APPLICATION OF CASCADED FREQUENCY MULTIPLICATION TO MOLECULAR SPECTROSCOPY

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Molecular spectroscopy in the laboratory supports atmospheric, planetary and astrophysical sciences through quantitative, high precision, spectral measurements. Atomic and molecular signatures across the electromagnetic spectrum identified in the laboratory can then be studied remotely using telescopes, radiometers, etc. The THz frequency spectrum is relatively unexplored, mainly due to atmospheric absorption and technological hurdles. Recent advances in the development of local oscillators for HIFI onboard the Herschel Space Observatory are now proven to be useful in the field of molecular spectroscopy. These oscillators consist of cascaded planar-diode frequency doublers and triplers pumped with an amplified millimeter wavelength source. Coupled with a low-noise frequency synthesizer, sensitive detector and lock-in-amplifier these devices can be utilized for routine submillimeter spectroscopic measurements. The resulting spectrometer provides higher precision measurements than the FT-FIR techniques in many laboratories and has simpler design and functionality than the BWO techniques. Ultimately the spectrometer will be highly useful for extension of the millimeter and submillimeter molecular transition database into the THz region.