Abstract

Among many emerging technologies, energy and display are two very important applications that potentially revolutionize our society. Nanophotonics holds the key to both these emerging technologies. While tunable devices enable 3D displays, virtual reality, and such other display applications, refractory nanophotonic devices enable efficient thermophotovoltaic energy conversion. Phase transition phenomena that arise from the collective behavior of materials enables both these classes of nanophotonic devices. While an electronic phase transition leads to a huge optical tunability, an optical one results in highly selective thermal emitters necessary for efficient thermophotovoltaics. This talk will describe tunable nanophotonic devices based on charge density waves in 1T-tantalum disulfide and frequency-selective thermal emitters based on parity-time symmetric nanophotonics.

At first, an optical phase transition in a hybrid plasmonic-photonic system exhibiting parity-time symmetry will be described. A route to achieve the best of both plasmonic and dielectric resonances will be demonstrated in this system emitting thermal radiation at 1000 K. Such bright and selective thermal emission is the key to efficient thermophotovoltaic conversion. In the second half of the talk, a strongly correlated quasi 2D material, 1T-TaS2, exhibiting an electronic phase transition will be described for its tunable optical properties. A unity order index tuning by shining relatively low-intensity white light enables tunable nanophotonic devices useful for emerging displays and imaging technologies.

Biography

Gururaj (Guru) Naik is an assistant professor at Electrical & Computer Engineering, Rice University. Previously, he was a post-doctoral scholar in the Dionne group at Stanford University. He received an M.E. from the Indian Institute of Science, India and a PhD from Electrical & Computer Engineering, Purdue University. During his PhD, he developed new plasmonic materials for nanophotonic applications. His research interests lie in the application of nanophotonic principles for energy, imaging and health. Guru is a recipient of IEEE Photonics Society Graduate Student Fellowship, an Outstanding Graduate Research award from Purdue University and a Gold Medal from the Indian Institute of Science.