Design, fabrication and characterization of hybrid superconducting structures for computing applications

IMDEA - Nanociencia Institute

www.nanociencia.imdea.org

CENTRE DESCRIPTION

IMDEA Nanociencia is a young interdisciplinary research centre dedicated to the exploration of basic nanoscience and the development of applications of nanotechnology in connection with innovative industries.

Our purpose-built building was inaugurated in 2014 and features state-of-the-art facilities for 21st century science, where the frontiers between fields disappear and Physics, Chemistry, Biology, Engineering, and Medicine merge. It features more than 30 operative laboratories with over € 16 M worth of equipment -including the Centre for Micro and Nanofabrication. We are located at the UAM Campus, with access to all the facilities of one of Spain's largest and most prestigious Universities. The UAM Campus is just a few minutes away from Madrid's lively city centre, connected by "cercanías" trains and several bus lines.

We are over 150 scientists, with different professional and personal backgrounds. Approximately 40% of our PhD and postdocs come from outside Spain, representing every corner of the world, from Germany to China, from the USA to Singapore –a true international environment in which to develop your scientific career. Women make up 36% of our scientific and 62% of our management staff. No matter who you are or where you come from, you will feel welcome from the very first minute.

We take science seriously and value quality over quantity. Our scientists enjoy tackling complex multidisciplinary problems, often within in-house collaborations, so all of our students receive truly interdisciplinary training. We also enjoy publishing in the very best journals, with >200 publications a year, and an institutional h index of 79. Check out our webpage http://nanociencia.imdea.org/, facebook @IMDEANanociencia or twitter @IMDEA_Nano for more information.

So if you are a talented, hard-working individual with a real interest in Science, IMDEA Nanociencia is the right place for you! Come work with us!

ADDRESS

Faraday 9, 28049 Madrid, Madrid

AREA OF KNOWLEDGE

Physical Sciences, Mathematics and Engineering

GROUP OF DISCIPLINES:

Physics

GROUP LEADER

Prof. José Luis Vicent

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Research Group Website: http://nanociencia.imdea.org/transport-in-2D-systems/group-home

Research project/ Research Group description

The research project is focused on the design, fabrication and characterization of hybrid superconducting devices to obtain qubits with new functionalities and performance controllable at will.

The proposed approach is to use the magnetic stray fields from an engineered nanostructured ferromagnet (FM) to modify the phase difference in the superconductor, which at the same time, will create and pin superconducting vortices. The main challenges of this idea are to minimize the number of vortices and, more importantly, to prevent their motion in the device (therefore, the vortices must be pinned). Both goals can be accomplished by using an adequate array of nanomagnets with out-of-plane magnetic anisotropy embedded in the superconducting device. The hybrid character of the proposed architecture can eventually profit from the advantages of different types of (superconducting and spin) qubits in one single device.

The project will be executed within the group "Transport in 2D systems" of IMDEA Nanociencia under the supervision of Dr. Mariela Menghini (mariela.menghini@imdea.org). The research within the group spans from fundamental problems such as the pinning mechanisms in superconducting/ferromagnet hybrids to more technological issues as to determine the heating effects in plasmonic sensors.

The experimental techniques available at IMDEA, among others, are: sputtering, chemical vapor deposition, clean-room nanofabrication and magneto-transport measurements at low temperatures. Some of the members of the research group have also affiliations in other institutions such as Universidad Complutense de Madrid, Instituto Nacional de Técnica Aeroespacial (Spain) and KU Leuven (Belgium), allowing access to experimental techniques complimentary to the ones available at IMDEA Nanociencia.

Finally, IMDEA Nanociencia is an interdisciplinary and international research centre which provides an exciting and stimulating environment for pursuing a PhD in Physics.

Job position description

We are searching for a highly motivated researcher with a master in physics, material science or nanotechnology who has excelled in their studies, has a critical mind and is willing to learn new experimental techniques. We are looking for a team-player but also someone who can tackle complex problems independently.

This PhD position focuses on fundamental studies of superconducting systems with potential for future quantum computing applications, mainly by experimental techniques such as magneto-electrical measurements. Besides, the PhD candidate will be directly involved in the growth of thin films of different materials and their processing using lithographic techniques. Therefore, prior experience in low temperature techniques, materials growth, clean-room processing techniques and/or electrical characterization would be an advantage.

Most of the daily work will be dedicated to organize, plan and execute experiments to then analyse the results and compare them with theoretical predictions when appropriate. Regular meetings with the supervisor(s) and other members of the research group will be organized to discuss technical and scientific problems providing a close follow up of the advances of the research work. The PhD candidate will have the opportunity to attend to workshops and schools related with the research topic and will be strongly encouraged to present his/her results in international conferences. Hence, a good knowledge of English and effective communication skills (such as presenting and reporting) are also of importance.

OTHER RELEVANT WEBSITES

IMDEA Contact

http://nanociencia.imdea.org/home-en/people/item/jose-luis-vicent-lopez