Co-hosted by Birck Nanotechnology Center, Electrical and Computer Engineering, and Discovery Park

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Thursday, April 18 • 11:00 a.m. - Noon • Burton D. Morgan Center, Room 121

Interface Enabled Technologies

This talk presents examples of how interfaces of similar and dissimilar materials give us opportunities for new science and possibly new applications. Using an interface of a 2D transition metal dichalcogenide (MoS_2) grown on $SrTiO_3$ we show how the trion in the MoS_2 layer couples with the soft phonon modes in the $SrTiO_3$ below its phase transition temperature to create a new quasi particle, the polaronic trion, which is electrically tuneable. Using an azo aromatic complex deposited on an atomically flat oxide surface, some of the lowest switching energy memories have been demonstrated. The atomically flat oxide surface enables the molecules to exhibit fascinating switching phenomena which can only be explained by molecular self-assembly. Using epitaxial barium titanate films grown on low epsilon perovskites we have demonstrated active devices which exhibit electro-optic coefficients larger than in $LiNbO_3$ devices by a factor of 20 with reduced propagation losses. Epitaxial oxide-based conductor/insulator combination may help with meta-surfaces with increased periodicity in the mid-IR region. This wavelength region is extremely important for designing molecular sensors for volatile organic compounds whose absorption spectra span the 2-20 micron range. Such hetero-structures also enable us to form MIM junctions with much higher reproducibility for injection emitters based on inelastic tunneling. Finally, rate of cell growth can be controlled by varying the chemistry of the surface on which the cells are grown, leading to potential applications in artificial meat, stem cell therapy, and implant technologies.

Thirumalai Venky Venkatesan

Prof. T. Venkatesan is currently the Director of the Nano Institute at the National University of Singapore (NUSNNI) where he is a Professor of ECE, Physics, MSE and NGS. He wore various hats at Bell Labs and Bellcore before becoming a Professor at the University of Maryland. As the inventor of the pulsed laser deposition (PLD) process, he has more than 750 papers and 30 patents and is globally among the top one hundred physicists (ranked at 66 in 2000) in terms of his citations (Over 43,000 with a Hirsch Index of 106-Google Scholar). He has graduated more than 45 PhDs, 35 Post Docs and 35 undergraduates. He is also the founder and Chairman of Neocera, a company specializing in the area of PLD and magnetic field imaging systems. Close to 10 of the researchers (PhD students and Post Docs) under him have become entrepreneurs starting more than 17 different commercial enterprises. He is a Fellow of the APS, winner of the Bellcore Award of excellence, Guest Professor at Tsinghua University, Winner of the George E. Pake Prize awarded by APS (2012), President's gold medal of the Institute of Physics Singapore, Academician of the Asia Pacific Academy of Materials, Fellow of the World Innovation Forum, was a 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.

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