

1. Position identification

Title of post : Postdoctoral position on many-body theory of quantum systems with long-range interactions using advanced numerical methods

Type of contract : Post-doctoral contract

Category (A,B or C) : A

Contract/project period : 01.01.2025 - 31.12.2025

Expected date of employment : 01.01.2025

Proportion of work : Full time

Workplace : Institut de Science et d'Ingénierie Supramoléculaires (ISIS) – Centre Européen de Sciences Quantiques (CESQ)

Desired level of education : PhD or equivalent

Experience required : PhD and/or postdoc experience in a relevant field, e.g. theoretical atomic, molecular and optical physics, condensed matter physics, numerical methods

Contact(s) for information on the position (identity, position, e-mail address, telephone) :

Guido Pupillo, pupillo@unistra.fr

Date of publication : October 29th 2024

Closing date for the receipt of applications : November 26th 2024

2. Research project or operation

The "SIX" project "Super-solidity with Indirect eXcitons" aims at investigating quantum matter phases accessible to strongly correlated dipolar bosons confined in two-dimensional lattice potentials. SIX brings together one group specialised in experimental studies of ultra-cold indirect excitons (CRHEA), and two theoretical groups specialised in modelling quantum matter states (ISIS and LPMMC), in particular realised with atomic systems.

3. Activities

➤ **Description of the research activities :**

The candidate will investigate many-body phases, phase transitions and dynamics of bosonic and fermionic quantum systems with long-range couplings, in particular developing and utilizing quantum monte-carlo methods (e.g. worm algorithm for bosons and diagrammatic quantum monte-carlo methods for fermions). S/he will collaborate with experimentalists and theorists in the network on the physics of strongly interacting excitons.

➤ **Related activities :**

The successful candidate will conduct independent research and work with the group of Professor Guido Pupillo on the topic of Quantum Computing with Trapped Atoms. This is a theory project at the interface of theoretical atomic, molecular and optical physics, and statistical physics. It is expected that the researcher will publish scientific and technical papers and present research results at national and international conferences.

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4. Skills

➤ **Qualifications/knowledge :** Proven record of research in numerical methods for quantum many-body physics, especially publications and presentations, external research grants, or other relevant indicators. Expertise in statistical physics and computational many-body physics is essential.

➤ **Operational skills/expertise :**

Proven record of research in atomic physics, many-body physics, publications and presentations, external research grants, or other relevant indicators.

- Demonstrated ability to conduct research collaboratively and independently.
- High-level communication skills.

➤ **Personal qualities :** curiosity, strong motivation for research, ability to learn new subjects. Ability to work in group. Skills for reporting on research results.

5. Environment and context of work

➤ **Presentation of the laboratory/unity :**

We offer the possibility to do exciting experiments embedded in a culturally and scientifically rich research environment, situated in the heart of Europe. The new European Centre for Quantum Sciences (CESQ), attached to ISIS (Institut de Science et d'Ingénierie Supramoléculaires), develops new lines of research and technology exploiting quantum principles, at the frontiers to chemistry, physics, materials science, and computing. CESQ hosts an operational prototype Rydberg quantum processor based on optically trapped Rydberg atom qubits and leads the development of the next generation dual species Rydberg quantum computer with >400 fully addressable qubits for scalable digital QC.

➤ **Hierarchical relationship :** The SIX project is locally coordinated by Guido Pupillo. The postdoctoral will be a member of the CESQ, currently directed by Guido Pupillo.

➤ **Special conditions of practice (notice attached):** None

To apply, please send your CV, cover letter and diploma to :

PUPILLO Guido, pupillo@unistra.fr