Contribution ID: **161** Type: **Poster**

# Quantum gas microscopy of strontium BECs in a clock-magic optical lattice

*Monday, 11 September 2023 22:40 (20 minutes)*

Ultracold atoms in optical lattices represent an outstanding tool to create and study quantum many-body systems. Combining these lattice systems with the properties of alkaline-earth atoms such as strontium gives rise to exciting research directions. On one hand, sub-wavelength arrays of bosonic strontium exhibit strong cooperative effects in atom-photon scattering, and constitute rich dissipative many-body systems. On the other hand, fermionic strontium allows to investigate the Fermi-Hubbard model, where SU($N$) symmetric interactions between the $N$=10 internal states give rise to exotic magnetic phases beyond the limits of natural materials.

To study these systems experimentally, we have developed an experimental apparatus for strontium quantum-gas microscopy. It routinely produces Bose-Einstein condensates of strontium-84 by evaporative cooling in an elliptical sheet beam, which confines the atoms to a two-dimensional plane. The gas is then loaded into a two-dimensional optical lattice in bow-tie configuration of lattice spacing 575 nm. The sheet and lattice potentials are generated by 813-nm light, corresponding to the strontium clock-magic wavelength, and a combined power of ~3 W. Exploiting a high-NA imaging objective, we demonstrate single-atom and single-site resolved fluorescence imaging by scattering photons on the broad 461-nm transition, while performing efficient Sisyphus cooling of the atoms on the narrow 689-nm transition. This allows us to obtain high signal-to-noise ratio single-site resolved images, where the atoms can be imaged for several tens of seconds without observing significant hopping. In my poster, I will discuss the details of our approach, as well as the perspectives opened by our new apparatus for quantum optics and quantum simulation experiments.

**Primary author:** HÖSCHELE, Jonatan (ICFO –Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain)

**Co-authors:** BUOB, Sandra (ICFO –Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain); Dr RUBIO-ABADAL, Antonio (ICFO –Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain); Dr MAKHALOV, Vasiliy (ICFO –Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain); Prof. TARRUELL, Leticia (ICFO –Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain; ICREA, Pg. Lluís Companys 23, 08010 Barcelona, Spain)

**Presenter:** HÖSCHELE, Jonatan (ICFO –Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain)

**Session Classification:** Poster Session II

**Track Classification:** Quantum Simulation with Single Atom Resolution