MOLECULAR GROWTH PROCESSES IN CIRCUMSTELLAR ENVELOPES OF EVOLVED STARS: A LABORATORY SIMULATION APPROACH

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Cosmic dust is mainly formed from molecular precursors in the Circumstellar Envelopes (CSEs) of Asymptotic Giant Branch stars (AGBs), which can be considered as the molecular factories of the Universe. In this talk, we present our recent results on the laboratory simulation of the CSE of carbon-rich (C-rich) AGBs using the *Stardust* machine, a worldwide unique experimental station that allows to simulate the long journey of cosmic dust from its formation in evolved stars to the interstellar medium [1,2]. In particular, we have recently shown that the interaction of atomic carbon (C) and molecular hydrogen (H_2), which is the most abundant gaseous species in AGBs, leads predominantly to the formation of aliphatic hydrocarbons [3]. In addition, we have investigated the chemistry of C and diatomic carbon (C_2) with acetylene (C_2H_2), the latter being the most abundant hydrocarbon in C-rich stars, and we have observed that the chemistry involved produces a non-negligible amount of pure and hydrogenated carbon clusters as well as aromatics with aliphatic substitutions, both being a direct consequence of the addition of atomic carbon [4]. Finally, we have studied the chemistry of atomic silicon (Si) and H_2, which efficiently produces silane (SiH_4) and disilane (Si_2H_6), and we have suggested that these species might be formed in the inner regions of the CSE of C-rich stars [5]. Overall, our results show that accurate laboratory simulation of the atmosphere of evolved stars provides unique opportunities to elucidate plausible physico-chemical mechanisms leading to the molecular complexity observed in Space.

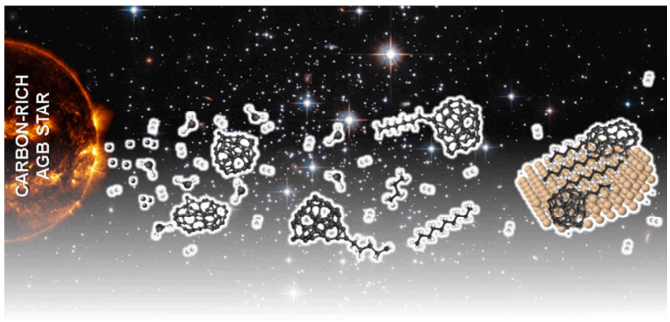

Figure 1: From molecules to cosmic dust grains in the CSEs of C-rich AGB stars.

References

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