

## HIGH-RESOLUTION ANALYSIS OF THE 83.3 $\mu\text{m}$ TORSIONAL BANDS OF THE $\text{ClONO}_2$ MOLECULE

F. KWABIA TCHANA, ANUSANTH ANANTHARAJAH, JEAN-MARIE FLAUD, *CNRS - Université de Paris - Université Paris Est Créteil, LISA, Créteil, France*; LAURENT MANCERON, *Synchrotron SOLEIL, CNRS-MONARIS UMR 8233 and Beamline AILES, Saint Aubin, France*; JOHANNES ORPHAL, *Karlsruhe Institute of Technology, IMK, Eggenstein-Leopoldshafen, Germany*.

Chlorine nitrate ( $\text{ClONO}_2$ ) is a very important atmospheric "reservoir" of  $\text{ClO}$  and  $\text{NO}_2$ , destroying stratospheric ozone through catalytic cycles<sup>a</sup>. It was detected for the first time by infrared (IR) spectroscopy<sup>b</sup>, a detection confirmed and extended by the MIPAS<sup>c</sup> and the ATMOS satellite experiments<sup>d</sup>. Many high-resolution microwave and mid-IR spectroscopy studies of  $\text{ClONO}_2$  have been published<sup>e</sup>. However,  $\text{ClONO}_2$  presents 4 fundamentals in the far-IR region below  $600\text{ cm}^{-1}$ , with the lowest one corresponding to the torsional mode  $\nu_9$  around  $83.3\ \mu\text{m}$ . This band has been observed at low resolution<sup>f</sup> but without precise determination of the band center. More recently, the analysis of the mid-IR  $\nu_8$  and  $\nu_8 + \nu_9$  band spectral regions of  $^{35}\text{ClONO}_2$  allowed the indirect but accurate determination of the  $\nu_9$  band center<sup>g</sup>.

In this work, the  $83.3\ \mu\text{m}$  region of  $\text{ClONO}_2$  has been recorded at high resolution ( $0.001\text{ cm}^{-1}$ ) using a Fourier transform spectrometer and the SOLEIL synchrotron light source. The spectrum corresponds to the absorption of the torsional mode,  $\nu_9$  around  $123\text{ cm}^{-1}$  and a series of  $n\nu_9 - (n-1)\nu_9$  hot bands. In this talk, the analysis of the  $\nu_9$  bands of  $^{35}\text{ClONO}_2$  and  $^{37}\text{ClONO}_2$  and  $2\nu_9 - \nu_9$  band of  $^{35}\text{ClONO}_2$  will be presented. In turn, this will enable an analysis of the hot bands involving low energy levels in the mid-IR region where  $\text{ClONO}_2$  is detected and modelled.

---

<sup>a</sup>P. J. Crutzen, *Quart. J. Royal Met. Soc.* **96**, 320 (1970); M. J. Molina and F. S. Rowland, *Nature* **249**, 810 (1974).

<sup>b</sup>D. G. Murcray *et al.*, *Geophys. Res. Lett.* **6**, 857 (1979).

<sup>c</sup>H. Fischer *et al.*, *Atmos. Chem. Phys.* **8**, 2151 (2008).

<sup>d</sup>R. Zander *et al.*, *Geophys. Res. Lett.* **13**, 757 (1986).

<sup>e</sup>J. Orphal, M. Birk, G. Wagner, and J.-M. Flaud, *Chem. Phys. Lett.* **690**, 82 (2017).

<sup>f</sup>J. W. Fleming, *Infrared Phys.* **18**, 791 (1978); K. V. Chance and W. A. Traub, *J. Mol. Spectrosc.* **95**, 306 (1982).

<sup>g</sup>J.-M. Flaud, W. J. Lafferty, J. Orphal, M. Birk, and G. Wagner, *Mol. Phys.* **101**, 1527 (2003).