Tracing the emergence of hot cores with complex organic molecules

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The detailed processes involved in the formation of high-mass stars have been long-standing issues in astrophysics. The new capabilities of state-of-the art radio-interferometers have recently opened a new window on the study of high-mass star-forming sites, which have become prime targets of large observing programs. The high-sensitivity wide-bandwidth observations delivered by ALMA, coupled with wide field mosaic mapping, give access to a large population of dense clumps, of which we are able to probe the structure and the chemical content, over scales from clouds to individual proto-stellar envelopes.

The ALMA-IMF observing program [1] [2] [3] targets 15 of the most massive star-forming regions in the Galaxy. The observational data give access to the innermost part of high-mass star-forming sites that contains hundreds of compact cores, providing an instantaneous view on Galactic star formation, at different scales and different evolutionary stages. The systematic and deep analysis of the dataset reveals a striking diversity among the investigated star-forming regions, as well as within each region, where cores show completely different spectral features. While some cores show an extremely rich chemical content, other nearby sources are poor or devoid of any molecular lines, such that chemistry plays here a key role in diagnosing physical properties and their evolution [4]. Based on the emission that arises from complex organic molecules we built an unprecedented catalog of more than 50 hot cores [5], that contributes to enhance the number of candidates of known high-mass star progenitors. From this catalog, we perform life-time estimates by comparing the hot core candidates with the list of pre- and proto-stellar sources identified based on the thermal dust continuum emission [6].

References

[1] Ginsburg, A., Csengeri, T., Galvàn-Madrid, R., & the ALMA-IMF consortium, A&A, (2021) *in press*.
[2] Motte, F., Bontemps, S., Csengeri, T., & the ALMA-IMF consortium, A&A, (2022) *in press*.
[3] Cunningham, N., et al. *in prep*.
[4] Brouillet, N., Despois, D., Molet, J., Motte, F., & the ALMA-IMF consortium, A&A, (2022), *subm*.
[5] Bonfand, M., et al., *in prep*.
[6] Louvet, F., et al., *in prep*.