Photonics from the Macroscale to the Nanoscale: Full spectrum solar energy conversion, two-dimensional semiconductors, and optical metasurfaces

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Abstract:

Photonic materials and devices hold great potential to address pressing societal challenges related to energy use, sensing, communications, space exploration, and more. In this talk I will address three key technologies we are developing that harness light-material interactions. 1) We are building systems designed to more fully harvest the entire solar spectrum, generating both electricity and high temperature process heat for a range of commercial and industrial applications. 2) We are synthesizing novel two-dimensional semiconductor materials at wafer scale and are studying their unique properties for optoelectronic device applications. 3) We are developing low-loss and tunable optical metasurfaces featuring highly resonant nanophotonic antennas, which offer the potential for revolutionary new optical functionality by enabling light manipulation by design.

Biography:

Matthew Escarra is an assistant professor in Physics and Engineering Physics at Tulane University, where he also serves as the faculty director of the Tulane Micro/Nanofabrication Facility. He received his Ph.D. in electrical engineering at Princeton University in 2011, where he made advances in the performance of quantum cascade lasers and mid-infrared metamaterials. He also was a Ford Fellow in Science, Technology, and Environmental Policy while at Princeton. He went on to complete postdoctoral training at the California Institute of Technology in Applied Physics and Materials Science, where he developed new approaches to high efficiency solar energy conversion. He also has worked with several companies, small and large, to commercialize related technologies, including Daylight Solutions, Sentinel Photonics, and Dow Chemical. Matthew's undergraduate studies were in electrical engineering at Rice University. He is a recipient of the National Science Foundation CAREER award and the Excellence in Teaching award from the Tulane Science & Engineering Honor Society.