Atomtronics in 1D quantum gases in ring geometries

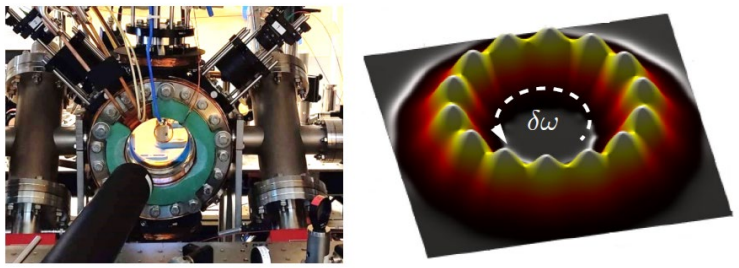

Figure 1 : left : picture of our BEC apparatus ; right : optical ring potential for studying 1D superfluidity

Atomtronics is an emerging quantum technology which uses tailored potentials for atomic matter waves with applications that range from quantum simulations to the development of practical devices. The goal of this PhD is to investigate experimentally fundamental physics questions relevant to atomtronics: the complex dynamics of 1D superfluid currents in near- and far-from-equilibrium situations and exploration of strongly-interacting regime in the 1D ring geometry. We will address these problems using an atomic Bose-Einstein condensate experiment using potassium atoms. Building upon this experimental platform, we will develop 1D ring structures to trap atoms, with the goal of studying 1D superfluidity in different interaction parameter regimes. The PhD project will benefit from high-quality support of established theoreticians, expert in theoretical and numerical methods for 1D quantum systems in different regimes, which will bring pivotal contribution for the success of the project. Experiments will validate the analytical predictions, and guide future theoretical direction beyond the current state-of-the-art.

Keywords: Ultracold quantum gas experiments, Atomtronics, Quantum simulations, Strongly-correlated quantum systems.

Integration & Financing: The thesis will take place in the PhLAM laboratory – University of Lille. The student will be integrated into the "Quantum Systems" team (7 permanent members), and will benefit from their expertise on disordered quantum systems. Funding for this thesis will be ensured through national quantum programs.

Pre-requisites: The candidate should have an advanced level in quantum and statistical physics. Although not compulsory, experimental background and attraction to numerical simulations are welcome.

Contact: Radu Chicireanu (radu.chicireanu@univ-lille.fr)

cnrs PhLAM Université de Lille