Single pixel Terahertz imaging towards bio-medicine applications

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This talk will review the state of the art in terms of single pixel THz imaging techniques, with a particular emphasis in techniques enabled by reconfigurable semiconductor-based devices, and discuss their potential applications in the bio-medical industry. Although THz systems employing arrays of sources or detectors can achieve real time operation, in the THz range such systems can be highly complex and expensive. Moreover, the performance of detectors used in a THz focal plane array can be compromised in comparison to that of a single optimized detector. Single detectors can be easily combined with high quality collection optics which can improve the performance of the system. Single-detector THz imaging systems have recently become particularly attractive since they can benefit from the superior detection sensitivity of an optimized detector as well as the coherence of a single-point source. Though scanning imaging systems are simple to implement, their image acquisition rates are very low because of the mechanical stages used and sequential acquisition of pixels. By replacing the slow mechanical stages with an electronically reconfigurable spatial light modulator with fast switching speed it is possible to achieve real time imaging. Moreover, these systems can be reconfigured so that compressed imaging is achieved at the moment of acquisition, which can further improve the system image acquisition rates. Recent progress in metamaterial devices, devices employing new materials such as graphene, and other recently proposed systems will be discussed. Challenges, tradeoffs, and perspectives towards the application of these systems in bio-medicine will be discussed and analyzed.