Stars are not static objects; they have a complex formation, evolution, and “death”. A star is born when, due to its force of gravity, hydrogen atoms start nuclear fusion reactions in the core. The evolution of the star dictates its fate mechanism. Correspondingly, a star “dies” when it is not able to generate more energy in the core. One way of how stars end their lives is a supernova explosion. Supernovae are extremely energetic explosions, having a brightness comparable to all stars together in the Milky Way. Also, supernovae are responsible for ejecting heavy material to the interstellar medium, i.e. new synthesised elements necessary for the existence of life. Therefore, it is important to have accurate models of supernovae in order to understand how the universe works at different scales: from planet formation to galaxy evolution.

A central problem in stellar astrophysics is the connection between supernovae and their respective stellar progenitors. To this day, progenitor-supernova studies are difficult to perform because most of the information that we measure is from the explosion itself. Detections of respective progenitor stars are restricted since telescopes are not able to track the complete evolutionary process in which stars form, evolve and explode as supernovae. That is why, a simpler but powerful approach to constrain the nature of supernova progenitors is by studying their environments, from past explosions in which we have access to their astrometric position on the sky.

Several properties can be inferred from the environments of supernovae in order to constrain their nature. Previous studies attempted to unveil progenitor properties, however, no strong conclusions were obtained in the topic. This is because observations were not at high resolution, the sample size was not large enough to have clear statistics and/or multiwavelengths techniques were not combined. This motivated us to combine the missing gaps, and to do so, we propose to constrain the multiphase interstellar medium of supernova environments for a statistically significant sample in order to elaborate in which conditions massive stars form, evolve, and explode as supernovae.

Currently, the Atacama Large Millimetre/submillimetre Array (ALMA), Very Large Telescope (VLT), and James Webb Space Telescope (*JWST*) are cutting-edge high resolution telescopes that cover different wavelengths, that make it possible to understand the interplay of the small-scale physics of gas and star formation within galaxies.

In this project, we plan to gather data from ALMA, VLT and *JWST* in order to have a better understanding of how different supernovae are related with their environments and identify the properties of the respective progenitor stars. The implications of this study will be of importance in the astrophysical community given that the nature of supernovae are not well understood and having a constraint on how environment affects the formation and evolution of stars will play a key role for numerical cosmological simulations, where supernova properties are assumed to compute the feedback and chemical mixing into the interstellar medium.