Anion chemistry in the interstellar medium: insights from the laboratory

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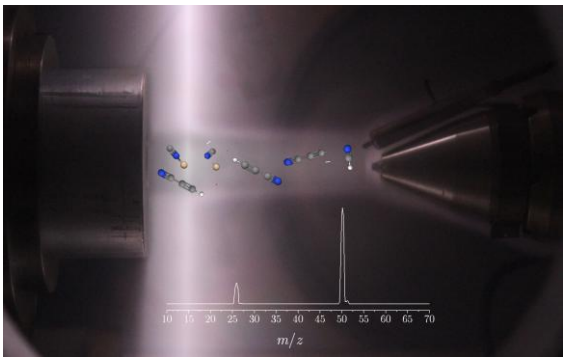
The molecular diversity of the cold interstellar medium has been recently enriched with the detection of anions, C_4H^-, C_6H^-, C_8H^-, C_3N^-, C_5N^-, and CN^-, all linear carbon chains [1-7]. The circumstellar envelope of the evolved carbon star IRC +10216 is the only object so far in which all of them have been identified. Despite growing interest, the physical and chemical processes that govern their abundance remain poorly known. A better knowledge of anion reactivity, including chemical kinetics and branching ratios between exit channels at the relevant, low temperature of the interstellar medium, is of crucial importance for properly modeling gaseous cold environments.



To address these questions, we have conducted a series of experiments using the CRESU (French acronym standing for Kinetics of Reactions in Uniform Supersonic Flows) combined with quadrupole mass spectrometry to explore the reactivity of a selection of molecular anions down to 50 K. In our setup, the anions are produced by electron dissociative attachment on a specific precursor directly in the supersonic flow with the help of an electron gun [8-9].

The mode of production of the ions employed under this configuration is however limited to the species, such as C_xN^- (x = 1, 3, 5), whose precursors easily attach low energy electrons and are available or synthesizable. In order to overcome these limitations, we have developed another methodology that relies on the implementation of a mass-selective source of ions on the CRESU chamber. The objective is to extend our study to the reactivity of the ions of the C_x^- and C_xH^- families. Preliminary results with this new set-up will be presented.

References

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