# TERAHERTZ PHOTONICS FOR IMAGING AND REMOTE SENSING

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The detection of concealed weapons and explosive hidden under clothing carried by terrorists is one of the most daunting problems facing the military and the civilian law enforcement personnel. Terahertz (THz) imaging, by virtue of its ability to penetrate materials and short wavelength (high resolution) is the most promising approach to address this problem. Terahertz frequencies fall in between the optical and millimeter wave domains of the electromagnetic spectrum, and there are no readily available techniques to generate low noise, frequency agile signals as required for imaging. To exploit the inherent advantages of THz imaging significant scientific and engineering breakthroughs are needed for the generation of THz signals. The extension of microwave photonics offers an ideal avenue for THz system development. This presentation concerns the design and related research for the development of optically generated THz sources for active illumination and for local oscillator applications, including a low loss optical distribution network. The fundamental approach of the evolving THz micro-system is comprised of three critical components; an efficient, high fidelity electro-optic microchip laser, a low loss fiberoptic/integrated optic distribution network and an optical to THz (O/THz) conversion module that includes 25 radiating elements on a chip. Each O/THz module is designed to radiate 50 mW of average (CW) power at .8 THz with an overall DC to THz efficiency of 2%. The micro-system is compact, lightweight, robust and scalable. The illuminator will be able to operate either in coherent or non-coherent mode. The frequency agility of the system is designed to be 10% of the carrier (THz) signal. The phase noise of the THz signal is designed to be -90dBc/Hz or lower, which is significant for coherent detection schemes. Finally, the micro-system is flexible and can be tailored to different applications. This approach has three significantly novel elements representing scientific and technological breakthroughs. These are: i. the imaging subsystem, that provides for high performance, flexibility and future improvements, ii. the high power, single mode microchip laser that generates the tunable, clean, low noise optical signals, and iii. the traveling photodetector that converts very efficiently the photons into electrons and millimeter waves, full details of the structure will be presented at the conference.

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2. D - Electronics and Photonics

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5. No special instructions