Jet-cooled mid-infrared laser spectroscopy of centrosymmetric and n-bearings pahs

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JET-COOLED MID-INFRARED LASER SPECTROSCOPY OF CENTROSYMMETRIC AND N-BEARINGS PAHS

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The recent detection of cyano naphthalenes within TMC-1 using radioastronomy [1] provided the first unambiguous confirmation of the interstellar PAH's hypothesis and raised new questions concerning their formation and destruction pathways. In the mid-infrared (IR) domain, the launch of the James Webb Space Telescope opens exciting perspectives to collect rovibrational information about low volatile polycyclic aromatic compounds.

In this context, rotationally resolved IR studies of large aromatic species are still very scarce and mainly used synchrotron-based Fourier Transform (FT) spectroscopy coupled to room temperature long path cells [2]. However, their spectral analysis remains very challenging due to the congested rotational structures and the presence of many hot bands.

Nowadays, few set-ups combining high resolution (HR) IR spectroscopy to supersonic jets, using FT and cavity ring down spectroscopic methods were implemented to target PAH compounds [3]. Recently, a mid-IR laser spectrometer coupled to a pulsed jet (SPIRALES set-up at MONARIS) allows recording rovibrational spectra of large molecules at low temperature [4].

We report here the jet-cooled rovibrational IR study of centrosymmetric PAH molecules in both regions of ring C-H bending and C-C stretching vibrations to extract reliable spectroscopic parameters both in ground and excited vibrational states [5].HR measurements of N-bearing PAHs with up two N atoms substituted on the same ring evidenced abnormal Q-branch structures which make puzzling rovibrational analyses and suggests the presence of vibrational perturbations in spectral regions with high density of states.

Keywords — astrophysics, PAH, rovibrational spectroscopy, supersonic jets

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