Émetteurs de photons uniques télécom dans le silicium
Single-photon emitters at telecom wavelengths in silicon

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The boom of silicon in semiconductor technologies was closely tied to the ability to control its density of lattice defects [1]. After being regarded as detrimental to the crystal quality in the first half of the 20th century [2], point defects have become an essential tool to tune the electrical properties of this semiconductor, leading to the development of a flourishing silicon industry [1]. At the turn of the 21st century, progress in Si-fabrication and implantation processes has triggered a radical change by enabling the control of these defects at the single level [3]. This paradigm shift has brought silicon into the quantum age, where individual dopants are nowadays used as robust quantum bits to encode and process quantum information [4]. These individual qubits can be efficiently controlled and detected by all-electrical means [4], but have the drawback of either being weakly coupled to light [5] or emitting in the mid-infrared range [6] unsuitable for optical fiber propagation. In order to isolate matter qubits that feature an optical interface enabling long-distance exchange of quantum information while benefiting from well-advanced silicon integrated photonics [7], one strategy is to investigate defects in silicon that are optically-active in the near-infrared telecom bands [8, 9].

In this talk, I will present our latest results on the isolation of single fluorescent defects in silicon [10,11,12]. These artificial atoms feature a single-photon emission directly in the telecom bands adapted for long-distance propagation in optical fibers. They are observed at single-defect scale in silicon-on-insulator wafers at 10K using confocal microscopy. This technique makes it possible to isolate not only well-known defects from the literature, such as the G-center or the W-center [13], but also to detect unreported defects in ensemble measurements. Given the advanced control over nanofabrication and integration in silicon, these individual artificial atoms are promising systems to investigate for Si-based quantum technologies, including integrated quantum photonics and quantum communications.

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