Materials Physics Center
Centro de Física de Materiales

23th of July 2020

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 3 Postdoctoral appointments.

Each position will cover a period of two years (1+1, with renewal for the second year subject to evaluation of performance), star date will be the last quarter of 2020. The salary will be 34.642,20€ 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

ASOCIACION DE INVESTIGACION MPC, as responsible for the treatment, informs you that your data is collected with the purpose of: Management of the employees and the data of the candidates for the places offered by the center and publication of the selected ones and of the persons they are on the waiting list on the Association's website. The legal basis for the treatment is the consent of the interested party and compliance with a legal obligation. Your data will not be transferred to third parties except legal obligation. Any person has the right to request access, rectification, deletion, limitation of treatment, opposition or right to the portability of their personal data, by writing to the address of our offices, or by sending an email to mpc@ehu.eus, indicating the right you want to exercise

The deadline for this call is 7th September 2020, at 12:00 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 (7th September 2020 at 12:00 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. Molecular dynamics study of Calmodulin.

Contact person: Aitor Bergara (a.bergara@ehu.eus); Aritz Leonardo (aritz.Leonardo@ehu.eus)

Reference: PD/2020/1

The complete resolution of the sequence of the human genome in 2016 has been a huge milestone that continuously reveals causal relations among pathologies and gene signaling. Moreover, the latest advances of experimental techniques, such as nuclear magnetic resonance, provide a direct access to 3D maps with atomic resolution of the proteins that form cell membranes. This new accessible structural information has become a revolution in biological sciences for the design of new drugs that improve the well-being of humans. Remarkably, 60% of the commercial drugs act precisely on the proteins located at the cell membranes. With this scenario in mind, physical models that mimic atomic interactions within the proteins and their posterior time evolution through molecular dynamics provide a very powerful tool for the prediction and comprehension of membrane phenomena. Theoretical

simulations of proteins serve as guidance for the design of new drugs and help understanding the enormous amount of experimental information available. In this project we shall consider the Kv7.2 channel of neuron membranes — a potassium voltage-gated channel located in human neurons —whose functioning relies in a potential difference induced by calmodulin (CaM). By means of All-atom simulations, molecular dynamics and coarse grain models, we would like to validate two claims regarding the behavior of the secondary structure of the IQ motiv of the channel: 1) Both wild type and mutant can form stable helices without the ribosome; 2) Wild type can form an alpha helix at the ribosome whereas the mutant cannot.

The successful candidate should have a PhD in physics or chemistry, and experience in these calculations or in these techniques. Knowledge on this and that topic will also be valuable.

Project P2. Computational design of self-healing materials made of polymeric nanoparticles.

Contact person: Angel Moreno (angeljose.moreno@ehu.eus)

Reference: PD/2020/2

Polymer-based materials with self-healing properties can be designed by implementing reversible bonds (metal-ligand, dynamically covalent, etc.) in the polymer architecture, which can form intra- and intermolecular reversible cross-links, and allow for exploiting the adaptability of the topology of the dynamic bond network to strains, shear or other changes of the environment (temperature, pH, light, etc.). The use of functionalized fully polymeric nanoparticles (nanogel-like, stars, rings, etc.) as the building blocks is a promising route for the design of smart materials that combine self-healing properties with specific functions (encapsulation, catalysis, luminescence, etc.). Key factors that ultimately control the stability and the mechanical and dynamical properties of the material are the specific topology of the nanoparticle and the competition between reversible intra- and inter-molecular bonding. The aim of this project is to systematically investigate, by means of large-scale simulations with different levels of coarse-graining, the role of these factors on the formation and properties of reversible self-healing gels based on such objects. The successful candidate should have a PhD in physics, chemistry or related areas and a strong background in theory/simulation of soft matter systems.

Project P3. Understanding catalytic reactions at the atomic scale: curved surfaces at ambient pressure.

