HIGH PRECISION MID-IR SPECTROSCOPY OF $^{12}C^{16}O_2$ NEAR 2.7 μm

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We have observed the sub-Doppler saturation spectrum of the $^{12}C^{16}O_2$ $[10^01,\ 02^01]_I \leftarrow 00^00$ band transitions near 2.7 μm using a mW-level DFG (Difference Frequency Generation) source. The DFG radiation is generated by a Ti:sapphire laser and a Nd:YAG laser amplified by a 10-W fiber amplifier in a 44-mm long PPLN (Periodically-Poled Lithium Niobate) crystal. We are able to generate 5 mW DFG power at 2.7 μm. The saturation spectrum is observed by monitoring the saturated 4.3 μm fluorescence using a conventional saturation spectroscopy arrangement. To increase the signal a 20-cm longitudinal cell having gold coating inside is used to collect the 4.3 μm fluorescence. This method provides zero background and better signal-to-noise ratio. It also eliminates the interference fringes completely. To measure the center frequency of a 2.7 μm transition, the Nd:YAG laser is frequency-doubled and frequency stabilized on one $^{127}I_2$ hyperfine transition. The Ti:sapphire laser is locked onto the center of the spectrum of the transition and its frequency is measured by an OFC (Optical Frequency Comb). In this talk, we will report our new measurements about this band and also the molecular constants obtained.