ICFO

SEMINAR: Precision spectroscopy and control of individual nuclear spins in the solid state

JAIME TRAVESEDO

June 01, 2026
12:00 to 13:00
Seminar Room

Pushing the sensitivity of nuclear magnetic resonance spectroscopy down to the single nuclear spin limit is a long-standing goal, and would find applications both in quantum computing and in high-precision spectroscopy. So far, the only mechanisms to detect individual nuclear spins is using an electron spin in close proximity, which couples via hyperfine interaction and acts as a local antenna. Therefore, individual nuclear spin detection requires single electron spin readout.?

Until recently, detection of single electron spins has been limited to electrical or optica readout, which achieves single electron spin detection only for certain specific systems, thu limiting the range of study. Our group has recently developed a new method to detec electron spins at 10~mK. By coupling the electron spin to a low-mode-volume high-quality-factor resonator, the radiative relaxation rate of the spin is enhanced by th Purcell effect. The spontaneous emission is detected by a novel detector relying o superconducting transmon qubit, the SMPD. As it relies solely on the magnetic dipol coupling of the spin magnetic moment to a resonator, this all-microwave method should b in principle broadly applicable to a large range of unpaired electron spin systems

In this presentation, we demonstrate a range of new methods to readout and measure th spectrum of individual nuclear spins coupled to an electron spin, itself measured b microwave photon counting. We apply these methods to the operation of two-nuclear-spin-qubit register, and to the high-resolution spectroscopy of an individua nuclear-spin-9/2 impurity.

Hosted by: Prof. Dr. Hugues de Riedmatten