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LAPME Seminar

Emerging Semiconductor Optoelectronics of Colloidal Quantum Wells



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Venue: N23-4018

Time: 10:30 - 11:30

Hosted by: Prof. Handong SUN

Abstract

Lighting and displays are integral parts of human activities and economic development. Semiconductor nanocrystals, now offering a market volume exceeding 5B Euros annually, have attracted great interest in quality lighting and displays in the last decade. Such colloidal semiconductors enable enriched color conversion essential to superior lighting and displays. These colloids span different types and heterostructures of semiconductors from colloidal quantum dots to wells. In this talk, we will focus on atomically-flat, tightly-confined, quasi-2-dimensional wells, also popularly nick-named ‘nanoplatelets’, particularly for use in lighting and displays. Also, we will present a powerful, large-area, orientation-controlled self-assembly technique for orienting these quantum wells either all face down or all edge up. We will demonstrate three-dimensional constructs of their oriented self-assemblies with monolayer precision. Among their extraordinary features important to applications in lighting and displays, we will show record high efficiency from their colloidal LEDs and record high gain coefficients and record low lasing thresholds from their colloidal laser media using their heterostructures and/or oriented assemblies. Given their current accelerating progress, these solution-processed nanocrystals hold great promise to challenge their epitaxial thin-film counterparts in semiconductor optoelectronics.

Biography

Hilmi Volkan Demir (IEEE Fellow’21; OPTICA Fellow’20) is a professor at the School of Electrical and Electronic Engineering, together with the Schools of Physical and Mathematical Sciences and of Materials Science and Engineering (by courtesy) at NTU. As an NRF Fellow of Singapore, he joined NTU with the appointment of Nanyang Associate Professorship and established the Centre of Excellence for Semiconductor Lighting and Displays, LUMINOUS!, at NTU in 2009, which has been awarded large-scale programs including NRF CRPs and NRF Fellowship as well as A*STAR programs. Demir earned his PhD (2004) and MSc (2000) degrees from Stanford University, USA, and his BSc (1998) from Bilkent University, Ankara, one of the top engineering schools in Türkiye. Concurrently, Dr. Demir is a professor of electrical engineering and physics at Bilkent University UNAM (his alma mater). His current research interests include the science and technology of semiconductor lighting and displays, nanocrystal optoelectronics, and smart metastructured implants. As a PI, Demir has contributed to commercialization and licensing of over 10 new enabling technologies, generating over 100 patent applications (granted and pending) as a principle inventor. His scientific and entrepreneurship activities resulted in several important awards including Nanyang Award for Research Excellence, NRF Investigatorship Award of Singapore, TÜBİTAK Science Award of Turkey, and EURYI Award of European Science Foundation.

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