

City University of Hong Kong  
Department of Electrical Engineering &  
IEEE Photonics Society Hong Kong Chapter  
Present a Seminar on

# *Quantum Photonics Using 2D Materials*

by

Prof. Vinod Menon  
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City University of New York, U.S.A.

Date : 30 July 2019 (Tuesday)

Time : 11:00 am – 12:00 nn

Venue : YEUNG-G6302, City University of Hong Kong

## **Abstract**

Two-dimensional (2D) Van der Waals materials have emerged as a very attractive class of optoelectronic material due to the unprecedented strength in its interaction with light. In this talk I will discuss approaches to realize quantum photonic devices by integrating these 2D materials with microcavities, and metamaterials. I will first discuss the formation of strongly coupled half-light half-matter quasiparticles (microcavity polaritons) [1] and their optical and electrical control [2, 3] in the 2D transition metal dichalcogenide (TMD) systems. Prospects of realizing condensation and few photon nonlinear switches using Rydberg states in TMDs will also be discussed. Following this, I will discuss the broadband enhancement of light-matter interaction in these 2D materials using photonic hypercrystals [4, 5] and chiral metasurfaces. Finally, I will talk about room temperature single photon emission from hexagonal boron nitride [6] and the prospects of developing deterministic quantum emitters using them through strain engineering [7]. The realization of room temperature single photon emitters and few photon nonlinear switches using 2D materials presents an attractive direction for robust next generation quantum photonic technologies.

[1] X. Liu, et al., *Nature Photonics* **9**, 30 (2015); [2] Z. Sun et al., *Nature Photonics* **11**, 491 (2017); [3] B. Chakraborty et al., *Nano Lett.* **18**, 6455 (2018); [4] T. Galfsky, et al., *Nano Lett.* **16**, 4940 (2015); [5] T. Galfsky, et al. *Proc. Natl. Acad. Sci.* **114**, 5125 (2017); [6] Z. Shotan, et al., *ACS Photonics* **3**, 2490 (2016); [7] N. Proscia, et al. *Optica* **5**, 1128 (2018)

## **Biography**

Vinod Menon is a Professor of Physics at the City College and Graduate Center of the City University of New York (CUNY). He is also an IEEE Distinguished Lecturer in Photonics (2018-20). He joined CUNY in fall 2004 as part of the initiative in photonics. Prior to joining CUNY he was at Princeton University (2001-2004) where he was the Lucent Bell Labs Post-Doctoral Fellow in Photonics. He received his MSc in Physics (Quantum Optics specialization) from the University of Hyderabad, India in 1995 and his Ph.D. in Physics from the University of Massachusetts in 2001. His current research interests include cavity QED with two-dimensional semiconductors, controlling transport and energetics in organic molecules through strong light-matter coupling, and engineered nonlinear optical materials. More details about his group can be found at [www.lanmp.org](http://www.lanmp.org)

~~~~~ All are welcome ~~~~~