12CO2 TRANSITION FREQUENCIES WITH KHZ-ACCURACY BY SATURATION SPECTROSCOPY IN THE 1.99-2.09 MICRON REGION

H. FLEURBAYE, C. CAMPARGUE, S. KASSI, D. ROMANINI, D. MONDELAIN, *Univ. Grenoble Alpes, CNRS, LIPhy, 38000 Grenoble, France*; **P. ČERMÁK**, *Department of Experimental Physics, Faculty of Mathematics, Physics and Informatics, Comenius University, Mlynská Dolina, 842 48 Bratislava, Slovakia*; **O. VOTAVA**, *J. Heyrovský Institute of Physical Chemistry, ASCR, Dolejkova 3, Prague 8, Czech Republic*

Saturation spectroscopy has been used to determine absolute frequencies of 107 ro-vibrational transitions of the two strongest $^{12}CO_2$ bands of the 2 μm region. The considered 20012-00001 and 20013-00001 bands are of importance for the CO_2 monitoring in our atmosphere. Lamb dips were measured using a cavity ring-down spectrometer linked to an optical frequency comb referenced to a GPS-disciplined Rb oscillator or to an ultra-stable optical frequency. The comb-coherence transfer (CCT) technique was applied to obtain a RF tunable narrow-line laser comb-disciplined source using an external cavity diode laser and a simple electro-optic modulator. This setup allows obtaining transition frequency measurements with kHz-level accuracy. The resulting accurate values of the energy levels of the 20012 and 20013 vibrational states are reproduced with a (1s)-rms of about 1 kHz using the standard polynomial model. The two upper vibrational states appear thus to be highly isolated except for a local perturbation of the 20012 state leading to an energy shift of 15 kHz at J= 43. A recommended list of 145 transition frequencies with kHz accuracy is obtained providing secondary frequency standards across the 1.99-2.09 μm range. The reported frequencies will be valuable to constrain the zero-pressure frequencies of the considered transitions in $^{12}CO_2$ retrieval from atmospheric spectra.

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