

# MATERIALS SCIENCE and ENGINEERING SEMINAR



**Helio Huet, C2N-CNRS/Universite Paris Saclay**  
**Prashant Ramesh, UD, C2N-CNRS**

## Versatile Spin-Photon Entanglement With A Semiconductor Quantum Dot-Cavity Device

Measurement-based quantum computing is a promising approach for scalable quantum computing and networking. This relies upon the on-demand generation of graph states composed of many entangled photons. Semiconductor quantum dots (QDs) are a proven source of single photons and hosts for solid-state spins, marking them desirable platforms for controlled entanglement generation. This talk will first present an overview of this research area from the group of Prof. Pascale Senellart at the Centre for Nanoscience & Nanotechnology in Palaiseau, France. Over the past 20+ years the team has developed scalable fabrication of QDs in micropillar cavity devices that serve as bright sources of indistinguishable single photons. These devices have then been used to generate usable photonic states via path-encoding with optical chips, sequential entanglement using linear optics, and entanglement with an electron spin in the QD. The second part of this talk will focus on recent work using these QD-cavity devices to generate genuine 4 partite entanglement between an electron spin and 3 single photons, and easily vary the state produced using optical spin control.

### BIOGRAPHIES

Helio Huet is a doctoral researcher in the group of Prof. Pascale Senellart at the Centre for Nanoscience & Nanotechnology in Palaiseau, France. His research focuses on spin-photon entanglement in quantum dot-cavity devices.

Prashant Ramesh is a PhD candidate in the group of Matthew Doty at UD, and a visiting researcher in the group of Prof. Pascale Senellart and Dr. Olivier Krebs at C2N-CNRS. His research focuses on the fabrication, characterization, and experimental realization of quantum computation using spins in QDs.

Prof. Pascale Senellart is a Director of Research at C2N-CNRS and the co-founder of the photon quantum computing company Quandela. Her research focuses on quantum light sources, having pioneered the development of semiconductor quantum dot-in-microcavity devices. She was awarded an ERC grant in 2011, the CNRS Silver Medal in 2014, made Fellow of The Optical Society in 2018, and elected member of the French Academy of Sciences in 2022.

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