

Dottorato di Ricerca in Fisica dell'Università degli Studi di Messina

25 Maggio 2012, ore 15.00, Aula E. Majorana, Dip.to di Fisica,

V.le F. Stagno d'Alcontres 31, S. Agata, Messina

Seminar title:

Quantum Bose liquids with logarithmic nonlinearity: Self-sustainability and emergence of spatial extent

Dr. Konstantin G. Zlochastiev

School of Chemistry & Physics, University of KwaZulu-Natal, South Africa

ABSTRACT

The Gross-Pitaevskii (GP) equation is a long-wavelength approach widely used to describe the dilute Bose-Einstein condensates (BEC). However, in many physical situations, such as higher densities, this approximation unlikely suffices hence one might need models which would account for long-range correlations and multi-body interactions. I'll show that the Bose liquid described by the logarithmic wave equation has a number of drastic differences from the GP one. It possesses the self-sustainability property: while the free GP condensate tends to spill all over the available volume the logarithmic one tends to form a Gaussian-type droplet - even in the absence of an external trapping potential. The quasi-particle modes of the logarithmic BEC are shown to acquire a finite size despite the bare particles being assumed point-like, i.e., the spatial extent emerges here as a result of quantum many-body correlations. If time allows, I'll study the elementary excitations and demonstrate that, depending on the density the latter can be of the massive relativistic, massless relativistic, tachyonic and quaternionic type.