GENERATION OF TUNABLE TERAHERTZ RADIATION USING STABILIZED DIODE LASERS

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Far infrared (FIR) studies are expected to be of great importance for identifying compounds in the interstellar medium. In addition to complex rotational spectra in the millimeter-wave region, many organic molecules also have low-lying, large amplitude vibrational bands in the much less densely populated FIR region. Both SOFIA and Herschel will provide excellent platforms for accessing interstellar THz radiation; however, in order for the results to be useful the spectra of targeted molecules need to be first characterized in a lab-based setting, which we are attempting with a new Fourier transform terahertz spectrometer.We propose a terahertz radiation source for this spectrometer based on beat note generation using an ultrahigh-speed photomixer (ErAs/InGaAs composite) and two sources of near infrared radiation derived from diode lasers operating around 1550 nm. We further propose two methods for frequency stabilizing the diode lasers to $\leq$ 3 MHz using frequency modulation spectroscopy, while still maintaining wide tunability in at least one of the lasers. This will allow for the generation of stable, $\leq$ 5 MHz linewidth radiation that is tunable from gigahertz to terahertz frequencies. Both of these setups have one widely tunable distributed-feedback laser that is locked to a transition in mono-deuterated water (HDO) using a PID feedback loop; this is one of the two IR sources. We can generate the other IR source in one of two ways: beat note locking between two diode lasers (one stabilized to a different HDO line) or generating a frequency modulated sideband with a broadband electro-optic modulator and then locking the sideband to the HDO line. These locking schemes provide 40-80 GHz of narrow-range tunability, which is then coupled with the rough tunability obtained by choosing different HDO lines to give broad range tunability. We will discuss the advantages and disadvantages to each approach as well as current progress implementing them.