Master 1: *International Centre for Fundamental Physics*

INTERNSHIP PROPOSAL

Laboratory name: Institute for Quantum Physics
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Development of a cold strontium atom source

Research field

In our laboratory we use ultracold strontium atoms to study quantum many-body physics. We are particularly interested in strongly correlated quantum many-body systems where interactions are comparable to kinetic energy, a situation which often leads to fascinating emergent phenomena such as high-temperature superconductivity or the fractional quantum Hall effect. Using laser light, we engineer and probe quantum gases both in and out of equilibrium with a resolution down to the single particle and spin (Fig.1). Such detection method offers a new paradigm to study quantum many-body systems and we plan to use it to study highly entangled phases of matter.

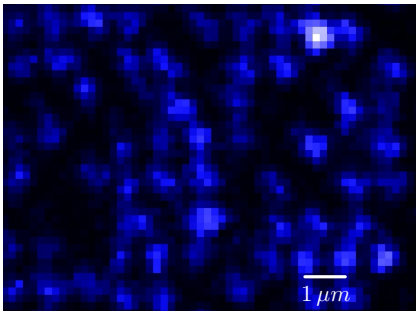

Figure 1: *Experimental picture obtained in a quantum gas microscope. Each blue dot is a single atom located on one site of a two-dimensional square optical lattice.*

Internship project

The goal of the experimental internship is to design, build and test a compact high flux cold atom source for quantum simulations with strontium. The system to be build will consist of an oven, a Zeeman slower and a 2d magneto-optical trap. During this project the student will develop expertise in several essential aspects of experiments with cold atoms ranging from laser cooling, laser spectroscopy and frequency stabilization, CAD and simulations, optics as well as vacuum technology. At the end of the internship the candidate will thus have acquired basic experimental knowledge to engage into a PhD in the field of cold atoms.