Abstract: Infrared imaging (3-25mm) has been an important technological tool for the past sixty years since the first report of infrared detectors in 1950s. The ability to detect the temperature of a scene from the blackbody radiation that it emits has spawned applications in a wide variety of fields ranging from defense and security to non-invasive medical diagnostics and remote sensing. However, IR imaging landscape has dramatically changed in the past decade. Firstly, the cost of lower end imagers has been steadily declining (30% every year since 2005) enabling them to be mounted on dashboards of automobiles including Audis and BMWs. Secondly, advent of novel antimonide based semiconductor technology has dramatically improved the performance of higher end imagers that are used for military, defense and security applications. Our group (www.chtm.unm.edu/kind) has been involved with the development of next generation infrared detectors and is one of two university laboratories in the country that can undertake “Design to Camera” research and realize focal plane arrays. Our research is currently focused along two directions. The first involves the fundamental investigation into quantum confined detectors and concepts such as metamaterials and plasmonics to realize the next generation of infrared detectors. The second involves the application of these detectors for biomedical diagnostics. In this talk, I will emphasize these two aspects of our research. Using the concept of a bio-inspired infrared retina, I 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 (neurophotonics). I 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, such as plasmonic resonators, will be discussed. I will also highlight the role of infrared imaging in non-invasive medical diagnostics. In particular, I will highlight some work on using infrared imaging in the early detection of skin cancer and the use of IR imaging for detection of flow in cerebral shunts.

Bio: Sanjay Krishna is the Director of the Center for High Technology Materials and Professor and Regents 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. He currently heads a group of 15 researchers involved with the development of next generation infrared imagers. 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, 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=35), two book chapters and seven issued patents. He is the co-founder and CTO of Skinfrared, a UNM start-up involved with the use of IR imaging for non-invasive medical diagnostics including early detection of skin cancer. He is a fellow of IEEE and SPIE.

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