Quantum metrology using single electronic spins in solids and molecules

Jerónimo R. Maze [1,2]

[1] *Institute of Physics, Pontificia Universidad Católica de Chile, Santiago, Chile*
[2] *Research Centre for Nanotechnology and Advanced Materials, Pontificia Universidad Católica de Chile, Santiago, Chile*

Coherence in nanoscale systems is a must have property for their implementation in quantum metrology and quantum information applications. Defects in solids with large bandgaps and single molecules with non-zero electronic spins that can be accessed by optical means might emerge as the main building blocks of these applications due to the large coherence times of their electronic spins, even at room temperature. However, uncontrolled interactions with their nearby environment such as lattice vibrations or phonons constitute a hazard to coherence, and therefore, to quantum metrology. Understanding how these systems are coupled to their environment is key to suppress this harmful effect. In this talk, I will present about different systems where the electronic spins can be accessed by optical means to realize quantum applications in metrology to explore other systems or materials. We will discuss on the effect of the interaction between the electronic spin associated to the nitrogen-vacancy defect in diamond and vibrations of the lattice as a function of temperature [1]. We will also discuss about the accessibility to other electronic spins in single molecules such as Vanadium Oxide Phthalocyanine [2] and unravel their internal properties from analysing their response to optical excitation.

[1] M. Cambria et al, Phys. Rev. Research **3**, 013123 (2021).
[2] R. Escalante, https://arxiv.org/abs/2209.09842