A newly-developed 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 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 (~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 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.