Physics Colloquium

Characterization of novel materials systems with terahertz time-domain imaging and "plasmonics"

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Since the 1990s, terahertz science has seen rapid growth in not only basic scientific fundamental advancements but also application development. The terahertz segment (0.1 – 30 THz) of the electromagnetic spectrum is worthy of such interest for several reasons. These frequencies are rich in spectroscopic signatures for a wide variety of solid, liquid, and gaseous materials. Most dielectric materials are transmissive at these frequencies. When all of this is coupled with the fact that terahertz radiation is non-ionizing and non-destructive, the possible application areas for spectroscopy and imaging span from materials characterization to biomedical imaging to security. Terahertz time-domain techniques offer a method of determining the complex frequency-dependent optoelectronic parameters of a material such as the refractive index, absorption, permittivity, or conductivity.

In this talk, I will outline how terahertz frequency light is generated and detected with a specific emphasis on ultrafast time-domain techniques. A brief overview of spectroscopy and imaging application areas will be presented. I will then focus on 2 aspects of my current work. I will show how THz imaging is being used to quantitatively assess degradation and damage in ceramic matrix composite materials as a function of historical external stresses such as heat and strain. I will then discuss computational and experimental work involving terahertz frequency plasmonics, the goal of which is to develop devices that will enhance the imaging and characterization of novel materials systems. I will conclude with a discussion of my future research and education goals.

Wednesday, December 4th, 4:00PM in SCI 10

Coffee will be served at 3:30PM in SCI 103.