Enhanced nitrogen fractionation at core scales: the high-mass star-forming region IRAS 05358+3543

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The $^{14}\text{N}/^{15}\text{N}$ isotopic ratio found for the proto-Solar nebula (PSN) (441, [1]), is higher than that measured in pristine Solar system materials, like comets (~1.40, [2]). This suggests a local chemical enrichment of $^{15}\text{N}$ during the star formation process. Since there is growing evidence pointing out that our Sun was born in a rich cluster, including massive stars (e.g. [3]), we have studied with the IRAM 30m radiotelescope the $^{14}\text{N}/^{15}\text{N}$ ratio in a sample of 87 massive star-forming regions ([4], [5]). In Fig. 1 the overall behavior of the $^{14}\text{N}/^{15}\text{N}$ ratio, for HCN and HNC, across the Galaxy is shown. We have confirmed that the $^{14}\text{N}/^{15}\text{N}$ ratio increases with the Galactocentric distance, as expected from Galactic chemical evolution models. Then, we have observed the massive star-forming protocluster IRAS 05358+3543, combining single-dish (IRAM 30m) and interferometric (NOEMA) observations of the $^{15}\text{N}$ isotopologues of N$_2$H$^+$. The analysis yields $^{14}\text{N}/^{15}\text{N}$ ratios of 100-200 towards the cores, and higher values of >200 in the diffuse clump gas ([6]). This result, which strongly suggests for the first time a local chemical enrichment of $^{15}\text{N}$ at core-scales, help us to understand how the chemical inventory evolves from the parental molecular reservoir to smaller-scale objects.

References