

Colloquia

SPRING 2017

Hilmi Volkan Demir

Bilkent University PHYS, EEE, MSN and UNAM

Nanocrystal optoelectronics: An emerging field

day

FEB 8, 2017 WED

location

SU-01

time

15:40

ABSTRACT

Solution-processed semiconductor nanocrystals have attracted great interest in optoelectronics including color conversion and enrichment in quality lighting and display backlighting. Optical properties of these colloidal nanocrystals can be conveniently controlled by tailoring their shape, composition, and size in an effort to realize high-performance light generation and lasing. Based on the rational design and control of excitonic processes in these nanocrystals, it is possible to achieve highly efficient light-emitting diodes and optically pumped lasers. In this talk, we will introduce the emerging field of nanocrystal optoelectronics. In particular, we will present a new concept of all-colloidal lasers developed by incorporating nanocrystal emitters as the optical gain media intimately into fully colloidal cavities for the first time. As an extreme case of solution-processed tightly-confined quasi-2D colloids, we will also show that the atomically flat heteronanoplatelets uniquely offer record high optical gain coefficients and ultralow threshold stimulated emission. In addition, we will discuss that controlled stacking of these colloidal quantum wells provides us with the ability to fine-tune and master their excitonic properties. Given the recent accelerating progress in nanocrystal optoelectronics, solution-processed quantum materials now hold great promise to challenge their conventional epitaxial counterparts in the near future.

Dr. Hilmi Volkan Demir is a professor of physics and electrical engineering at Bilkent University and UNAM – The National Nanotechnology Research Center at Bilkent. Concurrently, he is an NRF Fellow at NTU Singapore. Demir earned his PhD (2004) and MSc (2000) degrees from Stanford University, CA, and his BSc degree (1998) from Bilkent University. His current research interests include the science and technology of semiconductor lighting; nanocrystal optoelectronics; excitonics and plasmonics for high-efficiency light generation and harvesting; and wireless in vivo sensing and smart implants for future healthcare. Demir published over 250 peer-reviewed research articles in major scientific journals and delivered over 250 invited seminars, lectures and colloquia on the topics of LED lighting, colloidal nanophotonics, in vivo sensing, and nanoparticles research in industry and academia. Demir has contributed to commercialization and licensing of several new enabling technologies, leading to >30 patent applications (granted and pending), several of which have currently been used, owned or licensed by the industry. These scientific and entrepreneurship activities resulted in several important international and national awards including NRF Investigatorship Award (2015), Nanyang Award for Research Excellence (2013), and European Science Foundation EURYI Award (2007). Presently, he is the SPRINGER Series Editor of Nanoscience and Nanotechnology and an editor of Optics Express, a leading open-access journal of OSA. Professor Demir is serving as the 2017 General Chair, 2016 Member-at-Large and 2015 Technical Chair of IEEE IPC, IEEE Photonics Society flagship annual meeting.

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