Contact person: Enrique Ortega (enrique.ortega@ehu.eus)

Reference: PD/2020/3

Catalysis is extremely important in industrial processes with notorious relation with energy and environmental problems. However, the most relevant catalytic reactions are still optimized following a trial-and-error philosophy. Further improvement requires a rational atomic-scale understanding through new sample designs and techniques that can bridge the gap with real catalyst materials. In a bid to model industrial nanoparticles in-operando, our Lab investigates curved metal surfaces exposed to millibar pressures of reactants, using novel atom-sensitive techniques that operate under ambient-pressure conditions, such as X-ray photoemission.

The candidate must posses a Physics or Chemistry, and proven experience wth Surface Science techniques. She/he will focus on the exploration of structure and electronic properties of curved crystal surfaces, interacting with chemically active gases, such as CO, NO, O2, CO2, and water, using STM and micro-focus XPS in our Lab. This work will be combined with Ambient Pressure XPS experiments performed in Synchrotron Radiation facilities to examine the in-situ interaction of mixtures of reactants and products with such curved surfaces. The candidate will also take responsibility for the strong collaborative action, within this Project, with local theorists in San Sebastian and experimentalists at the University of Lund.

Project P4. Coherent Caloritronics and Spintronics in superconducting hybrid Structures.

Contact person: Sebastian Bergeret (*sebastian_bergeret@ehu.eus*)

Reference: PD/2020/4

The project will be carried out in the Mesosocopic Physics Group at the Materials Physics Center. The research of our group focuses on theoretical studies of transport in mesoscopic systems, with an emphasis on superconducting and spintronics devices. The group key contributions in the fields of non-equilibrium physics, unconventional superconductivity, and spin-dependent in nanostructures (see https://cfm.ehu.es/mesoscopics/publications.html)

The aim of this project is to investigate transport properties of superconducting hybrid devices with focus on spin and heat related phenomena. The candidate will use theoretical tools, recently developed in the Mesoscopic Physics Group, to explore systems consisting of superconductors, magnetic insulators and normal metals, with the aim of providing a thorough understanding of charge, heat and spin electronic transport, and reinforced the collaboration with local and international experimental groups working in the field of coherent caloritronics and spintronics.

The successful candidate should have a PhD in Physics, a solid background in Condensed Matter, quantum transport, and superconductivity. Basic knowledges of Keldysh Green's function technique and quantum kinetic equations are desirable.

Project P5. Nanostructures materials for artificial photosynthesis.

Contact person: Joseba Yury Rakovich (yury.rakovich@ehu.eus); Marek Grzelczak (*marek.g@csic.es*)

Reference: PD/2020/5

The post-doctoral candidate will join the Nanomaterials and Spectroscopy Group at the Centro de Fisica de Materiales. The research group focuses on the development of novel hybrid materials using nanoscale building blocks for advanced applications. Especially important are the nanomaterials compositions that define light harvesting capacity and drive catalytic reactions via electron transfer.

The aim of this project is the rational design and development of a to develop an artificial photosynthetic system, namely hybrid nanoparticle-based photocatalyst using variety of sub-units such as molecules, functional supramolecular complexes, plasmonic nanoparticles and semiconductor quantum dots to be later assessed on a single particle level with sub-particle resolution. The project is multi-disciplinary and involves a variety of techniques, ranging from fabrication of nanostructures to their characterization using absorption, photoluminescence and Raman spectroscopy, fluorescence confocal lifetime microscopy imaging as well as fluorescence correlation spectroscopy. The material development and advanced characterization techniques will serve to study the fundamentals of photocatalytic processes related to photosynthesis with particular focus on cofactor regeneration.

The candidate is expected to have experience in Materials Science or Nanoscience and especially in the following areas: colloid chemistry, nanoparticle synthesis, plasmonics, optical spectroscopy. Good written and oral communication skills in English are required.

Project P6. Fundamental properties of magnetic layered heterostructures.

Contact person: Andres Arnau (andres.arnau@ehu.eus); Mikhail Otrokov (mikhail.otrokov@gmail.com)

Reference: PD/2020/6

The post-doctoral candidate will join the Group of Modelisation and Simulation CFM, which focuses on the theoretical study, using first-principles methods, of electronic and structural properties of complex materials and nanostructures.

