THE CHINESE UNIVERSITY OF HONG KONG
Department of Electronic Engineering

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Integrating single-photon sources, circuits and detectors on quantum photonic chips

By

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Date: 15 November, 2023 (Wednesday)
Time: 11:00 a.m.
Venue: Rm 222, Ho Sin Hang Engineering Building, The Chinese University of Hong Kong

Abstract:

Photonic approaches to quantum technology are a frontrunner for quantum communication applications but also hold promise for optical quantum computing, simulation, and remote sensing. The scaling challenges of current implementations can be overcome through integration of photonic systems on semiconductor chips that allow for realizing complex functionalities in quantum technology. We identify quantum light sources, nanophotonic circuit components and single-photon detectors as essential building blocks and show how they can be integrated and replicated in large numbers on nanophotonic chips. We efficiently interface nanoscale solid state quantum emitters, such as defect centers in nanodiamonds or colloidal quantum dots, with nanophotonic waveguides. Further, we demonstrate a reinforcement learning-based inverse design method that allows for scaling down nanophotonic circuit components and implement an extraordinary wide range of functionalities. Lastly, we embed efficient, low noise superconducting nanowire single photon detectors exhibiting high timing accuracy with a variety of photonic integrated circuit components that enable high-rate quantum key distribution, among other applications of quantum technology.

Biography

Professor Carsten Schuck works at the Center for NanoTechnology (CeNTech), the Center for Soft Nanoscience (SoN) and the Department for Quantum Technology at the University of Münster (Germany). His academic activities focus on quantum technology and nanophotonics, in particular the integration of single photon sources, nanophotonic circuits and superconducting detectors on silicon chips. Before his appointment as full professor (2021), he was an Assistant Professor in Münster (2016), after a postdoctoral fellowship at Yale University (USA, 2010-2014) and work for ASML Research (The Netherlands, 2015). He studied physics in Hamburg, Munich (Germany), and Uppsala (Sweden) and obtained his PhD degree in Applied Physics for work with single-trapped ions at the Institute of Photonic Sciences, ICFO, in Barcelona (Spain). Prof. Schuck is the co-founder of Pixel Photonics, a start-up company that commercializes superconducting nanowire single-photon detectors.

ALL ARE WELCOME

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