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Amr S Helmy

University of Toronto, Canada

Integrated hybrid plasmonic devices–the role of 2D materials

Hybrid plasmonic devices and the associated circuits, with applications in data communications will be discussed. In addition, the role of 2D materials in this platform will be highlighted. Recent advances in the development of a range of 2D materials brings significant opportunities and challenges to photonic circuits. Because of their thicknesses, when compared to optical wavelengths in the visible and infrared, 2D materials physically overlap with a small fraction of the guided electromagnetic modes at these wavelengths in an integrated setting. In this talk, a new approach to profit from 2D materials in integrated planar setting through the utilization of hybrid plasmonic structures and anisotropic meta-materials will be discussed. Due to the dissipative nature of plasmonic modes there is an inherent trade-off between the propagation losses and modal confinement in their implementation. This talk will also demonstrate an effective approach that utilizes hybrid plasmonic modes to alleviate the trade-off associated with their loss behavior and the modal confinement factor. This new approach holds promise to provide effective, nano-scale photonic devices using 2D materials, with losses approaching those exhibited by their dielectric counterparts such as Si. Example devices that profit from this novel architecture include optical modulators, cavities and detectors with designs specially tailored to effectively utilize 2D materials. The performance metrics and figures of merit of this new class of integrated photonic devices will also be described in the talk and compared with other technologies to demonstrate their superiority.

Biography

Amr S Helmy is a Professor at the Department of Electrical and Computer Engineering and the Director for the Center of Quantum Information and Quantum Control at the University of Toronto. Prior to his academic career, he held a position at Agilent Technologies, R&D division, in the UK between 2000 and 2004. At Agilent his responsibilities included developing InP-based photonic semiconductor integrated circuits and high-power lasers. He received his PhD and MSc from the University of Glasgow with a focus on photonic devices and fabrication technologies, in 1999 and 1995 respectively.

a.helmy@utoroto.ca

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