MILLIMETER WAVE SPECTROSCOPY IN A SEMI-CONFOCAL FABRY-PEROT CAVITY

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A new generation of CMOS circuits operating at 89-104 GHz with improved output power and pulse switch isolation have enhanced the performance of the miniaturized pulsed-echo Fourier transform spectrometer under development for planetary exploration at the Jet Propulsion laboratory. Additional progress has been made by creating a waveguide-fed structure for the novel planar coupler design. This structure has enabled characterization of each component in the system and enabled spectroscopy to be done with conventional millimeter hardware that enables (1) direct comparisons to the CMOS components, (2) enhanced bandwidth of 74-109 GHz, and (3) amplification of the transmitter prior to cavity injection. We have now demonstrated the technique with room temperature detections on multiple species including N_2O, OCS, CH_3CN, CH_3OH, CH_3NH_2, CH_3CHO, CH_3Cl, HDO, D_2O, CH_3CH_2CN and CH_3CH_2OH. Of particular interest to spectroscopic work in the millimeter range is the ongoing incorporation of a $\Delta\Sigma$ radio-frequency source into the millimeter-wave lock-loop - this has improved the phase-noise of the tunable CMOS transceiver to better than the room-temperature Doppler limit and provides a promising source for general use that may replace the high end microwave synthesizers. We are in the process of building a functional interface to the various subsystems. We will present a trade-space study to determine the optimal operating conditions of the pulse-echo system.