Harvard Quantum Optics Center

Joint Quantum Sciences Seminar

Wednesday, November 29, 4:00 pm
Jefferson 250

Prof. Pierre Pillet

Laboratoire Aimé Cotton, CNRS, Univ Paris-Sud, ENS Paris-Saclay

"Interplay between two-, few- and many-body effects in a dense, cold and disordered gases in strong dipole-dipole coupling"

Dipole-dipole long-range interactions between two atoms in dense and cold atomic media play a crucial role in many configurations by considering ground state atoms as well as highly-excited Rydberg atoms. They may alter the coherent scattering of light by a dense and cold atomic sample. They open also many opportunities for studying few-body and many-body physics, and hopefully for simulating many different quantum systems.

A cold, disordered and dense cesium Rydberg gas in Förster resonant configurations is an interesting example of out-of-equilibrium quantum system. The atoms are prepared in a state, *np*, exchanging internal energy by a resonant way

$$np+np \rightarrow ns+(n+1)s$$

(the resonance is obtained by Stark shift of the *p* level). The reaction due dipole-dipole interaction leads to a very efficient transfer of population from the *p* level to the *s* ones. The Förster coupling offer the possibility to isolate few-body effects from two-body ones and to characterize their features. A saturation regime can be reached, characterized by an amazing behavior corresponding to the "thermalization" of the atomic sample, meaning an equal- distribution of the populations of the relevant levels of the resonant reaction. The dynamics of the thermalization seems to be the result of few-body effects. The interplay between two-, few- and many-body regime in dipole coupling will be discussed, as so well as the role of the diffusion scattering of the products of the reaction.

Student Presentation by Connor Hart will begin at 4:00 PM
Guest Presentation will begin at 4:30 PM
Refreshments will be provided