

SEMINAR

Thursday, 15th of November 2012 at 12:00

Dept. d'Estructura i Constituents de la Materia Univ. de Barcelona

Abstract

"Strongly correlated ultracold bosons as impurities immersed in a Bose-Einstein condensate."

Impurities, such as fermions or ions, immersed in a cloud of weakly interacting bosons forming a condensate have attracted recent interest because they conform versatile, highly controllable, and experimentally feasible systems for studying quantum correlations. We present an exact many body description of a mixture of ultracold bosons in which a few strongly interacting atoms play the role of impurities immersed in a second species of a much bigger cloud of weakly interacting atoms. The latter species acts as a tunable environment, whose effect over the impurities can be controlled through the interspecies interactions. This framework permits us to describe the behaviour of the quantum correlations between both species through the process of phase separation or along with the dynamics of the impurities within the environment. We also assess the possibility of mimicking the tools of quantum optics to analyse these quantum correlations. Finally, we derive a semiclassical description of the system in terms of two non-linear coupled differential equations where the nonlinearity depends on the interaction strength. Experimental feasibility and technological applications are henceforth discussed.