ULTRA-HIGH RESOLUTION SYNCHROTRON-BASED VUV SPECTROSCOPY USING A NEW FOURIER TRANSFORM SPECTROMETER: FIRST APPLICATION TO THE ABSORPTION SPECTRA OF THE RARE GASES.

MOURAD ROUDJANE, NELSON DE OLIVEIRA, LAURENT NAHON, *Synchrotron SOLEIL, L'orme des Merisiers, St. Aubin Bp 48, 91192 Gif sur Yvette Cedex, France..*

A newly-developped Fourier Transform spectrometer (FTS), based upon a wave-front division interferometer, has recently been connected to the VUV beamline DESIRS on the French synchrotron facility SOLEIL. This instrument, unique in the world, using the pseudo-white coherent background continuum of an undulator, allows to perform ultra-high resolution absorption spectroscopy in the 140 - 40 nm spectral range[ab], with a theoretical resolving power reaching 1000 000 over the full range. With the intrinsic multiplex capability of FTS over a wide spectral range (typically 5 % of the central wavelength) it should be a unique tool for the study of high lying electronic states of small diluted matter samples, in particular of atmospheric and astrophysical interest.
As a first application and performance test of this new spectrometer, we have re-investigated at ultra-high resolving power ($\approx$ 700 000) the VUV absorption spectrum of Ne, Ar, Kr and Xe rare gases involving Rydberg series in the spectral range [54-104] nm, using a windowless room-temperature absorption cell.
The comparison of our first results with previous data for these rare gases[cdef] led to the identification of several new transitions between the ground state and the five Rydberg *ns*,*ns'* and *nd*,*nd'* series and to a refined determination of the autoionization parameters of the *ns'* and *nd'* series.

[a] De Oliveira, N.;Joyeux, D.; Phalippou, D.; Rodier, J.C.; Nahon, L.; Polack,F.,(to be published).
[b] De Oliveira, N.; Joyeux, D.; Phalippou, D.; Rodier, J.C.; Nahon, L.; Polack,F.; Vervloët, M. AIP Conference Proceedings, Vol **879**, pp. 447-450 (2007).
[c] K. Ito, K. Ueda, T. Namioka, K. Yoshino and Y. Morioka, J. Opt. Soc. Am. **B5**, 10 (1988).
[d] K. Yoshino. J. Opt. Soc. Am. **65**, 9 (1970).
[e] L. Minnhagen, J. Opt. Soc. Am. **63**, 1185 (1973).
[f] E. B. Saloman, Phys. Chem. Ref. Data., **33**. 33 (2004).