Many applications, like sensing, data storage and quantum computation, are based on novel quantum phenomena that appear in two-dimensional magnetic materials. Its practical realization crucially depends on our ability to engineer and efficiently tune their electronic and

magnetic structures that, ultimately, would permit the development of devices based on the transfer of spin and orbital momentum by the passage of electrical current across the material.

The aim of this project is to achieve a complete understanding of the electronic properties of layered heterostructures made of two-dimensional magnetic materials. Special emphasis will be done on studying magnetic and relativistic phenomena, such as magnetic anisotropy or magnetic domain wall motion and skyrmion formation in systems with strong Dzyaloshinskii-Moriya interaction.

The candidate should preferentially have a degree in Physics, Quantum Chemistry, Materials Science or Nanoscience. Previous experience in one of the following areas will be highly valued: first-principles electronic structure calculations, computational materials science, tight-binding model Hamiltonians, Fortran and bash/tcsh programming. Good written and oral communication skills in English are required.

Project P7. Quantum Dynamical Simulation of Intramolecular Singlet Fission in Covalently Coupled Organic Dimers.

Contact person: Pedro B. Coto (pedro.brana@ehu.eus)

Reference: PD/2020/7

The post-doctoral candidate will join the Theoretical and Computational Chemistry Group (TCC) at the Centro de Fisica de Materiales. The TCC research lines focus on the investigation of photophysical and photochemical processes of complex systems with applications to organic photovoltaics, nanoelectronics, and lighting. Work in the group involves the application and/or development of computational approaches to fully characterize these processes.

The aim of this project is to investigate the dynamics of intramolecular singlet fission (iSF) and its application to the development of high performing solar cells. For this, we will first select several covalently coupled organic dimers exhibiting iSF and characterize the dynamics of the process using a vibronic-coupling model Hamiltonian and wavepacket propagation. In a second step, we will analyze the heterogeneous electron injection dynamics in a dimer-semiconductor nanoparticle system using model Hamiltonians and quantum-dynamical methods.

The successful candidate should have a PhD in physics or chemistry and experience in quantum-dynamical simulation methods. Knowledge on high-level ab initio methods for the characterization of electronic excited states will also be valuable.

Project P8. AFM-based local dielectric spectroscopy: opportunities and limitations.

Contact person: Angel Alegria (angel.alegria@ehu.eus)

Reference: PD/2020/8

The post-doctoral candidate will join the Polymer and Soft Matter Group (PSMG) at the Centro de Física de Materiales. The research group mainly focuses on studying the structure and dynamical properties of polymer-based soft-matter. A general overview of the activity developed during the last years can be found at http://www.sc.ehu.es/sqwpolim/PSMG.

One of the topics the group is deeply involved over the last few years is the development of an atomic force microscopy (AFM) based technique to characterize the dielectric relaxation phenomena in thin polymer films with nanometric lateral resolution.

The aim of the present project is to overcome the current limitations of this new experimental approach and explore its application to several areas of polymer physics.

The successful candidate should have a PhD in physics, chemistry, or related topics, and proved experience in AFM and dielectric relaxation techniques. Also, a good background in polymer physics is required.

Project P9. Light-induced on-surface synthesis of functional molecular materials.

Contact person: Celia Rogero (*celia.rogero@ehu.eus*), Martina Corso (*martina.corso@heu.eus*)

Reference: PD/2020/9

The postdoc candidate will join the Nanophysics Laboratory (NanoLab) in the Centro de Física de Materiales in San Sebastián (Spain) (https://cfm.ehu.es/nanophysicslab/). The NanoLab is an experimental surface science group devoted to the study of structural, electronic, magnetic and chemical properties of nanostructures. Among the different research lines, the NanoLab has a strong expertise on the bottom-up fabrication of functional molecular carbon-based nanomaterials. Specific graphenic nanoscale materials can be grown with atomic precision on metallic surfaces by means of on-surface synthesis. Nevertheless, the use of such materials as functional units in various technological applications as spintronics or optoelectroncis, requires non-metallic substrates as their support.

