ICFO

SEMINAR: Quantum Radar with Undetected Photons

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July 28, 2025
12:00 to 13:00
Seminar Room

Quantum sensing promises to revolutionize sensing applications by employing quantum states of light or matter as sensing probes. Photons are the clear choice as quantum probes for remote sensing because they can travel to and interact with a distant target. Existing schemes are mainly based on the quantum illumination framework, which requires a quantum memory to store a single photon of an initially entangled pair until its twin reflects off a target and returns for final correlation measurements. Existing demonstrations are limited to tabletop experiments, and expanding the sensing range faces various roadblocks, including long-time quantum storage and photon loss and noise when transmitting quantum signals over long distances. We propose a novel quantum sensing framework that addresses these challenges using quantum frequency combs with path identity for remote sensing of signatures ("qCOMBPASS"). The combination of one key quantum phenomenon and two quantum resources, namely quantum induced coherence by path identity, quantum frequency combs, and two-mode squeezed light, allows for quantum remote sensing without requiring a quantum memory. The proposed scheme is akin to a quantum radar based on entangled frequency comb pairs that uses path identity to detect/range/sense a remote target of interest by measuring pulses of one comb in the pair that never flew to target, but that contains target information "teleported" by quantum-induced coherence from the other comb in the pair that did fly to target but is not detected. This work was recently published in D.A.R. Dalvit et.al., Quantum Frequency Combs with Path Identity for Quantum Remote Sensing, PRX **14**, 041058 (2024).

Hosted by: Prof. Dr. Javier Garcia de Abajo