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TEMPERATURE DEPENDENCY OF CO2 AND H2O ABSORPTION CROSS SECTIONS IN THE VUV: IMPLICATIONS FOR THERMO-PHOTOCHEMISTRY OF HOT JUPITERS

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The evolution of observational techniques opened the way to the study of other planetary systems. One of the main breakthroughs in the recent years has been the possibility to observe the atmosphere of extrasolar planets which gives us the opportunity to get some clues about their origin and evolution. The first exoplanets from which we can study the atmosphere are Hot Jupiters orbiting close to their parent stars. Their atmospheric temperature can reach 700 to 2000 K and their irradiating photon flux can be 10,000 times more intense than the one at Jupiter. In order to understand the evolution of the composition of their atmosphere, we have developed thermo-photochemical models taking into account phodissociation processes, high temperature chemistry and transport. One of the main uncertainties in those models is the variations of the absorption cross sections of molecules with temperature. This could influence the radiative transfer inside the atmosphere which in turn governs the available actinic flux at each altitude and thus the dissociation processes. We have developed a new experiment in order to measure the absorption cross sections of molecule of interest, in physical conditions as close as possible of the studied environment. We used a 1.4 m Kantal (FeCrAl) cell in an oven placed in front of a VUV synchrotron beamline. We measured for the first time the variation of the

CO_2 and H_2O absorption cross section between 115 and 200 nm at temperatures between 300 and 750 K. The behavior of both molecules is very different. We observed that CO_2 absorption increases rapidly with increasing temperature above 180 nm while H_2O show little variations. We will present our latest results obtained CO_2 and H_2O absorption cross sections. Those will be compared with previous measurements made in combustion studies above 200 nm and above 1000 K (Schulz et al., 2002 ; Oehlschlaeger et al., 2004 ; Jeffries et al., 2005). We will also show the latest results obtained with our atmospheric models integrating those experimental studies.

References: C. Schulz, J. Koch, D. Davidson, J. Jeffries, R. Hanson. Chemical Physics Letters 355 (2002) 82–88 M. Oehlschlaeger, D. Davidson, J. Jeffries, R. K. Hanson. Chemical Physics Letters 399 (2004) 490–495 J. Jeffries, C. Schulz, D. Mattisona, M. Oehlschlaeger, W.G. Bessler, T. Lee, D.F. Davidson, R.K. Hanson. Proceedings of the Combustion Institute 30 (2005) 1591–1599