TRANSPORT PROPERTIES AT THE INTERFACE BETWEEN QUANTUM MATERIALS

Area of Knowledge: Physical Sciences, Mathematics and Engineering
Group of disciplines: Physics.

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RESEARCH PROJECT:

The discovery of many fascinating properties of graphene has shown that in the 2D world a variety of exotic quantum phenomena can take place. Moreover, properties can be transferred to or new effects can be induced into these thin layers by putting them in contact with specific materials.

For example, intercalation of graphene with certain materials or proximity to another 2D material can enhance spin-orbit coupling giving rise to a quantum spin Hall effect. Other interfacial effects can be realized when placing graphene in contact with a superconductor (SC). A remarkable feature in this case is the presence of specular Andreev reflections (AR). In a normal metal/SC interface an incident electron is reflected back as a hole following the same path (normal AR). However, if the electrons in graphene encounter an interface with a superconducting material they can be reflected as holes following the specular path with respect to the incoming electron (specular AR).

The study of these interfacial effects is relevant from both fundamental and technological points of view. The project’s main objectives are to study Andreev reflections at the interface between graphene and a high temperature superconductor and the effects of strong spin-orbit coupling in graphene in this interface phenomenon.

The project will be executed within the “Transport in 2D systems” group. Our research spans from fundamental problems such as the pinning mechanisms in superconducting/ferromagnet hybrids to more technological issues such as the determination the heating effects in plasmonic sensors.

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

JOB DESCRIPTION

We are searching for a highly motivated researcher with a master in physics, material science or nanotechnology who has excelled in his/her 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 heterostructures based on graphene and superconducting materials mainly by experimental techniques such as magneto-electrical measurements. Besides, the PhD candidate will be directly involved in the fabrication and processing of the heterostructures using different deposition and 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.

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

MORE INFORMATION:

Group Website: [www.nanociencia.imdea.org/transport-in-2D-systems/group-home](http://www.nanociencia.imdea.org/transport-in-2D-systems/group-home)

CENTRE INFO:

IMDEA Nanociencia Institute

[www.nanociencia.imdea.org](http://www.nanociencia.imdea.org)

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 180 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 45% of our scientific and 60% 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 90. Check out our [webpage](http://www.nanociencia.imdea.org), facebook [@IMDEANanociencia](https://www.facebook.com/IMDEANanociencia) or twitter [@IMDEA_Nano](https://twitter.com/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!