

# Position Offered: POSTDOCTORAL RESEARCHER

## Project: *Towards hybrid quantum machine learning with Rydberg atoms experiments*

**Technological and scientific fields:** Quantum Simulation, Quantum Technologies, Artificial Intelligence, Machine Learning, Cold Atoms.

**Location:** El Entrego, Principado de Asturias, Nanomaterials and Nanotechnology Research Center, <https://cinn.es/en/nanomaterials-and-nanotechnology-research-center/>

**Research Group/PI:** Quantum simulations / Daniel Barredo – Miguel A. Pruneda

### PROJECT SUMMARY

Quantum simulation and computation stand today as highly dynamic domains, potentially offering the only practical avenues for addressing significant quantum many-body problems found in physics and chemistry. Due to these advantages, numerous platforms are being explored. Among them, arrays of neutral atoms trapped in optical tweezers and excited to Rydberg states are becoming a leading technology (<https://doi.org/10.1051/e3n/2022406>). At CINN, we are building a new quantum simulator based on this technology for these tasks. The main objective of this project is to explore and exploit the possibilities of Machine Learning (ML) for quantum simulation. We plan to use ML to control hardware operations in the new machine and to optimize the simulation parameters. Moreover, we will explore the application of quantum simulations to encode optimization algorithms, or to solve classical machine learning problems. This objective will also be used as a testbed scenario to establish a transversal platform to provide ML techniques to a broad spectrum of research lines at CINN.

### PROFESSIONAL PROFILE

#### Minimum requirements:

- PhD in Physics, Mathematics, Computer Science or related fields.
- Proficiency in English.

#### Merits to be considered:

- Experience with technologies used in AMO experiments.
- Programming skills (Python, Julia, C++,...).
- Proficiency in data analysis.
- Knowledge of ML techniques

### WHAT IS OFFERED

The candidate will have the opportunity to join a dynamic team, composed of both experimentalists and theorists, to work on quantum simulation and computation with cold atoms, with a particular emphasis on integrating machine learning techniques. The position offers opportunities for professional growth through participation in international workshops, conferences and collaborations with other research groups in a multidisciplinary environment. Furthermore, a full training plan including specialized courses and seminars developed over four years will be provided. This training will be combined with several research stays in top-notch international laboratories.

#### Contract conditions:

Indefinite contract for a Postdoctoral Researcher associated to the Momentum Project of 4 years' duration according to Spanish science law. Gross annual salary (41.000 € - 52.000 €).

**Start of contract: before 31 December 2024**

### PRINCIPAL INVESTIGATOR CONTACT

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