacting fermions in our 3-D optical lattice. To get to this state we need to achieve temperatures of around 3.5% of the Fermi temperature. At higher temperatures we first encounter the Mott-insulating (MI) state. At the moment we are working on characterizing the MI state as well as on cooling and detection techniques that will enable us to observe the AFM state.

Contact Information