A new low temperature long-pass cell for mid-IR to THz spectroscopy at LISA and AILES beamline at SOLEIL

F. Kwabia Tchana[a], L. Manceron[b,c], Fabrice Willaert[a], Leatitia Lago[d], Mylène Chapuis[c], Xavier Landsheere[a], P. Roy[c], J.-M. Flaud[a]

[a] Laboratoire Interuniversitaire des Systèmes Atmosphériques, CNRS UMR 7583, Université Paris-Est Créteil et Université Paris Diderot, 61 Avenue du Général de Gaulle, 94010 Créteil Cedex, France, Tel.: +33 11 45 17 15 29, E-mail: fridolin.kwabia@lisa.u-pec.fr
[b] Laboratoire de Dynamique, Interactions et Réactivité, CNRS UMR 7075, 4 Place Jussieu, F-75252 Paris Cedex, France,
Tel.: +33 1 69 35 97 41, E-mail: laurent.manceron@synchrotron-soleil.fr
[c] Ligne AILES -- Synchrotron SOLEIL, L'Orme des Merisiers, F-91192 Gif-sur-Yvette, France,
Tel.: +33 1 69 35 96 57, E-mail: pascale.roy@synchrotron-soleil.fr

[d] Groupe Vide -- Synchrotron SOLEIL, L'Orme des Merisiers, F-91192 Gif-sur-Yvette, France,
Tel.: +33 1 69 35 91 64, E-mail: leatitia.lago@synchrotron-soleil.fr

In this poster we present the details and performances of the new LISA-SOLEIL cryocell, specially designed for accurate spectroscopic measurements in the 80 to 400 K temperature range with variable path lengths from 3 to more than 140 m. The spectral coverage at these temperatures ranges from the visible to less than 10 cm^{-1}, thanks to the use of diamond windows. The design of the cryostat and vacuum set-ups allows vibration-free operation. The equipment provides temperature homogeneity and pressure control to better than 2 % over the 100 to 400 K and the 0.1 to 1000 mbar ranges. Remote-controlled opto-mechanical systems enable in situ adjustments as well as changes of the optical path length within half an hour: This allows optimizing measurement time in an open user facility.

The new cell has been optically optimised for a Bruker IFS125 high resolution spectrometer. It will be used to:

- study unstable species that decompose rapidly at room temperature;
- reduce the density of lines in the spectra of heavier molecules (such as small organic molecules with very low vibration energies);
- study the temperature dependence of pressure-broadening coefficients (indispensable for the analysis of atmospheric spectra).

Finally it is worth noticing that this cell meets the specific requirements of high resolution measurements on the Far-Infrared (FIR) AILES beamline at SOLEIL as well as at the LISA facility, in Créteil, in the mid-IR. This new instrument opens up the way for many experiments in the field of high-resolution gas-phase IR spectroscopy, in particular in quantitative spectroscopy for atmospheric applications: measurements of absorption line parameters (position, absolute intensity, cross section, pressure shift, and pressure-broadening).

The design of the equipment will be briefly presented and illustrated with spectroscopic examples (C_3H_8, SF_6 and CF_4). using Fourier transform spectroscopy.