As a flagship research center in nanoscience and nanotechnology, our mission is to open and explore new frontiers of knowledge at the nanoscale, and bring value to society in the form of new understanding, capabilities and innovation, while inspiring and providing broad training to the next generations of researchers. Our values are Commitment, Collaboration and Transformation.

Our research lines focus on the newly-discovered physical and chemical properties that arise from the behaviour of matter at the nanoscale. ICN2 has been awarded with the Severo Ochoa Center of Excellence distinction for three consecutive periods (2014-2018 and 2018-2022 and 2023-2026). ICN2 comprises 20 Research Groups, 7 Technical Development and Support Units and Facilities, and 2 Research Platforms, covering different areas of nanoscience and nanotechnology.

**Job Title: PhD Position in Quantum Transport with van der Waals Heterostructures**

**Department: Physics and Engineering of Nanodevices Research Group**

**Description of Group/Project:**

The Physics and Engineering of Nanodevices Group, led by ICREA Prof. Sergio O. Valenzuela, focuses on developing novel devices designed to investigate the physical properties of materials at the nanoscale. The Group's research combines state-of-the-art lithographic and materials-processing techniques with advanced electrical, magnetic, and spectroscopic characterization. Current activities centre on quantum devices based on metals, graphene, topological insulators, and other two-dimensional and quantum materials. A major research direction is spintronics, which exploits the electron spin degree of freedom both to investigate fundamental phenomena and to develop new device concepts, with potential applications in fast, energy-efficient, non-volatile, and highly integrated electronics. This forms part of a broader effort to probe, control and exploit spin, charge, superconductivity and other quantum degrees of freedom in nanoscale devices.

**Main Tasks and responsibilities:**

We are seeking a highly motivated PhD candidate to join a research project on quantum transport in van der Waals heterostructures, funded by the Spanish State Research Agency (AEI). The project aims to address fundamental questions concerning charge and spin transport in quantum materials based on two-dimensional systems, with particular emphasis on controlling and probing quantum states through spin, proximity effects and electrical gating. The research will explore how the properties of atomically thin materials can be transformed when different two-dimensional crystals are brought together, creating artificial quantum systems with properties that are absent in the individual materials.

Depending on the specific direction of the project and the interests of the candidate, the research may address spin-orbit and magnetic proximity effects, spin-charge interconversion and spin torques, and the interplay between spin, magnetism and topology in graphene and related van der Waals materials. A central objective will be to reveal and manipulate the internal structure of quantum states using experimental probes that go beyond conventional charge-transport measurements.

The successful candidate, who will be supervised by ICREA Prof. Sergio O. Valenzuela and Dr. Juan F. Sierra, will participate in a broad range of experimental activities, including:

- Design and fabrication of quantum devices based on two-dimensional materials and van der Waals heterostructures.
- Preparation and deterministic assembly of two-dimensional materials.
- Nanofabrication using electron-beam lithography and related cleanroom techniques.
- Electrical and quantum-transport measurements at cryogenic temperatures and under high magnetic fields.
- Spin-resolved transport and magnetotransport.
- Advanced spectroscopic characterization of materials.
- Development of experiments combining electrostatic control, proximity engineering and quantum transport.
- Analysis and interpretation of experimental data.
- Presentation of results at international conferences and preparation of scientific publications.

**Requirements:**

- **Education:** Master's degree in Physics, Materials Science, Nanoscience, or a closely related field.
- **Knowledge:** Solid background in solid-state physics.
- **Professional Experience:** Previous experience in one or more of the following areas would be valued, although it is not essential:
    - Two-dimensional materials and van der Waals heterostructures.
    - Nanofabrication or cleanroom techniques.
    - Electrical, quantum-transport, or magnetotransport measurements.
    - Cryogenic experimental techniques.
    - Spintronics, magnetism, or quantum metrology.
    - Raman spectroscopy or related material-characterization techniques.
    - Scientific programming and data analysis.
- **Personal Competences:**
    - Strong scientific motivation.
    - Attention to detail and ability to work both independently and as part of a team.
    - Good written and spoken English.

**Summary of conditions:**

- Full time work (37,5h/week)
- Contract Length: Temporary, 4 years.
- Location: Bellaterra (Barcelona)
- Salary will depend on qualifications and demonstrated experience.
- Support to the relocation issues.
- Life Insurance.

Estimated Incorporation date: As soon as possible.

**How to apply:**

All applications must be made via the ICN2 website and include the following:

1. A motivation letter.
2. A full CV including contact details.
3. Reference letters or referee contacts.

4. Academic transcripts for their Bachelor's and Master's degrees.

Deadline for applications: Applications will be continuously reviewed.

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**Equal opportunities:**

At ICN2, we foster an inclusive and safe work environment, free from any form of discrimination—whether based on gender, sexual orientation, gender identity, age, origin, culture, religion, disability, or any other personal or social condition. We are committed to ensuring equal treatment and opportunities in all our processes, especially in recruitment, which is based solely on talent, experience, and ability. We implement proactive policies for inclusion and harassment prevention that reinforce our commitment to respect and fairness. If you share these values and are looking to grow in an open and diverse environment, ICN2 is ready to welcome you.