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An International Journal at the Interface Between Chemistry and Physics

Volume 111, 2013 - Issue 14-15: Dedicated to Martin Quack on the Occasion of his 65th Birthday

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Invited Article

# Absolute frequency measurements of CO<sub>2</sub> transitions at 4.3 μm with a comb-referenced quantum cascade laser

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Pages 2041-2045 | Received 15 Jan 2013, Accepted 27 Feb 2013, Accepted author version posted online: 06 Mar 2013, Published online: 03 Apr 2013

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## Abstract

The infrared spectrum of the (01<sup>1</sup>1-01<sup>1</sup>0) ro-vibrational band of <sup>12</sup>C<sup>16</sup>O<sub>2</sub> in the range 2306-2312 cm<sup>-1</sup> is investigated with saturated-absorption sub-Doppler spectroscopy. The absolute frequencies of six transitions belonging to the P-branch of this band are measured by recording their Lamb-dip features in a pump-probe detection scheme employing a room-temperature quantum cascade laser. The laser is phase-locked to a subkilohertz-linewidth difference-frequency-generated radiation source, which is referenced to an optical frequency comb synthesiser. The achieved relative uncertainties range from  $1 \times 10^{-11}$  to  $5 \times 10^{-11}$ , improving by three to four orders of magnitude the previous tabulated values for such frequencies. Moreover, thanks to this precision level, self-pressure-shift coefficients due to collisional processes of CO<sub>2</sub> molecules are reported for the first time.

Keywords:

## Acknowledgements

We wish to thank Prof. Gianfranco Di Lonardo for his valuable help in finding the most accurate calculated frequencies of our observed transitions. This work was financially supported by Ente Cassa di Risparmio di Firenze, by the Laserlab-Europe Consortium in the ALADIN project framework, by the Extreme Light Infrastructure (ELI) European project and by the Progetto Operativo Nazionale (PON) PON01\_01525 'MONitoraggio Innovativo per le Coste e l'Ambiente marino' (MONICA) funded by the Italian Ministry of Education, University and Research (MIUR).

## Notes

aComparison with the HITRAN database [3-4]. The uncertainty reported by the original database for each transition is between 3 and 30 MHz.

bComparison with Ref. [29], corrected by the calibration factor 0.999 999 817, as reported in table 3 of Ref. [30].

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