THE UNIVERSITY OF ARIZONA

Arizona State University

MateriAlZ Seminar Series

Exploring the Power of Low-Dimensional Materials for Neuromorphic Computing

Friday, September 1, 2023, 11:00 am MST

Abstract

Neuromorphic computing is an emerging technology that aims to overcome the limitations of the von Neumann bottleneck by taking inspiration from our human brain. Nevertheless, designing neuromorphic computing devices and hardware that can tackle vast quantities of information and offer sustainable, power-efficient computational methods possesses several challenges, such as enabling devices to efficiently mimic synapse, neuron, and non-linear information transmission processes. To address these challenges, low-dimensional materials have emerged as an important family of materials due to their superlative physical properties and mixed-dimensional integration capability. In this seminar, I will discuss state-of-the-art opportunities offered by low-dimensional materials for neuromorphic computing. First, I will introduce unprecedented quantum synaptic devices, stochastic neuron devices, and mixed-kernel devices that we developed by harnessing the unique properties offered by low-dimensional materials. Second, I will elucidate our efforts to interpret the unique quantum electronic states in our material system, which lead to novel computing functionalities. Finally, I will highlight the potential of making eco-friendly neuromorphic computing hardware with little manufacturing cost and low-energy consumption by scaling our efforts from building single devices towards circuit-level integration. I will discuss our efforts in exploring an interdisciplinary path that connects the study of low-dimensional materials, devices, circuits and algorithms together.

Prof. Xiaodong Yan

University of Arizona, Tucson

Dr. Yan is an assistant professor in Materials Science and Engineering department at the University of Arizona since 2023. He completed his B.S. in Physics from Peking University in 2011, a M.E. in Electrical Engineering from University of Notre Dame in 2014, and a Ph.D. in Electrical and Computer Engineering from the University of Southern California in 2020. Following his doctorate, he was a postdoc in Materials Science and Engineering department at the Northwestern University. His research focuses on interdisciplinary study over novel nanomaterials and physics, nano-electronic devices and mechanisms, and cutting-edge circuit and architectural designs for low-power applications including neuromorphic computing, quantum computing, artificial intelligence, and internet of things. He is a recipient of the MHI Ph.D. Scholar in the Ming Hsieh Department of ECE at the University of Southern California and was honored as an Outstanding Volunteer of the 29th Olympic Games.

Zoom link: https://arizona.zoom.us/j/85761118561: Passcode: 453004

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