

**INTERNSHIP PROPOSAL**

(One page maximum)

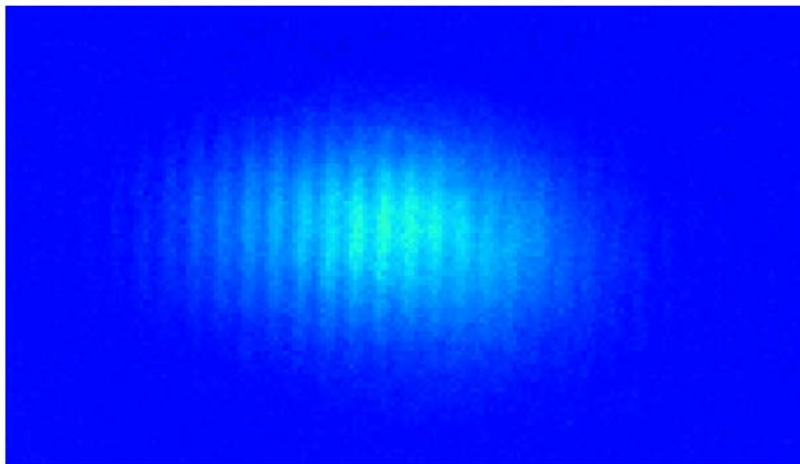
Laboratory name: Laboratoire Kastler Brossel  
CNRS identification code: UMR8552  
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Web page: <http://www.lkb.upmc.fr/ultracoldfermigases/>  
Internship location: LKB (ENS)

Thesis possibility after internship: YES  
Funding: NO If YES, which type of funding:

**1D Fermi gases**

Quantum physics in lower dimension is strikingly different from its 3D counterparts, and many paradigms governing three-dimensional phenomena fail when the dynamics of particles is confined in one or two dimensions. A celebrated example is the breakdown of Landau's Fermi liquid model in 1D: while thermodynamical and transport properties of 3D interacting fermionic systems can be captured by assuming that they behave as an ensemble of weakly interacting quasi-particles, the low-lying excitations of one-dimensional systems are governed by collective excitations where density and spin degrees of freedom are decoupled and are described by a so-called Luttinger-Tomonaga Liquid.

The project will be devoted to the experimental study of strongly correlated ultracold Fermi gases trapped in an optical lattice confining the atoms in tubes where their dynamics is (quasi) one-dimensional (see figure). In the preliminary stage of the experiment, we will explore the effect of "integrability" of 1D systems on their thermalization as well as the possibility of extending the "confinement induced resonance" phenomenon describing the effect on two-body scattering of virtual transitions towards transverse excited states of the trapping potential to engineer novel families of Hamiltonians.



**Picture of atoms trapped in an optical lattice. The distance between each layer is 2.5 $\mu$ m**

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES/~~NO~~      Soft Matter and Biological Physics: ~~YES~~/NO  
Quantum Physics: YES/~~NO~~      Theoretical Physics: YES/~~NO~~