

Studying the early phases of high-mass star formation

Maxime Valeille-Manet, Sylvain Bontemps, Timea Csengeri
Laboratoire d'Astrophysique de Bordeaux

The study of the early phases of high-mass star formation is a major topic in astrophysics that is still poorly understood, where several formation scenarios are still in competition. To elucidate which formation scenario is in action, it is necessary to identify the precursors of massive stars ($M > 8 M_{\odot}$) within high-mass star-forming regions. Here we survey for massive pre-stellar core candidates (MPSC) in the data cubes of massive proto-clusters mapped in the ALMA-IMF program (ALMA Large Program; Motte et al. 2022). This survey, which images the 15 most massive proto-clusters of the Galaxy located within 6kpc of the Sun, at a resolution of 2700 au, has allowed the identification of 700 compact cores among which we aim at identifying pre-stellar cores. For this purpose, an automatized method for systematically detecting outflows from proto-stellar cores is developed. Cores without significant outflows are considered as excellent candidates to be pre-stellar cores. For this we compare the spectrum of each source (on source) with the spectrum of its surrounding environment (off source). We use both the CO(2-1) and SiO(5-4) spectral lines to identify outflowing gas. In addition to the spectra, we use outflows maps in order to have the spatial information of the dynamic outflows in the field. Preliminary results confirm earlier findings that high-mass pre-stellar cores are rare with no more than 35 MPSC candidates detected in those regions, covering a mass range of 8 to $178 M_{\odot}$, and for a total amount of around 100 high-mass proto-stars in the survey. On the other hand, we detect a significant population of high-mass cores displaying surprisingly weak outflows that we plan to investigate further.

