

# Investigating transient species in the millimeter domain using spectral taxonomy

Marie-Aline Martin-Drumel<sup>1</sup>, Olivier Pirali<sup>1</sup> et Michael McCarthy<sup>2</sup>

<sup>1</sup> ISMO, UMR8214 du CNRS, Institut des Sciences Moléculaires d'Orsay, rue André Rivière, Université Paris-Sud, Université Paris-Saclay, 91405, Orsay Cedex – France ;

<sup>2</sup>Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, 02138 Cambridge, MA – United States

With their unprecedented performances in terms of spectral resolution and sensitivity, spectral survey currently recorded using the new generation of observational platforms (ALMA, NOEMA) reveal unsurprisingly many molecular features that are currently absent from spectroscopic databases as JPL or CDMS [1, 2] and thus arise from so far unknown species (U-lines). The determination of the carriers of these features, which will enable a better understanding of the physical conditions and chemical evolution of the ISM, requires deep investigations from laboratory spectroscopy especially in the spectral range covered by these instruments, at millimeter and sub-millimeter wavelength. Several types of compounds are of high interest as potential carriers for the U-lines: already identified stable interstellar species but in excited vibrational states or isotopic variants (owing to the increased sensitivity and signal-to-noise ratio of the new astronomical instruments) or entirely new compounds. Of particular interest are transient, highly reactive species, as they remain widely understudied in the laboratory compared to stable molecules.

Currently, most of the laboratory studies on astronomical species are highly biased: a target molecule, thought to be present in the ISM, is selected and experiments are performed to detect its rotational lines by recording spectra in very narrow spectral ranges matching the predictions for this species. We recently developed a new approach, spectral taxonomy, that allows investigation of complex mixtures and identification of new species without a priori knowledge of their elemental composition or molecular structure [3]. Spectral taxonomy involves acquiring a broadband rotational spectrum of a rich mixture and subsequently categorizing each individual line based on its relative intensity under series of assays: dependence over one precursor or another is an indication of atomic composition, disappearance in absence of the excitation source (e.g., discharge) implies a transient species, and influence of an external magnetic field on the line shape points out an open-shell molecule. Initially developed in the centimeter domain, spectral taxonomy is now extended to the millimeter domain. We will present recent results obtained on several transient species, as *c*-C<sub>3</sub>H<sub>2</sub> and HCCSH.

## Références

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