

Equilibrium and non-equilibrium dynamics of atoms in optical lattices

Ana Maria Rey

*Institute for Theoretical Atomic, Molecular and Optical Physics,
Harvard-Smithsonian Center of Astrophysics, Cambridge, MA, 02138.*

In this talk I review my theoretical work on cold atoms in periodic potentials starting from simple noninteracting systems and proceeding through the superfluid phase into the strongly correlated regime of Mott insulators and magnetic quantum phases. In particular, I shall discuss the use of effective action technique to study the non-equilibrium dynamics associated with patterned loading of an optical lattice; the physics of effective one dimensional lattice systems focusing on their characterization by fermionization and extended fermionization techniques and their analysis by noise correlation spectroscopy; and a projection technique based on singlet-triplet spin blockade that allows the preparation, detection and characterization of magnetic quantum phases such as anti-ferromagnetic spin orders. All these topics will be described in the context of current experimental efforts.