



Jean Dalibard

Professor at the École Polytechnique

Member of the French Academy of Sciences

Researcher at the École Normale Supérieure.

Talk Title: Solitons in an atomic 2D gas: an illustration of scale invariance

Abstract: Solitary waves are encountered in a broad range of fields, including photonics, hydrodynamics, condensed matter and high-energy physics. Most experimental observations are limited to one-dimensional situations, where they are naturally stable. For instance, in 1D cold Bose gases, they exist for any attractive interaction strength g and particle number N . By contrast, in two dimensions, solitons are expected to appear only for discrete values of gN , the so-called Townes soliton being the most celebrated example. In this talk, I will present recent theoretical and experimental results regarding the deterministic preparation of such a soliton. By varying the interaction strength and the atom number, we confirm that the soliton (i) can exist as soon as gN reaches the proper value and (ii) can have an arbitrary size, a hallmark of the scale invariance characteristic of 2D fluids with contact interactions. I will also discuss some initially unexpected findings in these 2D fluids such as the existence of "breathers", i.e., specific initial shapes that undergo a periodic evolution when placed in a harmonic potential.