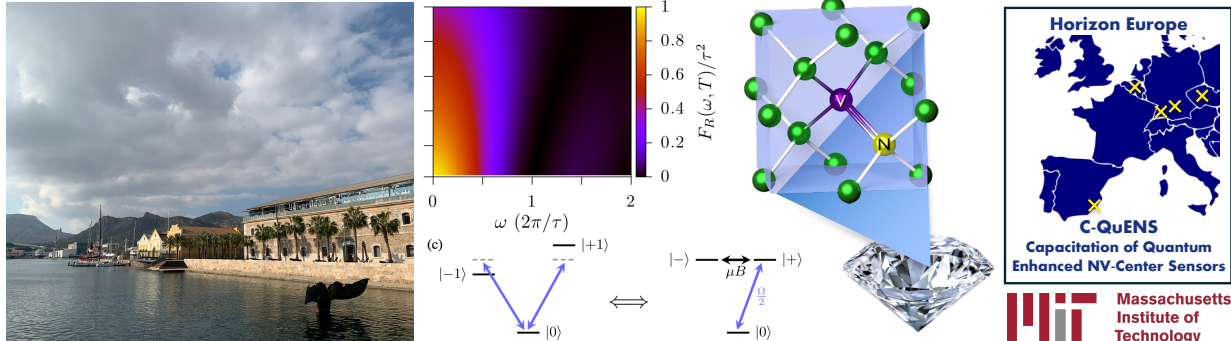


PhD Position on the Theory of Quantum Sensing

Research Group of Quantum Technologies - Department of Applied Physics
 Universidad Politécnica de Cartagena



The Research Group of Quantum Technologies at the *Universidad Politécnica de Cartagena* is offering a PhD position starting September 2024. The project focuses on the theory of quantum sensing with nanodiamonds. **Nitrogen-vacancy (NV) centers in diamond** can sustain long coherence times and couple selectively to a single component of the environmental magnetic field, making them extraordinary candidates for detection of molecules and biomolecules by means of **nuclear magnetic resonance (NMR)** techniques. Their detection capacities at the nanoscale have established an avenue of exploration for applications of nanodiamond sensing in medicine, biology, chemistry or materials science.

The position is funded by a **European consortium** of six laboratories through the Horizon Europe project C-QuENS (Capacitation of Quantum Enhanced NV-Center Sensing). The aim of the project is the development of protocols for biomolecular detection with ensembles of NV centres in nanodiamonds. Protocols will make extensive use of entanglement properties and criticality to improve the resolution of current sensors.

The PhD candidate is also expected to take part on a prestigious grant that has recently been awarded to the group by the **Massachusetts Institute of Technology (MIT, USA)** on the field of quantum simulation with superconducting qubits. Research stays at MIT and close collaboration with several of their researchers are anticipated. The group is further supported by two additional grants from the Spanish Research Agency (AEI).

The PhD student will theoretically model and design tools for the control and experimentation with NV centres in diamond:

- Theoretical analysis of NV-center ensembles and their interaction with molecules.
- Numerical simulation of sensing NMR protocols for detection of molecules.
- Use of IBM quantum computers in the cloud for quantum simulation of the proposed protocols and designs.

In addition, the doctoral candidate will be allocated **travel funds** to attend summer schools, conferences and carry out long-term stays in one of the laboratories of the European consortium or other collaborators of the research group (MIT, TU Berlin, UC San Diego...).

Prospective candidates should send a short application (short CV, motivation and transcript) to javier.cerrillo@upct.es before September 3rd, 2024. Candidates should hold a master's and bachelor's degrees in Physics, Engineering or related technical disciplines. Earlier applications are preferred.