SEMINARIO
Departamentos de Física Teórica I y II
Universidad Complutense de Madrid

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TITULO: Strongly interacting Rydberg gases out of equilibrium

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ABSTRACT:

In this talk I will focus on the non-equilibrium dynamics of strongly interacting gases of highly excited atoms, so-called Rydberg atoms. Here non-trivial behaviour is generated by the competition between coherent laser excitation, dissipation and the interaction. In the limit of strong dissipation the dynamics is hierarchical and correlated. Here it is possible to establish a connection to soft condensed matter systems such as kinetically constrained spin ensembles that are used as models for glassy dynamics. Moreover, the Rydberg system features other types of strongly correlated soft-matter type behaviour such as facilitation, nucleation and growth.

Beyond that I will discuss a dynamical transition between two stationary states characterized by different excitation densities that has recently observed experimentally. The structure and properties of the phase diagram of the Rydberg gas are determined and the universality class of the transition, both for the statics and the dynamics, is identified. It turns out that the proper dynamical order parameter is in fact not the excitation density and that evidence suggests that the dynamical transition is in the ``model A'' universality class. This means it features a non-trivial Z_2 symmetry and a dynamics with non-conserved order parameter.

This perspective permits a quantitative understanding of a recent experiment which observed bistable behaviour as well as power-law scaling of the relaxation time. The latter emerges not due to critical slowing down in the vicinity of a second order transition, but from the non-equilibrium dynamics near a so-called spinodal line.