



Materials Engineering Program
Texas Center for Superconductivity at Univ. of Houston
Center for Integrated Bio and Nano Systems
10:00 am, Friday, Nov. 17, 2023

This seminar will be held in **online only mode.**

Zoom: <https://uh-edu-cougarnet.zoom.us/j/97136580701>

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Semiconductor Quantum Dots Genesis, prospects & challenges

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Abstract: Semiconductor nanostructures with low dimensionality like quantum dots are one the best attractive solutions for achieving high performance photonic devices. In particular, quantum dots are currently experiencing a second revolution, in particular thanks to their very high potential for silicon photonics & quantum technologies. When one or more spatial dimensions of the nanocrystal approach the de Broglie wavelength, nanoscale size effects create a spatial quantization of carriers along with various other phenomena based on quantum mechanics. Thanks to their compactness, great thermal stability and large reflection immunity, semiconductor quantum dot lasers are very promising candidates for low energy consumption and isolation free photonic integrated circuits. When directly grown on silicon, they even show a four-wave mixing efficiency much superior compared to the conventional quantum well devices. This remarkable result paves the way for achieving high-efficiency frequency comb generation from a photonic chip. Quantum dot lasers also exhibit a strong potential for applications in optical routing and optical atomic clock. Last but not least, a quantum dot single photon source is a building block in secure communications, and therefore can be applied to quantum information processing for applications such as quantum computers. This lecture will review the recent findings and prospects on nanostructure based light emitters made with quantum-dot technology. Many applications ranging from silicon-based integrated solutions to quantum information systems will be presented. In addition, the lecture will strongly highlight the importance of nanotechnologies on industry and society especially for shaping the future information and communication society.

Bio: Frédéric Grillot is currently a Full Professor at Télécom Paris (France) and a Research Professor at the University of New-Mexico (USA). His research interests include, but are not limited to, advanced quantum confined devices using III-V compound semiconductors, quantum dots quantum dashes, light-emitters based on intersubband transitions, non-classical light, nonlinear dynamics and optical chaos in semiconductor lasers systems as well as microwave and silicon photonics applications.

Professor Grillot has made outstanding technical contributions in photonics and optical communications. He has intensively contributed to the development of quantum dot devices enabling their utilization as future active devices with superior performance. In particular, his recent achievements on epitaxial quantum dot lasers on silicon are crucial for the development of isolation-free integrated technologies. Among his major achievements, he also reported the first private optical communication using mid-infrared chaotic light, giant pulses emission in quantum cascade devices as well as multigigabits operation in the thermal atmospheric window with unipolar quantum optoelectronics. Overall, his research is a strong input to the advancement of science and to the emerging practical applications in computer and quantum technologies, as well as in more traditional areas such as optical communications.

Professor Grillot strongly contributes to promote and support the development of the general optics community. He has served diligently and successfully Optica in particular as an Associate Editor of Optics Express, now as a Deputy Editor since September 2022. As of now, he has published more than 130 journal articles, 3 book chapters, and delivered many invited talks in major international conferences and workshops. Frédéric Grillot is also a Fellow Member of the SPIE as well as a Senior Member of Optica and the IEEE Photonics Society. In 2022, he received the IEEE Photonics Society Distinguished Lecturer Award which honors excellent speakers who have made technical, industrial or entrepreneurial contributions to the field of photonics.