GENERATING THz RADIATIONS FROM GALLIUM ARSENIDE PHOTOCONDUCTIVE SWITCHES WITH OPTIMIZED PULSE AMPLITUDE

*Haitham Al Saif,* †Omar A Ibrahim and *N. E. Islam

†University of Missouri, Columbia, MO 65211

Terahertz radiations, which have a frequency range between 100 GHz and 30 THz, have applications in many fields, including nanotechnology, and photonics1. The use of femto-second laser pulses and a gallium arsenide photoconductive switch (PCSS) to generate THz radiations is well known. THz radiation waves occur when the signal generated in the substrate moves along the PCSS material (which acts as a transmission line for the signal) to reach the contacts which acts as the radiator or antenna. The PCSS based radiators characteristics are determined by the contact shape 2 and the materials properties of the substrate where charge carriers accelerate 3.

The objective of this presentation is to define a relationship between the characteristics of the substrate materials and the pulse amplitude, based on the fundamental properties of a trap filled semiconductor. Specifically, we discuss the substrate conditions for generating a pulse with maximum amplitude by linking such parameters as trap properties, recombination rate, compensation mechanisms, and the conduction of the current in a low temperature Gallium Arsenide (LT-GaAs) grown semi-insulating material4.

Maximizing pulse amplitude, which is usually desirable, will cause the received signal to noise ratio to increase nonlinearly. In communication systems, this increase would enable providers to improve the data rate by using multilevel coding in communications5. High amplitude signal is also useful in power applications. Improvement in rise time will allow maximum energy transfer to load.