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PHOTONICS LECTURE

WEDNESDAY, 08 MAY 2024 | 13:00

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LECTURE HALL A1

Towards tunable photon-emitter interfaces for on-chip and free space emission control

Mastering interactions between light and matter in solid-state platforms is at the forefront of today's advancements in photonic technologies and beyond. This extends across both traditional and emerging applications, encompassing high-speed telecommunications, manufacturing, medical sensing, as well as technologies like self-driving cars and AR/VR, all rooted in scientific breakthroughs within the field of optics and photonics.

In recent years, it has become increasingly evident that photons are poised to play a pivotal role in the ongoing development of quantum technologies. Unlike other information carriers, photons exhibit remarkable stability at room temperature, making them ideal for conveying quantum information over extended distances. Photons play a crucial role in distributed quantum computing as they allow the formation of interlinks for large-scale quantum networks. Here, photon-emitter interfaces are the fundamental building blocks in such networks, facilitating the controlled creation of single photons and active light-matter interaction on the atomic scale - essential features for future quantum memories. While great advancements in the field have been achieved, the tunability of photon-emitter interfaces remains challenging.

This talk explores strategies for establishing integrated active emitter–photon interfaces in the form of i) waveguides and ii) metasurfaces. It commences by introducing narrowband and broadband waveguide environments. Following this, it presents a tunable platform that enables active wavefront shaping of emission in free space, utilizing phase change materials. Lastly, it outlines a vision for how this research will contribute to scientific discoveries and address current technological challenges in the fields of classical and quantum optical communication.