

**Thursday, November 14, 2024**

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

## **Generation of Ultrafast Terahertz Radiation Using Vectorial Optoelectronic Metasurfaces**

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### **Abstract:**

The control of electromagnetic radiation lies at the core of many modern technologies. Naturally occurring materials provide only limited electromagnetic response insufficient for emerging technologies with increasingly demanding requirements. During the past decade metamaterials have been developed to accomplish many exotic phenomena and functionalities that are otherwise difficult or impossible to realize. In this talk, I will introduce the concept of metasurfaces, two-dimensional metamaterials, and further describe our work on vectorial optoelectronic metasurfaces<sup>1</sup> in which ultrafast light pulses induce local directional charge flow around symmetry-broken plasmonic nanostructures, with tunable responses and arbitrary patterning down to subdiffractive nanometer scales. Local symmetries and vectorial currents are revealed by polarization dependent and wavelength-sensitive electrical readout and terahertz (THz) emission, whereas spatially tailored global currents are demonstrated in the direct generation of elusive broadband THz vector beams. These results set the stage for versatile patterning and optical control over nanoscale currents in materials diagnostics, THz spectroscopies, nanomagnetism and ultrafast information.

### **Biography:**

Toni Taylor is a Laboratory Associate Fellow at Los Alamos National Laboratory (LANL) and a member of the Laboratory for Ultrafast Materials and Optical and Science (LUMOS) associated with the DOE Center for Integrated Nanotechnologies (CINT). She received her B.S., M.S., and Ph.D. degrees in physics from Stanford University where she was a Hertz Foundation pre-doctoral and doctoral Fellow. She pursued postdoctoral research at Cornell University where she investigated ultrafast dynamics in materials. She then joined the staff at Bell Laboratories in the Lightwave Systems Department where she developed a robust electro-optical sampling system based on lightwave technology to characterize high-speed circuits. In 1986 she came to Los Alamos to work on the Los Alamos Bright Source, an ultrahigh intensity laser system used to investigate the light-matter interaction in the high field regime. Toni. She has served in several leadership positions, including as the CINT Director, the Leader of the Materials Physics and Applications Division, and the Deputy Associate Director for Chemistry, Life and Earth Sciences. In 2022 she retired from LANL as the Associate Laboratory Director for Physical Sciences, overseeing R&D of ~1000 researchers in physics, materials science, manufacturing science, and accelerator technologies. Her research interests include ultrafast dynamical processes in quantum and nanoscale materials, electromagnetic metamaterials, and photonics-based diagnostics. Toni is the author or co-author of 370 peer-reviewed articles and has served in professional societies and chaired international conferences in these areas. She is a Fellow of the American Physical Society, Optica, and the American Association for the Advancement of Science, as well as a LANL Fellow. Toni was awarded won the inaugural Los Alamos Fellow's Prize for Outstanding Leadership in Science and Engineering. In her spare time, Toni enjoys rock climbing, canyoneering, hiking, skiing, and mountaineering.

Host: Prof. Robert Kaindl

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