3th of September 2018

MPC
MATERIALS PHYSICS CENTER

# CALL FOR POSTDOCTORAL POSITIONS

Centro de Física de Materiales - CFM is a joint centre by the University of the Basque Country - UPV/EHU and the Spanish Research Council - CSIC. The centre brings together several outstanding teams who develop frontier research using state-of-the-art facilities.

CFM's headquarters is located at Ibaeta Campus in San Sebastian, within walking distance from several institutions also committed to explore physics and material science, both at fundamental and applied levels. Altogether, we represent a thrilling international community devoted to innovation and discovery at the very edge of science.

We are currently seeking for bright, highly motivated young researchers who will be able to make the most of this opportunity and take the chance for boosting their visibility and integration within the research community.

This is a unique occasion to work in an intellectually stimulating environment in close interaction with all our scientific staff, a wide group of postdoctoral researchers and a large number of international, world-class visitors. There will be plenty of opportunities to develop collaborations and build a global network of contacts of great added value.

## Call is open for allocating 2 Postdoctoral appointments.

Each position will cover a period of two years (1+1, with renewal for the second year subject to evaluation of performance). The salary will be 36 243,24 € per year (before taxes). Funding is provided by the Research Association MPC – Materials Physics Center.

**Application Process:** The following documentation is required for applying:

1. **Updated CV.** Please provide clear contact information.
2. **Brief statement of motivation**, specifying the project you are interested in (see list of available projects below). Only one of the listed projects can be requested.
3. **A letter of acceptance/support** signed by the supervisor of a project is required.
4. **Reference letters** are welcomed but not essential.

*Please mind that candidates must choose one project only.* Candidatures applying for two or more projects at once will be automatically rejected.

All documents must be sent to jobs.cfm@ehu.eus

## The deadline for this call is 23th September 2018, at 17:00 CEST.

**Evaluation Process:** Applications will be evaluated by a Committee designated by the CFM Direction Board. The following criteria will be applied:

- CV of the candidate.
- Adequacy of the candidate's scientific background to the position to which he/she is applying.
- Reference letters.
- Gender balance and opportunities to young researchers.

*Only applications received before the deadline (23th September 2018 at 17:00 CEST) will be evaluated.* Evaluation results will be communicated to the candidates soon after.

Positions will only be filled if qualified candidates are found. If this is not the case, the deadline for submission of applications may be extended.

If you need further information about a specific project, please get in touch directly with the contact person indicated in the project description. For any general queries on the selection process, contact mpc@ehu.es.

## LIST OF AVAILABLE PROJECTS

### Project P1. Plasmonic effects on exciton and multiexciton emission of single quantum dots

*Contact person: Yury Rakovich (yury.rakovich@ehu.eus)*
Reference: PD/2018/1

The post-doctoral candidate will join the Materials and Spectroscopy Group at the Centro de Fisica de Materiales. The group research focuses on spectroscopy and photonic applications of nano-scale functional units, including semiconductor quantum dots and nanowires, metal nanoantennas, and organic/inorganic nano-hybrid systems.

The aim of this project is to investigate the interaction between single quantum dots or nanoparticles and plasmonic nanostructures with a particular emphasis on the generation and enhancement of emission of multiexcitonic states.

The successful candidate should have a PhD in physics or chemistry and experience in optical microscopy. As an advantage, knowledge of time-resolved fluorescent microscopy imaging and photon correlation spectroscopy will be considered.

We are looking for a highly-motivated post-doctoral researcher who can work independently, but also in team.

## Project P2. Electronic Properties of Van der Waals Graphene Nanostructures

*Contact person: Andres Ayuela (swxayfea@sw.ehu.es)*
Reference: PD/2018/2

We aim to study the electronic and transport properties of graphene heterostructures, for instance, bilayers and bilayer flakes. We will study topological states in carbon-based systems, including grain boundaries and deformations. We will look at the interplay between localized states of different origins: related to edges (vacancies, ad-atoms or defects) and topologically protected states. We then analyze the transport properties of topologically protected states as one-dimensional conducting modes.

This work requires mainly the use of tight binding methods. The proven ability/experience in tight binding codes will be very positively evaluated. Although some expertize in methods within density functional theory would also be appreciated.

## Project P3. Dynamics of molecules interacting with 2D systems

*Contact person: Ricardo Diez Muiño (rdm@ehu.eus)*
Reference: PD/2018/3

Advances in the description of elementary reactive processes at surfaces are largely triggered by the quest for systems and conditions under which reactivity can be controlled, enhanced or inhibited. From this point of view, two-dimensional (2D) layered systems, such as transition metal dichalcogenides or transition metal carbides/nitrides, are receiving increasing attention due to their high activity as catalytic agents. The catalycity of these systems can be also very dependent on the presence of defects as well as on the nanostructural properties when the system is finite (nanoribbons, nanosheets, etc.). The goal of this project is to advance in the theoretical description of physico-chemical processes that involve the interaction between small molecules ($H_2$, $N_2$, $O_2$… ) and 2D materials. Ab-initio molecular dynamics (AIMD) based on density functional theory (DFT) will be used to describe the dynamics of adsorption and dissociation processes. Candidates to this position must hold a PhD degree in physics or chemistry and should have experience in first-principles theoretical methods as well as in numerical simulations.

