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## PhD positions in experimental quantum simulation with ultracold atoms

The [Ultracold Quantum Gases research group at ICFO](#), led by Leticia Tarruell, is looking for well-qualified, highly motivated and dynamic PhD students who wish to enhance their scientific career in a friendly, international, and stimulating scientific environment within the field of quantum simulation with ultracold atoms.

The group explores quantum many-body physics with ultracold atoms in three experimental platforms.

In the potassium lab, we investigate two-component continuum systems with tuneable interactions. Our goal is to engineer novel states of matter which emerge when the overall interactions of the system almost completely cancel out, making quantum fluctuations and correlations play a key role and resulting in new effective interaction terms. During the last years, we have shown how this can be used to stabilize quantum liquid droplets [[Science 359, 301 \(2018\)](#)], to simulate gauge theories [[Nature 608, 293 \(2022\)](#)] or, in yet unpublished work, to investigate supersolids. Our long-term goal is to demonstrate other exotic superfluid phases in this platform, and to extend our experiments to the strongly interacting regime. We are looking for excellent PhD candidates to work in this topic within our [ERC project SuperComp](#).

In the strontium lab, our objective is to harness the properties of two-electron atoms in optical lattices for quantum optics and quantum simulation experiments. We aim at engineering quantum many-body states combining photons and bosonic strontium atoms, and at exploiting the large nuclear spin of fermionic strontium atoms to investigate Hubbard models for spin larger than 1/2. To this end, we have very recently demonstrated quantum gas microscopy of bosonic strontium, imaging for the first time strontium lattice superfluids atom by atom. We are looking for outstanding PhD candidates to perform the very first experiments on this new apparatus, and to extend its capabilities to include the fermionic isotope. This project is funded by the [European Quantum Flagship project PASQuanS2.1](#) and the [European project DAALI](#).

In the Rydberg lab, which we started less than a year ago, we are setting up a programmable quantum simulator using strontium atoms trapped in optical tweezers and excited to Rydberg states. Our goal in this apparatus is to expand the scope of quantum simulation from low to high energy physics by realizing lattice gauge theories in more than one spatial dimension. We are looking for a highly motivated PhD candidate to push forward the construction of the new setup and to perform the first experiments. This project is funded by the [European QuantERA project DYNAMITE](#) and by the Catalan and Spanish research agencies.

### Eligibility criteria:

We are looking for PhD applicants who have already worked in a laser lab before and have a background in quantum optics, atomic physics or quantum many-body physics. Knowledge of some of the relevant technologies such as vacuum, electronics, optics

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or programming is certainly a plus, but motivation to work in a team is as important. You should be enthusiastic about setting up and conducting challenging experiments at the forefront of both fundamental quantum science and technology, in a team of 3 to 4 people.

**Contact details/applications:**

To apply, please contact Prof. Dr. Leticia Tarruell ([leticia.tarruell@icfo.eu](mailto:leticia.tarruell@icfo.eu)) to discuss the scientific projects, sending her your CV and the name of two people who could provide letters of recommendation. A formal application should also be submitted through our Jobs Opening site <https://jobs.icfo.eu/>.