In this project the postdoctoral candidate will explore the concept of photopolymerisation, i.e. illumination with violet light to induce molecular covalent cross-linking, for the direct on-surface synthesis of graphenic nanoscale materials on non-metallic substrates, as oxides. The first goal will be the comparison between chemical reaction mechanisms upon light and thermal activation on metallic and non-metallic substrates.

The project is part of a national collaborative project between six Spanish groups of different disciplines (organic chemists, theoreticians and surface science experimentalists) aimed to fabricate complex covalent molecular nanostructures and test their potential operability as functional units in various technological applications.

The successful candidate should have a PhD in physics or chemistry, and demonstrated experience in ultra-high vacuum and in surface science characterization techniques (as STM, LT-STM or XPS). We are looking for highly motivated candidates, able to work in a dynamic environment and to contribute with his/her own ideas to the group.

Project P10. Phase behavior and metastability in hybrid photovoltaic materials.

Contact person: Felix Fernandez-Alonso (*felix.fernandez@ehu.eus*)

Reference: PD/2020/10

The post-doctoral candidate will join the Group of Felix Fernandez-Alonso at the Materials Physics Center. The group uses quantum beams in combination with computational materials modelling to interrogate and understand novel functional materials for energy applications and sustainability, in close collaboration with leading neutron and X-ray laboratories from around the globe.

The primary aim of this project is to gain new and much-needed insights into the properties and phase behavior of hybrid photovoltaic materials using state-of-the-art experimental and computational techniques. In particular, this post is part of ongoing efforts to understand and ultimately tailor the regimes of stability and metastability of these materials as a function of external parameters such as temperature, pressure or chemical environment, as well as to unveil the mechanisms underpinning photovoltaic performance and degradation pathways under physico-chemical conditions of technological relevance.

The successful candidate should have a PhD in Chemistry, Materials Science, Physics or related discipline, and be able to demonstrate a solid track record in neutron and/or X-ray science. Knowledge and experience in the use of first-principles methodologies to calculate observables amenable to scrutiny using radiation-scattering techniques would also be valuable.

Project P11. Unveiling the structure-activity relationships for water electrolysis.

Contact person: Sara Barja (*sara.barja@ehu.eus*)

Reference: PD/2020/11

Development of optimized catalyst requires a comprehensive atomic scale picture of the chemical and physical properties of surfaces, in connection to their macroscopic catalytic

performance. This project focuses on relevant metal-oxide surfaces for oxygen evolution reaction, and proposes to bridge the gap between surface science studies and real electrocatalytic systems. The experimental approach combines ultra-high-vacuum characterization (scanning tunneling microscopy, X-Ray photoemission spectroscopy and temperature programmed desorption), and parallel electrochemical test on the very same sample. The candidate will study the catalyst before and after the electrochemical reaction to unveil catalyst structure-activity relations. The main role of the Postdoc will be to take responsibility for the electrochemical tests in connection with the surface science characterization of the target electrocatalyst.

We seek a well-motivated candidate, with strong interest in electrocatalysis, and willing to work in a collaborative environment with complex experiments. Initiative, creativity and an independent working attitude will be highly valued. The candidate is expected to have a PhD degree in Chemistry, but candidates with appropriate background and a PhD in Physics or Chemical Engineering will also be considered. It is mandatory that the candidate has extensive experience in electrochemistry. Experience working with ultra-high-vacuum methods will also be valuable.

Project P12. Understanding the hydrogenation of CO_2 to methanol on surfaces from first principles.

Contact person: Maite Alducin (*maite.alducin@ehu.eus*)

Reference: PD/2020/12

The post-doctoral candidate will join the "Gas/Solid Interfaces" theoretical group at the Centro de Física de Materiales. The group focuses on understanding at the atomic scale, the elementary reactive processes that may happen whenever atoms or small molecules interact with surfaces (http://cfm.ehu.es/gassolid).