## Project P4. Theoretical description of femtosecond laser-induced molecular desorption and reactivit

*Contact person: Maite Alducin Ochoa (maite .alducin@ehu.eus)*
Reference: PD/2018/4

Femtosecond laser induced desorption has been experimentally demonstrated to be a promising technique to trigger and control the recombination and reaction of adsorbates on surfaces. However, the complexity and variety of the physical processes involved (electron excitations, surface phonons, adsorbate's excited states) and the strong dynamical nature of all of them have limited our understanding of the variables determining the efficiency and

applicability of this technique. The new AIMDEF methodology that accurately accounts for the electronic and phononic excitations and is also computationally efficient is perfectly fitted to investigate existing unsolved issues. The objective of the project will be to investigate, using this methodology, different laser induced desorption scenarios. In particular, to disentangle the mechanisms behind the strong coverage dependence of the desorption yields in the CO/Pd(111) system and the study of systems in which both CO molecular and O atomic adsorbates are present in metal surfaces. The candidate should hold a PhD in theoretical or computational physics or chemistry and must have a strong background on density functional theory, as well as, high expertise in computational work.

## Project P5. Dynamics of the CO-O recombination at metal surfaces studied from first principles

*Contact person: Joseba Iñaki Juaristi Oliden (josebainaki.juaristi@ehu.eus)*
Reference: PD/2018/5

Recombination processes involving gas-phase and pre-adsorbed species on surfaces play a prominent role in a huge variety of natural and technological processes: in the production of chemical compounds, in the search for controlling the emission of noxious gases, and in the research on hydrogen storage, to just cite some relevant examples in which they are exploited from the catalysis perspective. In addition, these processes usually being highly exothermic, they are also known to be a major source of surface damage in general plasma-wall interactions, such as those occurring on the internal walls of fusion reactors or on aerospace vehicles during the atmospheric entry. In this project, we propose to investigate the recombination of O with preadsorbed CO. There are experiments showing that the efficiency of these process depend dramatically on the metal surface considered and on the coverage. The objective will be to determine the surface electronic properties that cause such a dependence. The candidate should hold a PhD in theoretical or computational physics or chemistry and must have a strong background on density functional theory, as well as, high expertise in computational work. Experience on gas-surface dynamics simulations will be also valued.

## Project P6. Design and synthesis of high performance single-chain nanoparticles

*Contact person: Jose A. Pomposo (josetxo.pomposo@ehu.eus)*
Reference: PD/2018/6

Single-chain polymer nanoparticles are chemically folded polymers with protein-like architectures and with promising prospects for nanomedicine, catalysis, sensing, as well as other different application fields. The aim of this postdoc project is to investigate how to control the primary structure of synthetic copolymers to produce well-defined folded single-chain polymer nanoparticles, and to establish useful structure-properties relationships for potential applications.

We are looking for a motivated candidate with a high expertise in polymer synthesis via controlled/living radical polymerization techniques (RAFT, ATRP, NMP, etc) as well as polymer characterization techniques (SEC/GPC, NMR, DLS, FTIR, DSC, etc). The candidate must hold a PhD degree or be expected to get it within next months.

## Project P7. Crowding effects on the behavior of macromolecular nano-objects

*Contact person: Arantxa Arbe (mariaaranzazu.arbe@ehu.eus)*
Reference: PD/2017/7

The general framework of this project is to contribute to the understanding of crowding effects on the structure and dynamics of macromolecules of diverse types. We are currently running a project focused on single-chain nano-particles (SCNPs) –soft nano-objects obtained by intramolecular cross-linking of individual macromolecules. In dilute conditions, SCNPs have been found to adopt sparse morphologies, reminiscent of those presented by intrinsically disordered proteins (IDPs) under the same dilute conditions. This similarity motivates the use of synthetic SCNPs as mimicking nano-objects for IDP to investigate structural as well as dynamical aspects as functions of different variables. The proposed project aims to characterize the influence of increasing the concentration of the macromolecular environment of SCNPs and IDPs. In this way, we try to extract universal features due to steric effects of the behavior of biomacromolecules in the crowded conditions typical for cellular environments. The study will be based on the application of scattering techniques, in particular neutron scattering on deuterium-labeled samples, as well as small angle X-ray scattering (SAXS), static and dynamic light scattering (SLS and DLS) available in our labs. Experience of the candidate in light scattering will be particularly appreciated.

