nanoX invited scientist

Hanan Dery

Position Professor

Affiliation Rochester University, USA

Host lab at NanoX LPCNO Team Quantum Optoelectronics

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Dates of stay July 2022

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Brief Biodata

Hanan Dery is Professor at the University of Rochester (USA). He is a specialist in the theory of semiconductor spin electronics. He joined the Department of Electrical and Computer Engineering in July, 2007. Previously, he was a postdoctoral associate in Lu Sham's group in the Department of Physics, University of California San Diego (UCSD). During this time, he worked on spintronics, seeking ways to integrate information based on electron spin into semiconductors. Dery earned his PhD in electrical engineering from Technion-Israel Institute of Technology in 2004. His PhD research was in optoelectronic nanostructure devices with a focus on nonlinear gain processes and carrier dynamic properties.

Research project during the visit at nanoX

Properties of excitonic complexes in 2D semiconductors

The choice of two-dimensional (2D) materials to engineer devices with atomically flat active regions is currently extending far beyond graphene to a wide range of new semiconductors, insulators, metals and superconductors. Taking advantage of each material's properties, the stacking of diverse 2D layers to build van der Waals heterostructures, should open the way to a new class of devices with potential applications in optoelectronics, spintronics, flexible electronics or photovoltaics. Among the various families of 2D materials, semiconductor transition metal dichalcogenide (TMD) materials (MoS2, WS2, MoSe2, WSe2 and MoTe2) exhibit especially exciting properties when thinned down to one monolayer. In contrast to graphene, TMD monolayers have a direct band gap yielding interesting electronic and optical properties in the visible and near infrared regions of the optical spectrum. In particular, they exhibit a strong light-matter interaction governed by very robust excitons from cryogenic to room temperature. Secondly, the interplay between crystal inversion symmetry breaking and strong spin-orbit coupling provides a unique access to control simultaneously two degrees of freedom: the spin (up or down) and the electron momentum in k-space (K+ or K- valleys at the corners of the Brillouin zone). Thus, in addition to rich spin-valley physics, TMD materials open the way to the development of spintronics or valleytronics devices

If relevant, add a figure

Legend