



USC University of
Southern California

USC Viterbi

Ming Hsieh Department
of Electrical Engineering

Munushian Visiting Seminar Series

Debdeep Jena

Cornell University

The Wide-Bandgap Semiconductor Revolution in Electronic, Photonic, and Energy Systems

Friday, October 20, 2017

2:00 - 3:30 pm, EEB 132

Refreshments will be served

Abstract: Wide-bandgap nitride materials and devices have revolutionized the electronics and photonics industries in the last two decades. The optical device impact is moving from visible lighting and lasers to deep-UV photonics for biological applications. By exploiting the high electrical breakdown fields, and the high mobility of 2-dimensional electron gases, GaN HEMTs are now capable of generating enormous amounts of microwave power at high frequencies, and have become very attractive for RF amplifiers that power communications. At the same time, both lateral GaN HEMTs, and vertical GaN FETs are making inroads into high-voltage power electronics. Surprisingly, GaN also has a significant role to play in low-power energy-efficient electronics by exploiting internal polarization fields driven by the Berry phase. This talk will review these successes and discuss the physics underlying these revolutionary advances of the past two decades. Then, the same physics and a slew of new nitride materials to augment the ‘conventional’ nitrides and to take Wide-bandgap electronics well into the future into areas of quantum computation and communications will be discussed.



Biosketch: Dr. Debdeep Jena is a Professor of Electrical and Computer Engineering and Materials Science and Engineering at Cornell University. His research and teaching interests are in the MBE growth and electronic and photonic device applications of quantum semiconductor heterostructures (III-V nitrides, oxides, and 2D crystal semiconductors). By combining experiment and theory, his group explores fundamental speed, power, and efficiency limits of electronic and photonic devices based on a deep investigation of charge, heat, and spin transport. He has authored more than 200 scientific publications including articles in Science, Nature Journals, Physical Review Letters, Electron Device Letters, and Applied Physics Letters. During his research career, he has received the International MBE Young Scientist award in 2014, the IBM faculty award in 2012, the ISCS Young Scientist award in 2012, the most valuable contribution awards at the Workshop for Compound Semiconductor Materials and Devices (WOCSEMMAD) in 2014, 2010 and 2008, the National Science Foundation (NSF) Career Award in 2006, a best student paper award at the Electronic Materials Conference in 2002, and a young author best paper award from the International Union of Pure and Applied Physics (IUPAP) in 2000. He is most proud of the Joyce award for excellence in undergraduate teaching which he received in 2010. He is a Fellow of the American Physical Society.