Joint Quantum Seminar

Wednesday, November 28, 4:00 pm
Jefferson 250

Prof. Peter Lodahl

Center for Hybrid Quantum Networks (Hy-Q), Niels Bohr Institute

"Quantum-Information Processing with Solid-State Single-Photon Emitters"

Semiconductor quantum dots have improved their optical performance dramatically in recent years, and today a clear pathway is laid out for constructing a deterministic and coherent photon-emitter interface by embedding quantum dots in photonic nanostructures [1]. Such an interface can be employed as an on-demand single-photon source for quantum-information applications, but more generally enables single-photon nonlinearities and deterministic quantum gates [2]. We will review the recent experimental progress on quantum dots coupled to nanophotonic waveguides and cavities as a mean to engineer light-matter interaction. We discuss current status on efficiency, coherence
[3,4] and brightness [5], as well as the fundamental limits of photon indistinguishability [6,7]. Various potential quantum-information processing protocols are put forward that exploits the deterministic photon-emitter interface for single-photon nonlinear optics and spin physics. Finally, the experimental demonstration of a photonic switched controlled by a single spin coupled to a waveguide is discussed [8].

References: [1] Lodahl et al., Rev. Mod. Phys. 87, 347 (2015). [2] Lodahl, Quantum Science and Technology 3, 013001 (2018). [3] Kirsanske et al., Phys. Rev. B 96, 165306 (2017). [4] Thyrrestrup et al., Nano Letters 18, 1801 (2018) [5] Daveau et al., Optica 4, 178 (2017). [6] Tighineanu et al., Phys. Rev. Lett. 120, 257401 (2018). [7] Dreessen et al., Quantum Science and Technology 4, 015003 (2019). [8] Javadi et al., Nature Nanotechnology 13, 398 (2018).

Student Presentation by Tijs Karman will begin at 4:00
Guest Presentation will begin at 4:30 PM
Refreshments will be provided

ITAMP
Institute for Theoretical Atomic Molecular and Optical Physics

MPHQ

HQI
Harvard Quantum Initiative in Science & Engineering