The Abdus Salam International Centre for Theoretical Physics

Conference on Long-Range Interacting Many-Body Systems: from Atomic to Astrophysical Scales (25 - 29 July 2016)

Venue: ICTP Leonardo da Vinci Building - Budinich Lecture Hall
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Title:
Long-range gravitational-like interaction in a neutral atomic cold gas

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Abstract:

A quasi-resonant laser induces a long-range attractive force within a cloud of cold atoms. In this talk, we will first explain how we take advantage of this force to build in the laboratory a system of particles with a one-dimensional gravitational-like interaction. We give experimental evidences of such an interaction in a cold Strontium gas, studying the density profile of the cloud, its size as a function of thenumber of atoms, and its breathing oscillations. In addition, we will propose to use a cloud of laser cooled atoms in a quasi 2D trap to investigate a fundamental out-of-equilibrium phase transition: using theoretical arguments and numerical simulations, we show that, like in two-dimensional gravity, a transition to a collapsed state occurs below a critical temperature. We will describe precisely the experimental set-up, showing that the phase transition should be experimentally attainable with the current techniques.

References: PRA, 87, 013401 (2013) and PRL 112, 133001 (2014).