## Project P8. Theoretical studies of Magneto-electric Effects at hybrid Interfaces between Superconductors and magnetic Insulators

*Contact person: Sebastian Bergeret (Sebastian_bergeret@ehu.eus)*
Reference: PD/2017/8

The Mesoscopic Physics Group (MPG) search for a Postdoc to work on the theory of electronic transport of nanostructures with hybrid interfaces between metals, superconductors and magnetic insulators. The Postdoc will extend the quasiclassical formalism for superconducting hybrid structures in the presence of spin-dependent fields, by deriving boundary conditions for the quantum kinetic equations developed recently by members of the MPG. With the help of these boundary conditions the candidate will explore magneto-effects that might take place at hybrid interfaces. The Postdoc will have the opportunity to work closely with experimental groups that form the collaboration network of the MPG. The ideal candidate will have a PhD degree in Physics and experience with the non-equilibrium Green functions technique, as well as knowledge on spin-transport phenomena and/or mesoscopic superconductivity.

## Project P9. Quantum Nanophotonics in cryogenic environment

*Contact person: Gabriel Molina Terriza (Gabriel.molina.terriza@ehu.eus)*
Reference: PD/2017/9

The group of Prof. Gabriel Molina-Terriza has recently relocated to the Material Physics Center (San Sebastian, Spain). We are looking for highly motivated, talented researchers looking for a post-doctoral position in the area of Quantum Nanophotonics. The successful candidate will work in a state-of-the-art laboratory environment to study the interaction of quantum states of light with subwavelength structures, such as plasmonic nanoantennae, quantum dots and nanodiamonds. The Quantum Nanophotonics group at MPC is collaborating with renowned international research groups to control the quantum properties of small material particles. We are also collaborating with industrial partners to make them suitable to become the next generation of biosensors or to perform very precise measurements of electric and magnetic fields.

The project that the successful candidate will join is devoted to the study of the interaction of quantum light with nanostructures in a controlled cryogenic environment. Thus, the candidate will need to operate a closed loop cryostat with an optical access in order to perform spectroscopy of plasmonic and dielectric structures. The candidate will be expected to adapt the system to use entangled photon sources to interact with the structures and study quantum decoherence effects.

The candidates should have a PhD in Physics or Engineering and extensive experimental experience in Quantum Optics and the operation of closed loop cryostat with optical access. Experience with the use of spatial light modulators, programmable logic devices such as FPGAs, and numerical methods to solve electromagnetic scattering will be favourably considered.

## Project P10. Topological interfaces

*Contact person: Lucia Vitaliy (lucia_vitali@ehu.eus)*
Reference: PD/2017/10

Two dimensional materials provide a unique platform to explore physical effects occurring via quantum tunneling or Coulomb interaction. 2D layers are particularly suited to characterize the “transferring of electronic properties” as in these materials these induced effects are expected to be strongest. It is expected that in these “all surface atoms” systems, one material may be able to borrow properties to the other, enabling the implementation of new logic.

In this contest of 2D interfaces we offer a postdoctoral position (m/f) focusing in the field topological insulator interfaces. A primary objective of this project will be the growth in ultra-high vacuum environment of the interfaces and their experimental characterization by means of a scanning tunneling microscope at low temperature. We offer an environment where experimental achievements can be developed and tested in close collaboration with in-house

computational experts. To strengthen the team, the group is looking for a highly motivated researcher with a background on physics/chemical physics, and experience with surface science characterization. He/she will have the opportunity to collaborate closely with local theoretical experts and to work with state-of-the-art infrastructures. Proven record in topological insulators and/or scanning tunneling microscopy is a plus.

## Project P11. Optical response of metasurfaces based on plasmonic nanoantennas

*Contact person: Nerea Zabala (nerea.zabala@ehu.eus)*

Reference: PD/2017/11

Hybrid platforms combining plasmonic nanoantennas and materials with special properties as a phase-change or spintronics offer excellent technological opportunities for active plasmonics, as they provide large changes in their optical response.

The main goal of this project is to address theoretically, and in collaboration with experimental groups, the plasmonic response of hybrid nanostructures or metasurfaces composed of metallic nanoantennas and materials exhibiting interesting physical properties as, for instance, a metal-dielectric phase change, ferromagnetism or ferroelectricity. These combinations increase the tunability of their plasmonic resonances in the visible and near infrared spectral range and allow for the external control using laser pulses or external electric or magnetic fields.

We are looking for a post-doctoral candidate with expertise in theoretical and computational electrodynamics. The candidate should hold a PhD in Physics, with a strong theoretical background in photonics and condensed matter physics.

The successful candidate will join the Theory of Nanophotonics group at the CFM.