Many of the relevant elementary reactions related to clean energy, climate action, and clean production of chemical compounds, proceed under thermal equilibrium conditions. Under these conditions, entropic, energetic, and dynamical aspects of the system interplay in determining the rate constants of the intermediate reactions, and therefore, the performance of the process. **In this project, we propose to investigate the hydrogenation of carbon dioxide to methanol via formate formation on Cu/ZnO.** This CO_2 recycling strategy suffers of a side reaction that damages the catalyst, the so-called reverse water-gas shift reaction. The aim is to study the thermodynamics that rules the competition between these two reactions by combining transition state theory (TST) and molecular dynamics simulations based in density functional theory. This novel approach offers valuable capabilities to study different reaction conditions such as temperature, surface structure, and surface coverage. Moreover, it allows

the inclusion of electronic and vibrational properties of surfaces that might be decisive. The final goal is to determine the characteristics that enhance and inhibit the performance of this process used in large-scale industrial applications.

Candidates must hold a PhD degree in physics or chemistry and should have experience in first-principles theoretical methods as well as in numerical simulations. Knowledge on TST and molecular dynamics will also be valuable.

Project P13 Magnetism and Topological States in Layered Heterostructures of Two-dimensional Graphene-like Materials.

Contact person: Andrés Ayuela (swxayfea@sw.ehu.es)

Reference: PD/2020/13

The post-doctoral candidate will join the Group of Electronic Excitations in Surfaces and Nanostructures within the research line of The Electronic Properties at the Nanoscale in the Centro de Física de Materiales. The research group focuses on studying the electronic properties of defects in novel heterostructures piling two dimensional nanolayers, such as graphene, and that topic is of high interest in the area of nanoelectronics. During last years, we have studied the growth of triangular nanostructures patterned on bilayer graphene films on SiC(0001) surface using hydrogen intercalation [1]. Furthermore, we have achieved the description of topological states due to stacking domains walls in bilayer graphene [2].

The aim of this project is to investigate the interaction between very interesting physical systems consisting of heterostructures of two-dimensional materials in the context of domain boundaries and topological states together with magnetic impurities.

The successful candidate should have a PhD in physics or physical chemistry, and experience in density functional calculations and/or in tight binding techniques. Knowledge on the structural and electronic properties of two-dimensional layers (magnetism, excitons,…) will also be valuable.

[1] https://cfm.ehu.es/highlights/self-assembled-triangular-graphene-nanostructures/

[2] https://cfm.ehu.es/highlights/layertronics-controlling-the-layer-localization-of-topologically-protected-states-in-bilayer-graphene/

Project P14. Water in Nanostructured functional materials

Contact person: Silvina Cerveny (*silvina.cerveny@ehu.eus*)

Reference: PD/2020/14

There are few things more central to life on earth than water. However, the behavior of water in different environments (from synthetic polymers to proteins), the interaction between water and nanostructured materials and the role of water in these processes are still not well understood. Our research focuses on studying the interaction of water and matter in addition to the dynamics of these systems at supercooled temperatures.

The present project addresses the development of nanostructured functional materials based on biodegradable polymers (PVA, pectin, or peptides) to be used in applications related to water remediation and/or biodegradable packaging.

Candidates must hold a doctoral degree in Physics, Materials Science, or other related disciplines. It is expected expertise in experimental science, in particular in the use of characterization techniques in the field of soft matter (polymers, biopolymers and membranes) as well as in some of the following techniques: dielectric spectroscopy, infrared spectroscopy, rheology or calorimetry.

Project P15. Synthesis and characterization of organic and inorganic interfaces under different environmental conditions

Contact person: Lucia Vitali (*lucia.vitali@ehu.eus*)

Reference: PD/2020/15

The post-doctoral candidate will join the Group of Spectroscopy at Atomic Scale at the Centro de Fisica de Materiales. The research group focuses on studying physical and chemical effects at the interface of materials with possible applications in energy conversion and storage. By using the power of high-resolution scanning probe microscopy (STM-AFM) techniques, we locally probe their physical properties and survey chemical reactions visualizing the reaction intermediates. Further information can be found here: https://cfm.ehu.es/atomic-spectroscopy/

Aim of this project is the formation of hybrid organic-inorganic interfaces of materials with ionic character starting from the smallest molecule-atom interacting unit to periodic structures. Structural and electronic properties will be correlated through a characterization at local level. Specifically we aim to understand the stability of the formed bond under applied electric fields, light and/or the exposure to selected gases. The structural dynamics and electronic properties will determine in which conditions the material is suited for energy conversion or storage.

