CONSTRUCTION AND PRELIMINARY RESULTS OF A KU-BAND CHIRPED-PULSE MICROWAVE FOURIER TRANSFORM SPECTROMETER

S. COLLIGNON, *Institute of Condensed Matter and Nanosciences, Université catholique de Louvain, Louvain-la-Neuve, B-1348, Belgium*; **B. M. HAYS**, *Université de Lille, CNRS, UMR8523—PhLAM—Physique des Lasers Atomes et Molécules, F-59000 Lille, France*; **D. LEDERER**, *Institute of Information and Communication Technologies, Electronics and Applied Mathematics, Université catholique de Louvain, Louvain-la-Neuve, B-1348, Belgium*; **M. DAMAN, C. LAUZIN**, *Institute of Condensed Matter and Nanosciences, Université catholique de Louvain, Louvain-la-Neuve, B-1348, Belgium*

The chirped-pulse Fourier transform microwave (CP-FTMW) spectroscopy technique is an efficient tool for the rapid measurement of broadband rotational spectra [1]. Fast, state-of-the-art arbitrary waveform generators (AWG) and oscilloscopes are usually required for CP-FTMW spectrometers to induce and detect the free induction decay (FID) in a gas of molecules.

Alternatively, the CP-FTMW spectrometer currently developed at UCLouvain makes use of a 2.5 GSa/s direct digital synthesizer in place of an AWG, following the work of Ref. [2]. It also leverages heterodyne detection to allow the acquisition of the FIDs with a 1 GSa/s oscilloscope. A quadrature demodulation technique is implemented to discriminate between the lower and upper sidebands of the probed frequency range [3]. A computer program was developed to automate the scan of the Ku-band (12−18 GHz) and remove the spurious content from the spectra.

Methanol spectra have been measured in the Ku-band to assess the performances of the spectrometer. The methanol sample was first studied at room temperature in a waveguide cell. The 12−18 GHz frequency range was covered by concatenation of multiple 500 MHz sub-spectra, all acquired and averaged 10^5 times in $\sim$ 13 minutes. In this configuration, the acquisition rate, precision and sensitivity of the instrument were evaluated. Based on Ref. [4], we fitted the FID in the time domain and extracted the resonant frequency and the T_2 coherence time. First measurements performed in a supersonic expansion will also be presented.

[1] doi:10.1063/1.2919120, G. G. Brown et al., *Rev. Sci. Instrum.*, **79**, 053103 (2008).

[2] doi:10.1063/1.4818137, I. A. Finneran et al., *Rev. Sci. Instrum.*, **84**, 083104 (2013).

[3] doi:10.1039/C1CP22197C, J.-U. Grabow et al., *Phys. Chem. Chem. Phys.*, **13**, 21063-21069 (2011).

[4] doi:10.1016/j.jqsrt.2020.107001, B. M. Hays et al., *J. Quant. Spectrosc. Radiat. Transf.*, **250**, 107001 (2020).