AN INFRARED HETERODYNE SPECTROMETER WITH A TUNABLE DIODE LASER AS LOCAL OSCILLATOR

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A new mid-infrared heterodyne spectrometer, which is intended to be applied for atmospheric and astrophysical studies, is presented. The spectrometer uses a frequency stabilized Tunable Diode Laser (TDL) as local oscillator, which allows to detect any molecular species within the frequency range of IR-TDLs.

Due to the low output power of available single mode diode lasers, a newly developed infrared diplexer is used to efficiently superimpose the signal and the local oscillator. Additionally, the diplexer serves as optical filter that establishes controlled optical feedback between the laser diode and the detector. This allows stable laser operation with line widths in the order of 1 MHz.

The heterodyne signal from the HgCdTe detector is analyzed by means of a 2000 channel, acousto optical spectrometer with a resolution of about 1 MHz and a total bandwidth of 1.4 GHz.

With this setup we find system temperatures as low as 5000K, that is within a factor 4 of the quantum limit. The system is currently used in the 10 micron region but will be extended to other wavelengths in the near future.