Metasurface-empowered quantum emission in high dimensions

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Manipulation of single-photon emission from quantum emitters (QEs) has attracted a considerable attention in recent years due to its importance for quantum information technologies in quantum communication, computation, sensing and metrology. Here, recent progress in on-chip manipulation of the polarization, directionality and phase distribution in single-photon emission by making use of planar holographic QE-coupled metasurfaces is presented and discussed. The underlying idea is related to the concept of meta-atom, in which a QE is efficiently and non-radiatively coupled to surface modes, such as surface plasmon polaritons (SPPs), that are subsequently outcoupled into free propagating waves. An innovative metasurface design approach, vectorial scattering (computer-generated) holography, is introduced for the purpose of designing hybrid SPP-QE coupled metasurfaces suitable for generation of well-collimated beams of single photons with desirable polarization characteristics propagating along given directions. Latest results include its extension for realizing single-photon sources with radiation channels that exhibit diverse (including vectorial with spin and orbital angular momenta) wavefronts and polarization characteristics, opening thereby a way to generating quantum structured light in high dimensions.

Short Bio:

Sergey I. Bozhevolnyi received his PhD degree in Quantum Electronics from Moscow Institute of Physics and Technology (Russia) and Dr. Sci. degree from Erhus University (Denmark). He is a Professor and Head of Center for Nano Optics at the University of Southern Denmark.