The successful candidate should have a PhD in physics or chemistry, and experience in scanning tunneling microscopy and spectroscopy at cryogenic temperatures in ultra-high vacuum conditions.

Project P16. Atomistic simulations for guiding the design of new cement-based materials with radiative cooling ability

Contact person :Jorge Sánchez Dolado (*jorge_dolado002@ehu.eus*)

Reference: PD/2020/16

The post-doctoral candidate will join the Group of Ceramic and Cement-based Materials at the Centro de Fisica de Materiales. The research group activity mainly focuses on designing new cementitious materials (oxides and distorted zeolites and clays) for energy efficiency and storage purposes.

In this proposed project, the bulk dielectric properties of the main phases present in cementitious matrices will be predicted by atomistic simulations. These simulations will guide the design of new concretes whose response to light exhibit radiative cooling capacity; i.e. the concretes will be able to expel heat to the outer space without any extra energy consumption. Radiative cooling technology utilizes the atmospheric transparency window (8-13 □m), called Atmospheric Window (AW), to passively dissipate heat from the Earth to outer space. The key concept here is to find cementitious phases/materials that simultaneously exhibit high reflectivities to the incoming solar radiation (~0.5 □m) and high emissivities within the AW.

The successful candidate should have a PhD in physics, chemistry, or engineering, and experience in atomistic calculations. Knowledge on ceramics and cement-based materials and will also be valuable.

Project P17. Synthesis and electronic structure of graphene and hexagonal boron nitride nanostripes on curved crystals.

Contact person: Frederik Schiller (*frederikmichael.schiller@ehu.eus*)

Reference: PD/2020/17

The candidate will join the NanophysicsLab that focuses on experimental studies of nanostructures at surfaces by means of electron spectroscopies (X-ray absorption-XAS and photoemission-PES) and scanning tunneling microscopy (STM).

Aim of this project is to grow and investigate physical-chemical properties of 2D materials, namely Graphene-GR, hexagonal boron nitride-hBN and mixtures of them on vicinal substrates. 2D materials, stripes or wires of this material group attract interest due to their

promising electronic, magnetic, or mechanical properties, among them the heavily investigated graphene, a material that was once supposed to replace silicon in device fabrication. GR-devices have been realized in certain fields (Sensoring, Biomedicine), but GR cannot be used in electronics because it lacks a semiconducting band gap. Hexagonal boron nitride (hBN) is the isostructural semiconducting counterpart of graphene, and hence of fundamental importance in the development of nanolectronics applications. Yet the synthesis and electronic characterization of 2D hBN-GR monolayers and 1D nanostructures, such as nanostripes, is poorly developed, requiring intensive search of appropriate growth substrates and characterization. We recently demonstrated that hBN can be grown on curved Ni and Rh crystals, leading to homogenous coating and one-dimensional nanostripes.

The candidate should have a PhD in physics, experience in either STM or photoemission. Travelling to European synchrotrons is mandatory for this project.

Project P18. Quantum sensors based on rotating nanoparticles

Contact person: Gabriel Molina-Terriza (Gabriel.molina.terriza@gmail.com)

Reference: PD/2020/18

The post-doctoral candidate will join the Quantum Nanophotonics Laboratory at the Centro de Fisica de Materiales. 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. We collaborate 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 and to perform very precise measurements of electric and magnetic fields.

The aim of this project is to investigate levitated rotating nanonoparticles to engineer the next generation of quantum sensors. The candidate will develop a levitation system for particles and will use quantum and classical sources of light to control the motion of the particles. We are interested in using coloured centers in nanodiamonds or other suitable systems to detect inertial forces and magnetic fields.

The successful candidate should have a PhD in physics or engineering, and will be familiar with optical trapping experiments, control of optical modes of light, and/or control of coloured centers in diamonds. Experimental experience in an optical laboratory is required and control of equipment with Python or Labview environments.