Thermal dependency of CO2 VUV absorption cross section and application to warm exoplanetary atmospheres

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Abstract

Most of exoplanets detected so far have atmospheric temperatures significantly higher than 300 K. These exoplanets are often close to their star and thus receive an intense UV photons flux, triggering important photodissociation processes. However, the temperature dependency of VUV absorption cross sections, which are essential data to model photolyses in atmospheric models, are barely known. Thus, by lack of appropriate data, absorption cross sections at room temperature are used in photochemical models of extrasolar planets, leading to a non-measurable uncertainty. With the future space- or ground-based telescopes that will be developed in the coming years (JWST, E- ELT...) investigating these research fields becomes urgent [1].
In this context, we quantified the temperature dependency of the VUV absorption cross section of carbon dioxide (CO_2). We performed experimental measurements on the range (115-230 nm) between 150 and 800 K. The absorption cross section of CO_2 increases with the temperature (Fig. 1). At 200 nm, there are more than four orders of magnitude between the one at 300 K and the one at 800 K. We also determined a parametrisation to calculate the continuum of the absorption cross section on this wavelength range. We used these new data in our photo-thermochemical model for exoplanets [2] and studied the impact on the results (photolyses rates and chemical composition) as well as on the observables (synthetic transmission spectra) [3, 4]. We will present these experimental results and their consequences on the modelling of exoplanet atmospheres.

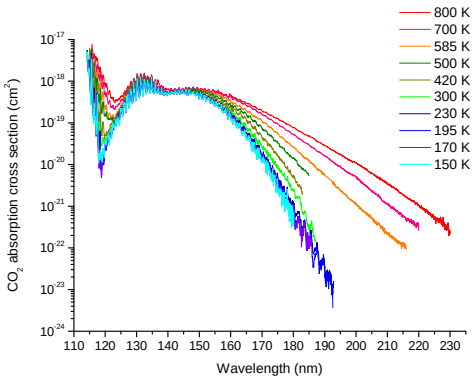

Figure 1: Absorption cross section of CO_2 (cm^2) at temperature between 150 and 800 K.

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