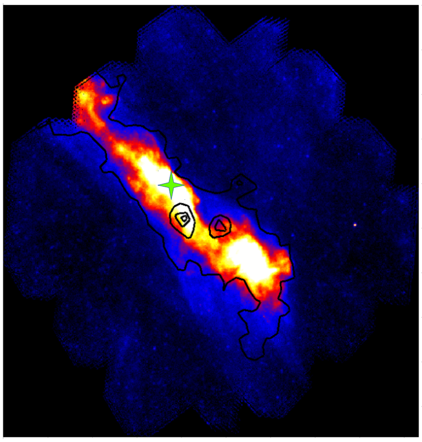
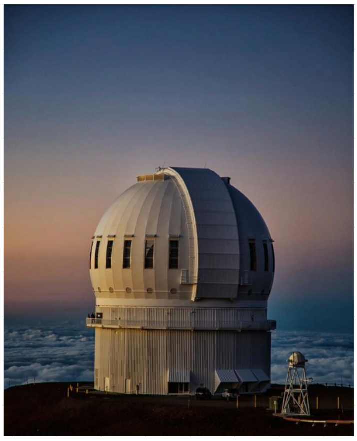
Extinction map of the low-mass straight filament G110-13

Star formation occurs in molecular clouds, i.e. dense and cold parts of the interstellar medium where the gas (mostly hydrogen) is molecular. Most focus has been dedicated to the most massive molecular clouds where most stars form. However, massive molecular clouds are generally large and complex structures characterized by multiple star formation events. Studying low-mass clouds can shed new light on the star formation mechanisms, thanks to their greater simplicity in terms of morphology and history.

The molecular cloud G110-13 is a low-mass (~100 Msun) isolated filament with a simple straight morphology, that has sustained a regular star formation activity for at least a few million years. Radio observations have revealed that it probably corresponds to the collision front between two converging atomic hydrogen streams, and that it hosts a dense prestellar core, possibly on the verge of collapse. Interestingly, optical data show that three stars of very similar mass (3-4 Msun) and spectral type (B8) were formed sequentially, suggesting (i) that the mass of the stars was determined by very stable environmental conditions (e.g. the speed of the converging streams), and (ii) that the prestellar core will eventually give birth to a similar star. This makes G110-13 a unique laboratory to study the early stages of star formation of this type of stars. We aim at characterizing as completely and accurately the G110-13 filament in the perspective of a future benchmark with star formation simulations.

In this project, we propose to build an extinction map, where one uses near infra-red data to characterize the column density of the cloud by observing background stars seen in extinction through the filament. The student will implement state-of-the-art numerical method(s) from scratch based on the literature, and apply them to data from the 2MASS survey and the WIRCAM instrument on the 3.6-m Canada-France-Hawaii telescope. Dust grain growth in the filament will be investigated by comparing the obtained extinction map with dust thermal emission from the Herschel satellite. In case of fast progress, the results will be used to constrain a 3D radiative transfer model of the filament.





Left: The G110-13 filament seen by the Herschel satellite at 250 µm, which traces the thermal emission from the cold interstellar dust grains. The green four-branch star shows the location of the prestellar core. The black contours are from the DSS optical data and reveal the location of the three B8-type stars. Right: The dome of the CFH telescope in Hawaii, that was used to obtain the data that will be analyzed in this project.

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