



## AVVISO DI SEMINARIO

Il giorno mercoledì 8 giugno 2016 alle ore 11,00  
presso l'Area della Ricerca CNR di Pisa, Aula 33, piano Terra, Edificio "A"

*il Dr. Giacomo Cappellini*

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*terrà un seminario sul tema:*

# Novel Quantum Simulation with Ultracold two-electron Fermions

Alkali-earth(-like) (AEL) atoms represent a very powerful platform for the implementation of novel quantum simulation schemes, due to the existence of metastable electronic states accessible with optical clock technology, and to the native SU(N) symmetry of inter-atomic interactions.

I will report on two experimental results, achieved with the fermionic  $^{173}\text{Yb}$  AEL species, which shows the possibilities offered by this class of atoms for the realization of novel quantum information schemes.

In a first experiment, we realize strongly interacting ultracold Fermi gases of Ytterbium [1] by tuning the interaction strength between atoms in different electronic states, exploiting a novel kind of Feshbach resonance, the recently proposed Orbital Feshbach Resonance [2], based on the orbital spin-exchange mechanism recently demonstrated by us [3]. By observing the hydrodynamic expansion of the Fermi gas, we detect the emergence of the strongly interacting regime, determining the location of the resonance, and estimate its lifetime to investigate the exploitability of this technique. In a second experiment we exploit the nuclear spin degree of freedom as an additional "extra" dimension to engineer a magnetic field flux trough a synthetic Hall ribbon [4]. We probe the onset of chiral currents along the edges of the system by studying the deformation of the spin-resolved momentum distribution and observing the edge-truncated cyclotron dynamics of the atoms.

References:

- [1] G. Pagano, et al., Strongly Interacting Gas of Two-Electron Fermions at an Orbital Feshbach Resonance, Phys. Rev. Lett. 115, 265301 (2015).
- [2] R. Zhang, et al., Orbital Feshbach Resonance in Alkali-Earth Atoms, Phys. Rev. Lett. 115, 135301 (2015).
- [3] G. Cappellini et al., Direct Observation of Coherent Interorbital Spin-Exchange Dynamics, Phys. Rev. Lett. 113, 120402 (2014).
- [4] M. Mancini, et al., Observation of chiral edge states with neutral fermions in synthetic Hall ribbons, Science 349, 1510 (2015).