THZ IMAGING USING BROADBAND DIRECT DETECTION OF PULSED THZ RADIATION

Zachary D. Taylor*[1], Shijun Sung[1], Priyamvada Tewari[1], Ioanna Kakouli[2], Jean-Pierre Hubschman[3], Sophie Deng[3], Elliott Brown[4], Warren Grundfest[1]

[1]Bioengineering, UCLA, Los Angeles, CA

[2]Archaeology, UCLA Cotsen Institute, Los Angeles, CA

[3]Ophthalmology, UCLA Jules Stein Eye Institute, Los Angeles, CA

[4]Physics/Electrical Engineering, Wright State, Dayton, OH

Research in THz imaging is currently focused on three primary application areas: medical, security, and nondestructive evaluation (NDE). While research in THz security imaging and personnel screening is populated by a number of different active and passive system architectures, medical imaging and NDE are dominated by THz time-domain systems. These systems typically employ photoconductive or electrooptic source/detector pairs and can acquire depth resolved data or spectrally resolved pixels by synchronously sampling the electric field of the transmitted/reflected wave. While time-domain is a very powerful scientific technique results reported in the literature suggest that desired THz contrast may not require the volume of data available from time-resolved/spectrally resolved measurements and that simpler techniques may be more optimal for specific applications. In this talk we discuss a direct detection system architecture operating at a center frequency of ~ 525 GHz that uses a photoconductive source and schottky diode detector pair coupled with a train of off-axis parabolic mirrors. This design takes advantage or radar-like pulse rectification and novel reflective optical design to achieve high target imaging contrast with significant potential for high speed acquisition time and scatter mitigation.

In this talk, system signal to noise ratio computations and measurements are presented and tradeoffs between acquisition time and image quality are discussed. The advantages of scatter mitigation is using this technique is elucidated. Results in spatially resolved hydration mapping and concealed target imaging for both medical and NDE applications are presented and contrast mechanism sensitivity of this technique compared to traditional THz imaging system architectures are discussed.