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Novel photosensitive devices based on graphene-carbon nanotube hybrid materials

Professor Fengqiu (Frank) Wang
School of Electronic Science and Engineering, Nanjing University, China

Abstract: Combining low-dimensional nanomaterials into hybrid nanostructures is a promising avenue to obtain enhanced material properties and to achieve nanodevices operating with novel principles. The family of carbon allotropes, with its rich chemistry and physics, has attracted a great deal of attentions in forming novel hybrid nanostructures. In particular, the excellent electrical conductivities and large specific surface areas of 2D graphene and 1D carbon nanotubes have stimulated earlier theoretical and experimental investigations of 3D nanotube-graphene hybrid systems for hydrogen storage, supercapacitors and field-emitter devices. Both graphene and carbon nanotubes exhibit intriguing optical properties, such as broadband and tuneable light absorption. These features combined with scalable synthesis and environmental robustness make them promising materials for photodetectors. I will talk about our recent demonstration of an all-carbon photodetector featuring broad operating bandwidth (400-1550 nm), high photoconductive gain (~10^5 electrons per photon) and a fast response time (~100 µs). Such performance is enabled by efficient photocarriers generation and transport within the 1d-2d hybrid nanostructure. Flexible and photo-sensitive synaptic devices based on this all-carbon hybrid material will also be discussed.

About the Speaker: Prof. Fengqiu (Frank) Wang obtained his B.S. degree in Electronic Engineering from Peking University, China in 2003, and then a PhD from Cambridge University Engineering department in 2009. He moved to Nanjing University in September 2013 and has since focused on the optical characterizations of low-dimensional materials for applied photonic devices. He has published over 70 papers and contributed 30 oral presentations at international conferences. His publications have drawn a total citation of >4000. He is technical committee member for CLEO (2016-2018), CLEO-pacific rim (2015) and is editorial board member of Scientific Reports. Current research interests include 2d materials photonics, ultrafast spectroscopy, and mid-infrared lasers and applications. He was awarded youth-1000-talent fellowship (2013) and Distinguished Young Scholars of Jiangsu Province (2017) and is principal investigator of 2 NSFC projects and 1 National Key Basic Research Program project.

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Venue: Room 107, 10 College Walk
Monash University, Clayton

Info: sarah.colbert@monash.edu
monash.edu/mcatm