DISCOVERY AND FREQUENCY MEASUREMENT OF SHORT-WAVELENGTH FAR-INFRARED LASER EMISSIONS: A REVIEW

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An optically pumped molecular laser system has been used to discover short-wavelength ($\lambda < 150\,\mu$m) far-infrared (FIR) laser emissions. With this system, fifty-five FIR laser emissions, having wavelengths ranging from 26.3 to 185.0 μm, were discovered from hydrazine (N_2H_4) and several isotopic forms of methanol (CD_3OH, $^{13}CH_3OH$, $^{13}CD_3OD$, CH_2DOH, CHD_2OH, CH_3OD and $^{13}CD_3OH$). Once discovered, the three-laser heterodyne technique was used to measure the frequencies of these laser emissions. Recently, several improvements were made to the experimental heterodyne system that have resulted in an increase in the spectral range used to search for the beat between the known and unknown laser frequencies (an increase of up to 25 GHz) as well as an increase in the system's sensitivity (by up to a factor of 30), all without requiring the use of an additional microwave frequency source. Along with an overview of the experimental systems, a review of the FIR laser emissions that have been discovered and measured will be presented.

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