



UNIVERSITY OF MIAMI  
COLLEGE of  
ENGINEERING

## MIAMI INSTITUTE FOR CLEAN ENERGY SEMINAR SERIES

Friday, February 14, 2024 | 12:00pm  
[Zoom Link](#) | Meeting ID: 997 7973 5104

**QUESTIONS? CONTACT**  
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### 2D MATERIALS FOR NEXT-GENERATION ELECTRONICS: FROM LOW-POWER LOGIC TO MONOLITHIC MEMORY

Silicon has long dominated electronic computing, but with Moore's law reaching its limits, researchers are exploring alternatives to enhance efficiency, speed, and data handling. While revolutionary computing paradigms like all-optical or quantum computing remain out of reach, the integration of novel materials with silicon presents promising opportunities.

This talk will explore how layered two-dimensional (2D) chalcogenide materials and three-dimensional (3D) nitride materials can address silicon's limitations. I will discuss our work on integrating 2D chalcogenide semiconductors, particularly In-Se, with silicon to develop low-power tunneling field-effect transistors, focusing on wafer-scale, phase-pure, epitaxial thin-film growth at silicon-compatible temperatures.

Additionally, I will present research on memory devices using 2D materials integrated with wurtzite-structured ferroelectric nitride materials, specifically aluminum scandium nitride (AlScN). This includes Ferroelectric Field-Effect Transistors (FE-FETs) and recent advancements in scaling 2D/AlScN FE-FETs, achieving ultra-high carrier and current densities in ferroelectrically gated MoS<sub>2</sub>, as well as engineering AlScN/dielectric/2D interfaces to demonstrate negative-capacitance FETs.



#### Deep Jariwala

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Deep Jariwala is an Associate Professor and the Peter & Susanne Armstrong Distinguished Scholar in Electrical and Systems Engineering and Materials Science and Engineering at the University of Pennsylvania. He earned his undergraduate degree in Metallurgical Engineering from IIT Varanasi and his Ph.D. in Materials Science and Engineering from Northwestern University. After a Resnick Prize Postdoctoral Fellowship at Caltech, he joined Penn to establish his research group. His work focuses on new materials, surface science, and solid-state devices for computing, optoelectronics, and energy harvesting, as well as developing correlated and functional imaging techniques. Widely recognized, he has received numerous awards, including the Optica Adolph Lomb Medal, Bell Labs Prize, AVS Peter Mark Memorial Award, and the Alfred P. Sloan Fellowship. With over 150 journal publications and 21,000+ citations, he also holds multiple patents. Jariwala serves as Associate Editor for ACS Nano Letters and has been named a 2025 Distinguished Lecturer for the IEEE Nanotechnology Council.