The goal of this project is to create open-shell graphene nanostructures. These are customized graphenoid structures with unpaired electrons, which have a strong potential for a new generation of magnetic materials.
In principle, graphene is far from becoming magnetic. Magnetism is generally associated to a large degree of electron localization around one atom and to strong spin-orbit interaction. Both conditions are absent in graphene, which is a strongly diamagnetic material. However, it is known that certain graphene structures may spontaneously rearrange their electrons and induce a spin imbalance in parts of the systems. These are the so-called open-shell graphene structures.

This Master project will combine theoretical simulations and experiments with the final goal of producing an open-shell graphene structure. The candidate will first predict structures with emerging magnetic properties using tight-binding methods, in collaboration with theoretical collaborators. In a second step, the Master candidate will determine a route for producing the graphene structure on a surface using a method called "on-surface synthesis" in which our group is deeply involved. The production route will be realized in collaboration with organic synthesis collaborators. Finally, the Master candidate will realize the synthesis on a metallic surface, in the experimental set-ups of our group in nanoGUNE. The success of the reaction and the demonstration of its magnetic state will be realized using a low-temperature scanning tunnelling microscope during the last three months of the Master research project.

The Master project has a strong multidisciplinary character, involving ground knowledge of quantum physics, condensed matter physics and molecular physics, and combines theoretical simulations, and experimental work. It will be realized in the nanoimaging group in CIC nanoGUNE.

Description of the research group:

The goal of the **Nanoimaging group** is to elucidate the laws of magnetism, optics, and electronics at the scale of atoms and molecules. We use low-temperature Scanning-Probe Microscopy to study the basic quantum phenomena behind the macroscopic behavior of matter and to manipulate their basic atomic components. For more information, see our website at
https://www.nanogune.eu/en/research/groups/nanoimaging

Application:

If you are a master student with interest for cutting edge research in hybrid materials, please contact **Nacho Pascual** (ji.pascual@nanogune.eu).

To apply for a master scholarship fill in the form below and follow the instructions and recommendations of the general call (**open until 30 June 2022**).

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.