HIGH-TEMPERATURE SPECTROSCOPIC DATA FOR EXO-PLANETARY STUDIES: THE e-PYTHEAS PROJECT

VINCENT BOUDON, *Laboratoire ICB, CNRS/Université de Bourgogne, DIJON, France*; ATHENA COUSTENIS, *LESIA, Observatoire de Paris / CNRS / UPMC, Meudon, France*; ALAIN CAMPARGUE, *UMR5588 LIPhy, Université Grenoble Alpes/CNRS, Saint Martin d'Hères, France*; ROBERT GEORGES, *IPR UMR6251, CNRS - Université Rennes 1, Rennes, France*; VLADIMIR TYUTEREV, *Laboratoire GSMA, CNRS / Université de Reims Champagne-Ardenne, REIMS, France*.

The e-PYTHEAS project combines theoretical and experimental work with exoplanet modelling applications. Our approach is to use theoretical research validated by laboratory experiments and to then inject it into models of the atmospheres of the giant gaseous planets in the solar system and other planetary systems. Our consortium of five French laboratories and associated partners proposes to improve the existing high-temperature spectroscopy data for several molecular species detected in exoplanets. More in detail, the goals are to: (1) Generate experimental and synthetic spectra in the 1–17 μm wavelength region for hydrocarbons and their isotopologues such as $^{12}CH_4$, $^{13}CH_4$, CH_3D, C_2H_2, C_2H_4 and C_2H_6 up to 2500 K. (2) Produce complete line lists without the current limitations in frequency and temperature ranges. (3) Record new absorption and emission spectra at high temperature by unique techniques developed by IPR, LIPhy and GSMA. (4) Produce global *ab initio* spectra predictions. (5) Validate and empirically correct them using spectra measurements. (6) Use the generated spectroscopic data to enhance the output of radiative transfer codes and improve our understanding of the processes involved in hot gaseous environments thanks to the analysis of a large amount of observations. (7) Determine the role of the target species on the thermal structure of hot exoplanets and hence to a new understanding of the origin and evolution of exoplanetary atmospheres. The results will help to analyze data and address essential questions on the formation and evolution of planetary systems, such as retrieved by ESA's M4 space mission ARIEL in 2029. See the project's website: `http://e-pytheas.cnrs.fr`