ASU Department of Physics
Arizona State University

COLLOQUIUM

Thursday, September 21, 2023

Refreshments at 3:15pm outside PSF 101
Colloquium from 3:30pm - 4:30pm in PSF 101

Towards Properties on Demand in Quantum Materials

Professor Richard Averitt

University of California San Diego

Abstract:

Quantum materials manifest fascinating phenomena ranging from superconductivity to metal-insulator transitions. Many of these materials exhibit colossal changes to external perturbations which includes electromagnetic excitation. This opens exciting possibilities for "on-demand" control of emergent properties using light. Following a global overview of this topic, I will present vignettes from my research group highlighting the potential of light to explore quantum materials. From equilibrium and non-equilibrium perspectives, such materials offer enormous possibilities for light-based discovery and control arising from delicate interplay between interactions and dimensionality. The terahertz region of the electromagnetic spectrum (roughly 0.1 – 20 THz) is particularly fertile with plasmonics, metamaterials, and quantum materials (and combinations thereof) being actively investigated. I will present examples from our research in this area spanning from the "simple" to complex. This includes nonlinear and tunable plasmonic disks and mushrooms, metamaterial-quantum material coupling in insulator-to-metal transition compounds and superconductors and, in a putative excitonic insulator, terahertz parametric amplification arising from coherent order parameter dynamics.

Biography:

Richard Averitt received his PhD degree in Applied Physics from Rice University in 1998 for work on the synthesis and optical characterization of gold nanoshells. Following this, he was a Los Alamos National Laboratory Director's Postdoctoral Fellow where his work focused on time resolved spectroscopy of correlated electron materials and metamaterials. In 2001, Richard became a member of the technical staff at Los Alamos, and in 2005 a member of the Center for Integrated Nanotechnologies co-located at Los Alamos and Sandia National Laboratories. In 2007, Richard joined Boston University as a faculty member in the Department of Physics and the Boston University Photonics Center. Since 2014, Richard has been with the Department of Physics at UC San Diego. Richard's current research is primarily directed towards characterizing, creating, and controlling the optical and electronic properties of metamaterials, plasmonic materials, and quantum materials using ultrafast optical spectroscopy spanning from terahertz to visible frequencies.

Host: Prof. Robert Kaindl

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