

Felicidades a la nueva graduada de doctorado del ICFO

La Dra. Maria Hernandez Ruiz se ha doctorado con una tesis titulada i¿½Cavity-Enhanced, Optically Pumped Magnetometry a d its Miniaturizationi¿½

July 07, 2026

Felicitamos a la Dra. Maria Hernandez Ruiz que ha defendido su tesis esta tarde en el Auditorio del ICFO.
La Dra. Hernandez Ruiz obtuvo su Master en Optical Fiber and Photonic Engineering por la University of Southampton, y se unio al equipo de investigacion de Atomic Quantum Optics dirigido por el profesor Dr. Morgan Mitchell. Su tesis titulada i¿½Cavity-Enhanced, Optically Pumped Magnetometry and its Miniaturizationi¿½ fue supervisada por el profesor Dr. Morgan Mitchell y el Dr. Vito Giovanni Lucivero.

RESUMEN:
This thesis presents the development and experimental implementation towards a miniaturized cavity-enhanced atomic magnetometer designed for high sensitivity and high

spatial resolution. The proposed technique relies on a cavity-based optical readout of atomic polarization using the Pound Drever Hall technique.
The magnetometer was experimentally realized and characterized, including a design compatible with biological measurements. The magnetometer can operate with one endcap open in a weak shielding environment (only only layer of mu-metal.) The system was applied to the study of magnetotactic bacteria, whose magnetic response arises from the alignment and relaxation dynamics of intracellular magnetosome chains. Time resolved measurements of the magnetic signal were analyzed assuming exponential relaxation. Furthermore, the model was expanded using a stochastic model to detect deviations from exponential behavior associated with sample evaporation.
The achieved sensitivity and stability of the magnetometer enabled the reliable detection of magnetic signals on the nanotesla scale, with a sensing characteristic length Lat=1.5 mm. These results demonstrate the potential of cavity-enhanced atomic magnetometry for the investigation of biological magnetic systems. This work establishes a versatile platform for high-sensitivity magnetic measurements and opens promising perspectives for future applications in biophysics and magnetic microscopy.

Tribunal de Tesis:

Prof. Dr. Rosario Gonzalez Ferez, Universidad de Granada
Prof. Dr. Hugues De Riedmatten, ICFO
Prof. Dr. Anne Fabricant, Physikalisch-Technische Bundesanstalt (PTB)