National space day seminar

Department of aerospace engineering

Indian Institute of Science, Bengaluru

Recent Advances in Infrared Optics: From Metalenses to Upconversion Imaging

Varun Raghunathan

Associate Professor, ECE Department, IISc

Friday, August 23, 2024, 4.00 PM

Department of Aerospace Engineering, IISc, Bengaluru

Abstract: Infrared imaging and spectroscopic sensing are strategic technologies with diverse applications in defense, space, industrial monitoring, medical diagnosis and treatment. Advancements in infrared sensing technology over the years has relied on key developments in light sources, detectors, optical components and image processing techniques. However, the high costs of infrared coherent light sources, poor performance of cooled focal plane-arrays, use of exotic materials for building lenses, filters, polarizers etc. has been a deterrent in finding widespread use for this technology. There is an ongoing effort worldwide to realize high performance yet, practically relevant optical hardware solutions for infrared sensing and imaging. In this talk, I will give an overview of this field drawing on personal pain points working on the applications. I will also discuss in detail three key developments in this area, namely: (i) small foot-print metalenses for building low-cost infrared imaging systems, (ii) high performance, resonant metasurfaces as wavelength selective filters for multispectral applications, and (iii) up-conversion imaging as an alternative for direct infrared detection by converting infrared photons to the visible range for detection using high performance silicon sensors.

Biography: Varun Raghunathan is an Associate Professor at the ECE department, Indian Institute of Science, Bangalore, India. His research group works broadly in the area of experimental optics with interest in nonlinear optics, integrated nanophotonics, biophotonics, optical and quantum communications. He obtained his Ph.D. degree in electrical engineering from the University of California Los Angeles, Los Angeles, CA, USA, in 2008, working on silicon photonics. From 2009 to 2012, he was a Postdoctoral Scholar with the Department of Chemistry, University of California Irvine, Irvine, CA, USA, working in the area of nonlinear optical microscopy. He was also Research Scientist with Agilent Research Laboratories, Santa Clara, CA, USA from 2012 to 2016, working in the areas of infrared micro-spectroscopy with applications of novel optical sensing techniques in digital pathology.

All are welcome