



Molecular Physics >

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](#)

300 | 25

Views | CrossRef citations to date | Altmetric | 0

Invited Article

Absolute frequency measurements of CO₂ transitions at 4.3 μm with a comb-referenced quantum cascade laser

Iacopo Galli, Saverio Bartalini, Pablo Cancio Pastor, Francesco Cappelli, Giovanni Giusfredi, Davide Mazzotti, ...show all

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

Cite this article <https://doi.org/10.1080/00268976.2013.782436>

Sample our
Mathematics & Statistics
Journals
>> [Sign in here](#) to start your access
to the latest two volumes for 14 days

Full Article

Figures & data

References

Citations

Metrics

Reprints & Permissions

Read this article

Share

Abstract

The infrared spectrum of the (01¹1-01¹0) ro-vibrational band of ¹²C¹⁶O₂ in the range 2306–2312 cm⁻¹ 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 1×10⁻¹¹ to 5×10⁻¹¹, 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 CO₂ molecules are reported for the first time.

Keywords:

carbon dioxide

saturated-absorption spectroscopy

Lamb dip

quantum cascade laser

optical frequency comb

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].

Related research

People also read

Recommended articles

Cited by
25

Information for

[Authors](#)

[R&D professionals](#)

[Editors](#)

[Librarians](#)

[Societies](#)

Opportunities

[Reprints and e-prints](#)

[Advertising solutions](#)

[Accelerated publication](#)

[Corporate access solutions](#)

Open access

[Overview](#)

[Open journals](#)

[Open Select](#)

[Dove Medical Press](#)

[F1000Research](#)

Help and information

[Help and contact](#)

[Newsroom](#)

[All journals](#)

[Books](#)

Keep up to date

Register to receive personalised research and resources by email



Sign me up



Copyright © 2026 Informa UK Limited [Privacy policy](#)

[Cookies](#) [Terms & conditions](#) [Accessibility](#)

Registered in England & Wales No. 01072954
5 Howick Place | London | SW1P 1WG

 Taylor and Francis
Group