

The Nanoscience Cooperative Research Center, CIC nanoGUNE, located in Donostia / San Sebastian, Basque Country (Spain), is currently looking for a

MASTER STUDENT

to work on

Exact numerical solution of many-body problems in solids amenable to quantum computers

NanoGUNE is a research center devoted to conducting world-class nanoscience research for a competitive growth of the Basque Country. NanoGUNE is a member of the Basque Research and Technology Alliance ([BRTA](#)) and is recognized by the Spanish Research Agency as a *María de Maeztu* Unit of Excellence.

The position is offered in the **Theory Group**, led by **Emilio Artacho**. More information can be found at <https://www.nanogune.eu/en/research/groups/theory>

Project Description

In a collaboration with IBM Quantum in IBM Research Zurich we are implementing computational methods to resolve the quantum many-body problem for finite systems (molecules) using quantum computation. They are embedded in larger systems treated with large-scale (but conventional) high-performance computers. In this Masters project we want to explore extending that approach from molecules to crystalline periodic systems.

The main idea is to replace the equivalent to exact diagonalisation of the Hamiltonian in the active space defined on a finite region, by the one in which the active space is repeated periodically, thereby addressing highly correlated solid systems.

We will be using second quantisation defined on non-orthogonal bases as basic formal tool. And we will be addressing the model Hamiltonian defined by fully interacting electrons in a cosine potential. In particular we will be addressing the highly-correlated high-amplitude potential limit in the correlated Mott insulator phase. k-point interpolations from the on-body density matrix (DM) and the diagonal of the two-body DM will be attempted.

The project will start with formal work and numerical tests on small test systems (Jupyter notebooks with python and numpy should be enough). Time permitting (depending on how much time your Masters allows to dedicate to the project) we may move on to consider implementation connecting with IBM's QISKIT platform for actual quantum computations.

Candidates should **apply** by following the instructions and recommendations of the general call and by completing the form below and attaching the following documents:

- a. A complete CV
- b. Academic record and cover letter grouped in a single PDF file

The **deadline** for applications is **06/04/2026**.

NOTES:

- (i) All applicants will receive an answer after the end of the selection process; but please note that due to the large number of submissions that are expected, we cannot provide individual feedback.
- (ii) Additional information about nanoGUNE's commitment towards [HR excellence in Research and Gender Equality](#) are available on our website.

(iii) We encourage you to subscribe to our [HR mailing list](#) to receive information related to nanoGUNE's open positions and open calls for different training and talent attraction programs.