**Abstract**

We present our experiments on trapping $^9$K–$^8$Rb degenerate mixture in 1-D optical lattices. In presence of additional quadratic confinement we observe spatial localization of the particles, which can be directly observed by radio-frequency spectroscopy. In case of an external linear potential we can follow Bloch oscillations of Fermi gas and we determine accurately the Bloch period and therefore the acceleration of gravity. It constitutes the first interferometer with degenerate atomic Fermi gases. We can also study the interactions properties of the mixture by confining it in a very tight optical lattice. In particular we can tune the interspecies scattering length with an external magnetic field (Feshbach resonances). This is the first step towards the detection of heteronuclear ultracold molecules.

**Observing fermionic interference**

To observe the interference, we let the atoms evolve in the lattice plus the gravitational potential for holding times $\Delta t$. We adiabatically release the atoms at different instants and we study the oscillation of the interference pattern. We observe the interference peaks oscillating with the Bloch period.

**Optical lattice and parabolic potential: localization**

We prepare a Fermi gas of $^9$K in $F'=0/2$, $m_s=0/2$ by sympathetic cooling with $^8$Rb atoms in $|F=2>, m_s=2$ [1]. We transfer the mixture in the combined potential of the parabolic magnetic trap and a one-dimensional optical standing wave [2].

**Interspecies Feshbach resonances**

We transfer the mixture in a tight 1-D optical lattice and we spin polarize $^9$K in $F=0/2$, $m_s=0/2$ and with Rb atoms in $|F=1>, m=1$. We apply an homogeneous magnetic field and we observe losses in $\{00,11\}$ states, reducing the visibility of the interference fringes.

**Atom interferometry with trapped Fermi gases**

We load the degenerate Fermi gas in a far defined 1-D optical lattice aligned along gravity [4].

The energy spectrum is given by the Wannier-Stark ladder of states which are equally spaced by $\Delta E=mg_\perp\omega_{\perp}$. The spatial extension of each of these states is few lattice sites while in momentum space it occupies the whole Brillouin zone. Neighboring states evolve in time with a phase difference $\Delta \phi=2n\Delta E/\hbar$. Giving rise to an interference pattern periodic in time with $T_B=\hbar/\Delta \phi$. The interference between Wannier-Stark states results in equally spaced peaks in momentum space. In particular the Bragg momentum is the inverse of the spatial period of the lattice, and it can be defined as $q_B$, where $q_B\hbar/\lambda$ is the Bragg momentum.

**References**