Theory and Experiment for Elucidating Chemical Evolution in Space

C. Puzzarini[1]

[1]*Department of Chemistry "Giacomo Ciamician", University of Bologna, Italy*

Understanding the chemical evolution of the universe is one of the main aims of Astrochemistry, with the starting point being the knowledge whether a molecule is present in the astronomical environment under consideration and, if so, its abundance. In this context, molecular spectroscopy plays the central role. The astronomical observation of the spectroscopic features of a given molecule is the definitive, unequivocal proof of its presence in the astronomical environment under consideration, with the overwhelming majority of gas-phase chemical species being discovered via their rotational signatures.

Among the goals of astrochemistry, the detection of prebiotic COMs in astrophysical environments is fundamental in view of possibly understanding the origin of life. While the evidence for molecular complexity in the universe is undisputed, there is still much to be understood about what prebiotic molecules are present and how they are formed in the typically cold and (largely) collision free environment of the interstellar medium. By means of selected examples, it will be shown that: (*i*) the interplay of experiment and theory in the field of rotational spectroscopy is a powerful tool in astrochemistry [1-3]; (*ii*) state-of-the-art computational approaches allow for deriving formation pathways able to explain the molecular abundances derived from astronomical observations [3-5]; (*iii*) a rationalization of interstellar chemistry in terms of class of reactions might be a feasible way [5].

References

[1] C. Puzzarini & V. Barone, 2020, PCCP 22, 6507.
[2] C. Puzzarini, 2020, Proc. IAU 15(S350), 65.
[3] C. Puzzarini, 2020, Front. Astron. Space Sci. 7, 19.
[4] C. Puzzarini et al., 2020, MNRAS 496, 4298.
[5] J. Lupi, C. Puzzarini & V. Barone, 2020, ApJL 903, L35.