



# ECE Distinguished Seminar Series

Sponsored by the IEEE EDS/Photonics Columbus Chapter under its Distinguished Lecturer Program



Tuesday, May 17, 2011

1:30 PM in 260 Dreese Laboratories

## ***The Infrared Retina: Bioinspired Sensing for Using Nanoscale Superlattices and Quantum Dots***

**Sanjay Krishna**

*Professor and Assoc. Director Center for High Technology Materials  
University of New Mexico*



**Abstract:** Infrared detectors operating in the 3-20  $\mu\text{m}$  are important due to three main reasons. Firstly, the atmosphere is transparent in the two bands referred to as mid wave infrared (MWIR, 3-5  $\mu\text{m}$ ) and long wave infrared (8-12  $\mu\text{m}$ ) making it possible to see through fog and smoke under poor visibility conditions. Secondly, a lot of chemical species have characteristic absorption features in this wavelength range making these detectors vital for remote sensing and stand off detection. Finally, there is blackbody emission from living objects at these wavelengths making it possible to use them for “night vision” and thermography applications such as surveillance and medical diagnostics. Presently, we are in, what is referred to as, the third generation of infrared detectors. In this colloquium, Prof. Krishna will make predictions about the fourth generation of infrared detectors. Using the concept of a bio-inspired infrared retina, he will make a case for an enhanced functionality in the pixel. The key idea is to engineer the pixel such that it not only has the *ability* to sense multimodal data such as color, polarization, dynamic range and phase but also the *intelligence* to transmit a reduced data set to the central processing unit. He will use two material systems, which are emerging as promising infrared detector technologies as prototypes to highlight this approach. These are (i) InAs/InGaAs self assembled quantum dots in well (DWELL) heterostructure and InAs/(In,Ga)Sb strain layer superlattices (SLS) Detectors. Various approaches for realizing the infrared retina will be discussed. In addition to the applications of infrared imaging for defense application, Sanjay highlight the role of infrared imaging in non-invasive medical diagnostics. In particular, he will highlight some work on using infrared imaging in the early detection of skin cancer.

**Bio:** Sanjay Krishna is the Associate Director of the Center for High Technology Materials and a Professor in the Department of Electrical and Computer Engineering at the University of New Mexico. Sanjay received his M.S. from IIT, Madras, MS in Electrical Engineering in 1999 and PhD in Applied Physics in 2001 from the University of Michigan. He joined UNM as a tenure track faculty member in 2001. His present research interests include growth, fabrication and characterization of nanoscale quantum dots and type II InAs/InGaSb based SLS for mid infrared detectors. Sanjay received the Gold Medal from IIT, Madras, Ralph Powe Junior Faculty Award, IEEE Outstanding Engineering Award, ECE Department Outstanding Researcher Award, School of Engineering Jr. Faculty Teaching Excellence Award, NCMR-DIA Chief Scientist Award for Excellence, the NAMBE Young Investigator Award, and the IEEE-NTC and SPIE Early Career Achievement Award. He was recently awarded the UNM Teacher of the Year and the UNM Regents Lecturer award. Sanjay has more than 200 peer-reviewed journal articles (h-index=24), two book chapters and five issued patents and has recently been elected as an SPIE Fellow.

**Host:** Paul R. Berger