Optoelectronic Terahertz Sources Based on Photomixers

Being the spectral regime between the low-frequency reaches of photonic sources (such as lasers) and high-frequency reaches of electronic sources (such as microwave tube sources), the terahertz region (0.1 – 10 THz) has long been known as the *gap region* in the electromagnetic spectrum. For astrophysics, molecular-line observation in the THz region employing heterodyne receivers is a powerful way to investigate the chemistry and physics of the interstellar medium. The Earth's high opacity in the terahertz region requires space-based platforms. Therefore, compact, low-power-consuming, and robust technology is indispensable; solid-state components are inherently most compatible with these demands. To date, space-based THz heterodyne observation's potential is far from being fully realized mainly due to source-technology limitations. The available solid-state, CW sources with enough power to serve as local oscillators (LOs) above ~1 THz are currently limited to ~10% in bandwidth and 1.6 THz in maximum frequency. Additionally, the lack of high spectral purity, frequency-agile sources hinders laboratory spectroscopy, and receiver/component characterization.

To help overcome these impediments, the Jet Propulsion Laboratory's spectroscopy group has been developing innovative photomixer sources and laser systems. First, we developed a three-diode-laser, THz-difference-frequency synthesizer to realize an accurately and widely tunable THz spectrometer with high spectral purity. Moreover, we have developed a photomixer using a novel traveling-wave design that demonstrated an untra-wide-band output, up to 2 THz. This seminar will provide a brief overview of these developments at JPL. In addition, a brief survey of recently reported advances in terahertz photomixer technology and applications will be presented.