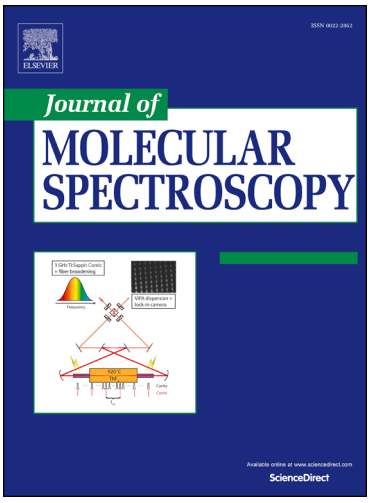


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**Title**

# High-resolution Fourier transform measurements of air-induced broadening and shift coefficients in the $00^{0}2$-$00^{0}0$ main isotopologue band of nitrous oxide

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## Abstract

In the present study, we report highly accurate air-induced broadening and shift coefficients for the nitrous oxide ($N_2O$) $00^{0}2$-$00^{0}0$ band at 2.26 µm of the main isotopologue retrieved from high-resolution Fourier transform infrared (FTIR) measurements with metrologically determined pressure, temperature, absorption path length and chemical composition. Most of our retrieved air-broadening coefficients agree with previously generated datasets within the expanded (confidence interval of 95 %) uncertainties. For the air-shift coefficients our results suggest a different rotational dependence compared to literature. The present study benefits from improved measurement conditions and a detailed metrological uncertainty description. Comparing to literature, the uncertainties of the previous broadening and shift coefficients are improved by a factor of up to 39 and up to 22, respectively.

## Keywords

Nitrous oxide, Fourier transform infrared spectroscopy, spectral line parameters, air-broadening, air-shift, gas metrology

## 1. Introduction

In our recent studies, we have determined self-induced broadening and shift coefficients [1] as well as line strengths [2] for the $R_0$ to $R_{40}$ lines of the $00^{0}2$-$00^{0}0$-band of the main isotopologue of nitrous oxide ($^{14}N_2{}^{16}O$) using the Voigt-line shape model. The examined band of this greenhouse and major ozone-depleting gas is used by the Total Carbon Column Observing Network (TCCON) [3] to monitor its atmospheric abundance. For its retrievals TCCON utilizes [4] spectral line parameters for the Voigt-profile from the HITRAN-database [5]. The HITRAN line data for air-induced broadening and shift coefficients are based on an extensive FTIR spectroscopy laboratory study of Toth [6] with a nominal spectral resolution of 0.011 $cm^{-1}$ performed over a partial pressure range of air between 389 hPa and 655 hPa.