Light-matter interaction in optical cavities

Dr. Sejeong Kim

All-optical networks of photonic integrated circuits (PICs) promises a future with more economical and more powerful systems for computation and optical communications. This is because PICs utilize photons as information carriers, enabling the transfer of vast amounts of data with higher speeds and lower losses. PICs include light sources, waveguides, optical modulators and detectors. The first part of my talk will discuss light sources and the method to increase light-matter interaction in nanoscale. Photonic crystal cavities are studied to provide strong confinement of photons, and their application for tunable laser and optical sensors will be discussed.

Since 1990s, researchers have envisaged a leap in computing efficiency by entering the quantum regime, where information is encoded into quantum states of light. Integrating such quantum light source into classical PICs will introduce a whole new level of technologies such as scalable quantum computers, quantum internet, and integration of quantum sensors into laptops and cell phones. In the second part of the talk, I will discuss the 2D materials as one of the promising material candidates for quantum integrated photonics. In particular, hexagonal boron nitride (hBN) is studied as they host single-photon emitters with ultra-brightness. Future photonic integrated platform with new functionalities will also be discussed.

Biography

Sejeong Kim is currently a research fellow at the University of Technology Sydney (UTS) and appointed for a lecturer at the University of Melboune. Dr Kim is also an APL Photonics Early Career Editorial Advisory Board member and OSA Sydney Local Section Committee member. She received her PhD in Physics from Korea Advanced Institute of Science and Technology (KAIST) in 2014. Her research focuses on studying light-matter interaction at the nanoscale, especially with optical cavities. This includes studies of photonic crystal cavities for microlasers, sensors and quantum applications, as well as developing an integrated photonics platform. She received the Excellence Award for a Young Scientist (2018) and the Best Emerging Scientist Award in Photonics and Quantum Electronics (2017) from Korea. This year, she is selected as the top 30 rising stars by Optical Society of Korea.