

**BOSE-EINSTEIN CONDENSATES IN PERIODIC AND DISORDERED  
OPTICAL POTENTIALS****L. Fallani, C. Fort, V. Guarrera, J. E. Lye, M. Inguscio***LENS European Laboratory for Nonlinear Spectroscopy  
and Dipartimento di Fisica Università di Firenze  
Via Nello Carrara 1, I-50019 Sesto Fiorentino (Firenze), Italy*

We report on the experimental investigation of several aspects regarding the interaction of atomic  $^{87}\text{Rb}$  Bose-Einstein condensates with potentials created with laser light.

Optical lattices produced with laser standing waves can be used as powerful tools to simulate the behavior of solid state systems and to manage the superfluid properties of the bosonic field. We have experimentally studied this system in the superfluid regime, evidencing how nonlinearities caused by atom-atom interactions can produce instabilities of the atomic Bloch waves and eventually destroy the superfluid flow.

Laser light can also be used to produce disordered potentials in a controlled way in order to study the effects of disorder on a bosonic system, with the main aim of investigating the possible achievement of localized quantum phases. We report on experiments that have been performed in Florence with Bose-Einstein condensates in random potentials created with optical speckles. We evidence properties and limitations of such a system and discuss possible perspectives also in combination with a Mott insulating phase.