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

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The $^{14}N/^{15}N$ isotopic ratio found for the proto-Solar nebula (PSN) (441, [1]), is higher than that measured in pristine Solar system materials, like comets (~140, [2]). This suggests a local chemical enrichment of ^{15}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 $^{14}N/^{15}N$ ratio in a sample of 87 massive star-forming regions ([4], [5]). In Fig. 1 the overall behavior of the $^{14}N/^{15}N$ ratio, for HCN and HNC, across the Galaxy is shown. We have confirmed that the $^{14}N/^{15}N$ 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}N isotopologues of N_2H^+. The analysis yields $^{14}N/^{15}N$ 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}N at core-scales, help us to understand how the chemical inventory evolves from the parental molecular reservoir to smaller-scale objects.

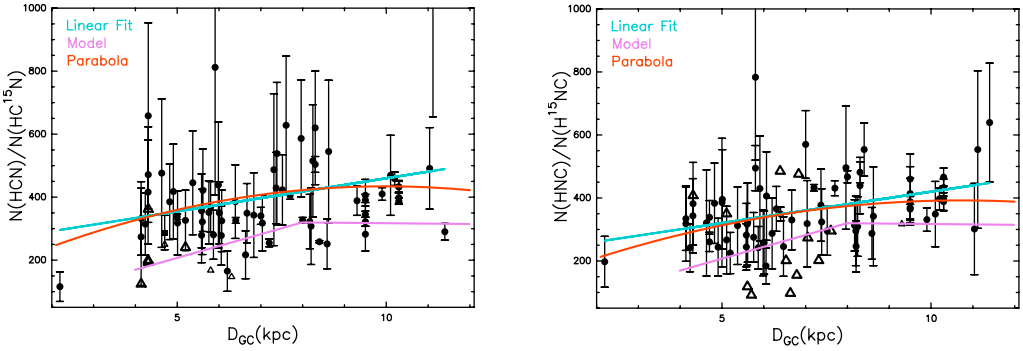

Figure 1: $^{14}N/^{15}N$ ratios for HCN (left) and HNC (right) as a function of D_{GC}

References

[1] Marty, B., Zimmermann, L., Burnard, P.G., Wieler, R., Heber, V. S., et al., 2010, GCA, 74, 340
[2] Hily-Blant, P., Magalhaes, V., Kastner, J., Faure, et al., A&A, 604, L6 (2017)
[3] Adams, F. C., ARA&A, 48, 74 (2010)
[4] Colzi, L., Fontani, F., Caselli, P., Ceccarelli, C., et al., A&A, 609, A129 (2018a)
[5] Colzi, L., Fontani, F., Rivilla, V. M., et al., MNRAS, 478, 3, p.3693-3720 (2018b)
[6] Colzi, L., Fontani, F., Caselli, P., Leurini, S., et al., MNRAS, 485, 4, p.5543-5558 (2019)