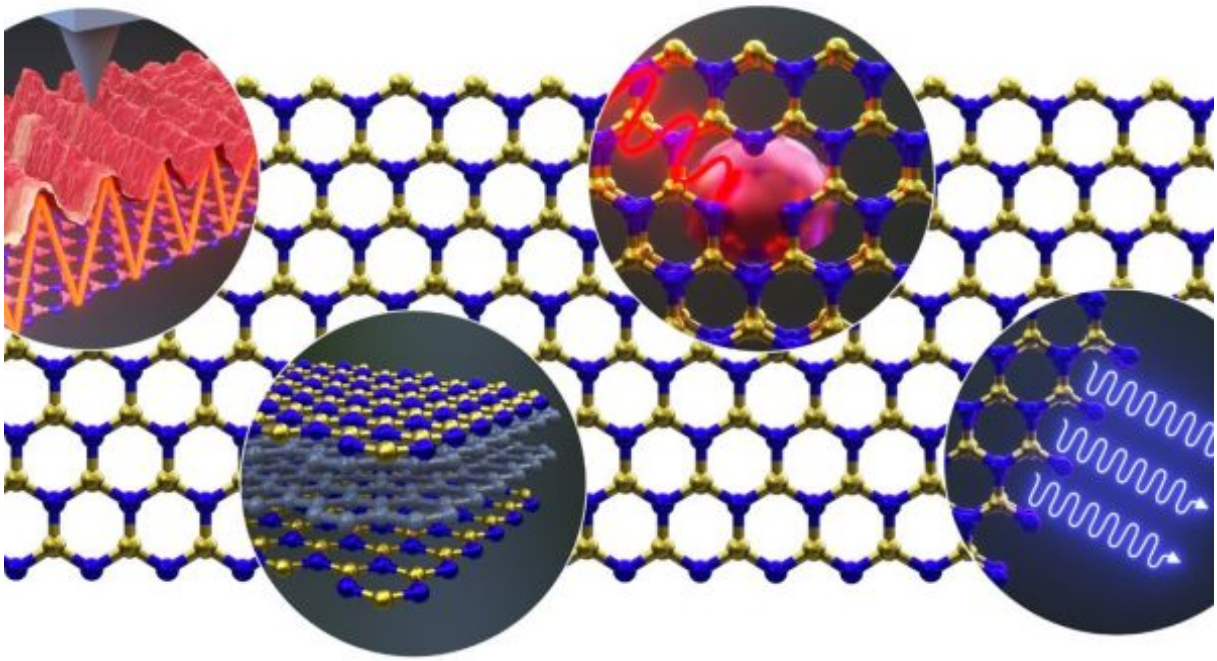

L4G SEMINAR: Quantum Technologies with Atomically Thin Materials

IGOR AHARONOVICH

April 19, 2022
12:00 to 13:00
SMR

ABSTRACT:
Engineering robust solid-state quantum systems is amongst the most pressing challenges to realize scalable quantum photonic circuitry. While several 3D systems (such as diamond or gallium arsenid) have been thoroughly studied, solid state emitters in two dimensional (2D) materials are still in their infancy.
In this presentation I will discuss the appeal of an emerging van der Waals crystal - hexagonal boron nitride (hBN). This unique system possesses a large bandgap of ~ 6 eV and can host single defects that can act as ultra-bright quantum light sources. In addition, some of these defects exhibit spin dependent fluorescence that can be initialised and coherently manipulated. In this presentation I will discuss in details various methodologies to engineer these defects and show their peculiar properties. Furthermore, I will discuss how hBN

crystals can be carefully sculpted into nanoscale photonic resonators to confine and guide light at the nanoscale. Taking advantage of the unique 2D nature of hBN, I will also show promising avenues to integrate hBN emitters with silicon nitride photonic crystal cavities. All in all, hBN possesses all the vital constituents to become the leading platform for integrated quantum photonics. To this extent, I will highlight the challenges and opportunities in engineering hBN quantum photonic devices and will frame it more broadly in the growing interest with 2D materials nanophotonics.

BIO:

Professor Igor Aharonovich received his PhD in 2010 from the University of Melbourne and spent two years in Harvard as a postdoctoral researcher in the group of Prof Evelyn Hu. In 2013 Igor returned to Australia and joined the University of Technology Sydney (UTS) where is currently a full Professor and the UTS node director of the ARC Centre of Excellence for Transformative Meta-Optical Systems.

Igor's group is focusing on exploring single emitters in wide band gap semiconductors, such as diamond and more recently hexagonal boron nitride. His group is also interested in innovative approaches for nanofabrication of nanophotonics devices for quantum circuitry. But most importantly - Igor's group has members from 11 different countries which forms a vibrant and a dynamic environment.

Igor received numerous international awards and recognitions including the 2017 Pawsey medal from the Australian Academy of Science, 2019 CN Yang Award - honors young researchers with prominent research achievements in physics in the Asia Pacific region and the 2020 Kavli foundation early career lectureship in materials science. He was also elected as a fellow of the Optical Society (class 2021).

This activity is co-funded by the European Regional Development Funds (ERDF) allocated to the Programa operatiu FEDER de Catalunya 2014-2020, with the support of the Secretaria d'Universitats i Recerca of the Departament d'Empresa i Coneixement of the Generalitat de Catalunya for emerging technology clusters devoted to the valorization and transfer of research results (GraphCAT 001-P-001702).

Hosted by: Frank Koppens

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