



Physikalisches Kolloquium

26.01.09

16:15 Uhr

Hörsaal H2

Prof. Dr. Ennio Arimondo (Dipartimento di Fisica, Universita di Pisa, Italy)

“Ultracold atoms in optical lattices: a testbed for quantum simulation”

Abstract:

Novel techniques have been recently developed for quantum engineering and quantum control of ultracold atoms confined in periodic nanostructures as those created by optical lattices. Parallel quantum processing of atoms confined in periodic nanostructures imposed by an optical lattice is expected to lead to significant advances in different areas of quantum information. For instance Bose and Fermi gases in optical lattices have applications in analogue quantum simulation, in which a Hamiltonian of interest is directly engineered in a highly controllable system and the time evolution of that system under the Hamiltonian is observed. Optical lattices provide highly controllable realizations of important lattice models in condensed matter physics. By implementing such Hamiltonians it will be possible to use optical lattice systems as a special-purpose computer that provides information on the dynamics generated by these lattice models. As examples of quantum simulations for condensed matter processes, for a Bose gas of rubidium atoms loaded within an optical lattice we have experimentally investigated the resonant quantum tunneling, the photon-assisted tunneling, the coherent control of tunneling, the production of a Mott-insulator phase and the dynamical localization.

Betreuer: Prof. Schleich