SEMINAR ANNOUNCEMENT

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
COLLEGE OF DESIGN AND ENGINEERING
Website: https://cde.nus.edu.sg/ece

Area: Microelectronics Technologies and Devices (MTD)

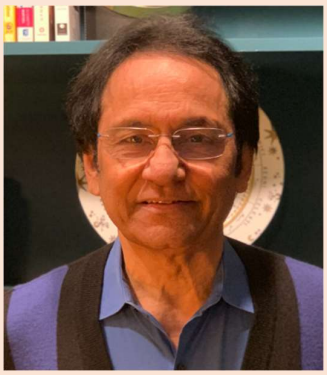
Host: Assoc Prof Aaron James Danner

TOPIC	:	**Quantum Materials and Processes for Complex Microsystems on Silicon**
SPEAKER	:	**Prof Thirumalai Venkatesan** **Professor, Center for Quantum Research and Technology, University of Oklahoma**
DATE	:	**Thursday, 30 July 2026**
TIME	:	**3:00PM-4:00PM**
VENUE	:	**E5-03-20 SEMINAR ROOM**

ABSTRACT

Materials and processes for complex microsystems (MEMs, microbots, opto-electronics, etc.) on silicon are very much in vogue today. Novel ways to integrate different materials and processing them with ease on silicon are key to this goal. My research is focused on the use of pulsed laser deposition (PLD), a technology being accepted by the semiconductor industry, to grow crystalline functional materials on silicon for a variety of applications ranging from quantum information systems, opto-electronics and heterogeneous integration. There are significant challenges currently with optical qubits based on color centers, namely nuclear hyperfine interaction induced decoherence, lack of scalability to large areas, precise location of the qubits and difficulty in nano-structuring the host materials. We are working with CeO2 (with zero nuclear moment) and developing a layer-by-layer growth (and doping) process on silicon to help with scalability and qubit spatial accuracy. Another interesting quantum material is Cu2O which is a very difficult material to grow as a smooth, single crystalline thin film. Because of the high energy exciton in this material system, high order Rydberg states are accessible and in photoluminescence we can resolve up to n= 6 while in absorption spectroscopy higher order states may be accessible. We have developed a buffer layer scheme for the growth of a variety of crystalline functional oxides on silicon. Since many of these oxides are not easy to etch using reactive ion etching, we have invented a novel process, PLATEN (Pulsed Laser Template Engineering) whereby these functional films are deposited using PLD on pre-patterned silicon wafers whereby the deposited films take the exact shape of the patterns leading to an easier way to fabricate opto- electronic devices. Reactive ion etching of silicon is a highly evolved process owing to its importance to the silicon industry and we leverage this technology here. We are also manipulating oxide heterostructures to introduce new functionalities and I will discuss recently discovered ferroelectricity in a highly unlikely combination of materials.

BIOGRAPHY



Prof. T. Venkatesan is currently with the Center for Quantum Research and Technology (Professor of Physics and ECE) at University of Oklahoma (OU), and Scientific affiliate at NIST Gaithersburg. As the inventor of the pulsed laser deposition (PLD) process, he has over 830 papers, about 50 filed patents and citations of over 61,600 with a hirsch Index of 128- Google Scholar. He is a Fellow of the Royal Society (FRS), National Academy of Inventors (USA), Foreign member of the Indian National Academy of Science, Singapore National Academy of Science, Asia Artificial Intelligence Academy, World Innovation Foundation, American Physical Society (APS), Materials Research Society (MRS), Academician of the Asia Pacific Academy of Materials, winner of the Bellcore Award of excellence, George E. Pake Prize awarded by APS (2012), Distinguished Lectureship on the Applications of Physics Award-APS (2020), President's gold medal of the Institute of Physics, Singapore, Provost Chair Professor at NUS, Guest Professor at Tsinghua University, past member of the Physics Policy Committee (Washington DC), the Board of Visitors at UMD and the Chairman, Forum of Industry and Applications of Physics at APS. He was awarded the outstanding alumnus award from two Indian Institute of Technologies- Kanpur (2015) and Kharagpur (2016), India. He was the 2024 Jubilee Chair Professor of the Indian Academy of Sciences. He has been appointed the Fellow of the Trinity College Cambridge for the summer of 2028.

He has founded several startups (over seven) and is the President of Neocera and CEO of Neocera Magma, companies manufacturing equipment for specialty coatings (pulsed laser deposition systems) and semiconductor fault isolation (using magnetic field imaging systems). He is an associate editor of Applied Physics Reviews.