

# SEMINARIO

Sala Consiglio - Martedì 17 Maggio, ore 11:00

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## Spectroscopy of the rare $^{12}\text{C}^{17}\text{O}$ and $^{13}\text{C}^{17}\text{O}$ isotopologues and deperturbation analysis of the $A^1\Pi$ state

Carbon monoxide is the second most abundant molecular species in the Universe. CO is used as a physicochemical benchmark in many astronomical environments, such as: interstellar clouds, circumstellar discs, as well as planetary and exoplanetary atmospheres. It has become crucial to obtain precise values of the molecular parameters of various CO isotopologues, as they facilitate study of the chemical evolution of low-mass star formation and solar nebula and protoplanetary discs as well as planetary nebulae. The research of  $^{12}\text{C}^{17}\text{O}$  and  $^{13}\text{C}^{17}\text{O}$  is of significant importance for inter alia explanation of the so-called *depth optical effect* in interstellar absorption as well as for precise determination of the  $^{12}\text{C}/^{13}\text{C}$  and  $^{16}\text{O}/^{17}\text{O}/^{18}\text{O}$  ratios, which are used, among others, to determine relationship between the processes of stellar nucleosynthesis of the first and second generation [1]. From a pure spectroscopy perspective, the CO molecule is a benchmark species for the investigation of perturbations in the spectroscopy of diatomic molecules. In particular the energy level structure of the first excited singlet state of CO, i.e.  $A^1\Pi$ , exhibits a wealth of perturbations in all CO isotopologues.

In the framework of this lecture I would like to present the first investigations of the VIS Ångström ( $B^1\Sigma^+ - A^1\Pi$ ) and Herzberg ( $C^1\Sigma^+ - A^1\Pi$ ) systems as well as VUV Hopfield-Birge ( $B^1\Sigma^+ - X^1\Sigma^+$ ,  $C^1\Sigma^+ - X^1\Sigma^+$ ) systems in the rare  $^{12}\text{C}^{17}\text{O}$  and  $^{13}\text{C}^{17}\text{O}$  isotopologues by means of the high-resolution methods of high-precision optical dispersion spectroscopy (HADOS, Rzeszów) as well as Fourier-transform spectroscopy of VIS region (Bruker 125 HR spectrometer, Rzeszów) and VUV region (SOLEIL synchrotron, St. Aubin, France). The first deperturbation analysis of the unique  $A^1\Pi$  state in  $^{12}\text{C}^{17}\text{O}$  and  $^{13}\text{C}^{17}\text{O}$  will be also presented [2, 3].

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[1] F. Bensch, I. Park, J. G. A. Wouterloot, G. Klapper and G. Winnewisser, *ApJ*, **562**, L185 (2001).

[2] R. Hakalla i in. *RSC Adv.* **6**, 31588-31606 (2016).

[3] R. Hakalla i in. *J. Quant. Spectrosc. Radiat. Transfer*, **189**, 312–328 (2017).