SEARCHING NEW MOLECULES IN THE ISM BY ROTATIONAL SPECTROSCOPY: ANALYSIS OF INDOLE

C. BERMUDEZ, C. CALABRESE, A. LESARRI , *Dpo. Química Física y Química Inorgánica, Facultad de Ciencias - I.U. CINQUIMA, Universidad de Valladolid, Paseo de Belén 7, Valladolid 47011, Spain.*

Most of the chemical species identified in the interstellar medium (ISM) or circumstellar envelopes (CSE), about 290 species, have been detected by rotational spectroscopy. Earth observatories, like the IRAM 30 m or the 40 m Yebes radiotelescopes, detect the spectral emission of the chemical species present in the objects of the ISM or CSE in the millimeter frequency ranges (around 75-300 GHz). Those spectra contain transitions from all the chemical species in space, hence, if the rotational spectra of each individual specie is not known, the identification of individual species is almost impossible. Our goal in the laboratory consists of providing the experimental spectroscopic parameters (rotational constants and conformational behavior) to be able to identify the chemical species in the space.

In the molecular cloud TMC-1 (Taurus Molecular Cloud), several complex organic molecules (COMs) have been detected, between them, the first aromatic species, like: benzonitrle or indene.[1] These detections contribute with essential information to the question of the presence of the PAHs (polycyclic aromatic hydrocarbons) in the space. Indole is a PAH (see Figure 1) whose structure is relatively close to indene or cyanoindene, both detected in TMC-1. The rotational spectra of indole is known up to 60 GHz[2], but to be able to search for this species in the space a precise set of rotational parameters and a wide frequency range are required. In the Physical Chemistry department of the University of Valladolid, we have now available a broadband chirped pulsed rotational spectrometer covering the 75-110 GHz frequency range. In the present contribution, I will introduce the spectroscopic fundamentals and the work about molecules of astronomical interest that we are working on in the group, with special attention to the analysis of the rotational spectrum of indole up to 110 GHz. More than 400 transitions for indole will be included in a global analysis that will allow to search this species in molecular clouds like TMC-1 in the space.

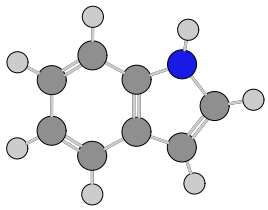

Figure 1: Indole.

[1] McGuire, B. *et al.*, *Science*, **359**, 202-205 (2018); Cernicharo, J. *et al., Astron. Astrophys.*, **649**, L15 (2021).

[2] Suenram, R. D., *et al.*, *J. Mol. Spectrosc.*, **127**, 472-480 (2022); Caminati, W., *et al., J. Mol. Struct.*, **240**, 253-262 (1990).

p-number: p227 **Submitted on Mon, 19 Jun 2023 15:48:13 +0200**