The evolution of massive YSOs in two Hi-GAL fields

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and:

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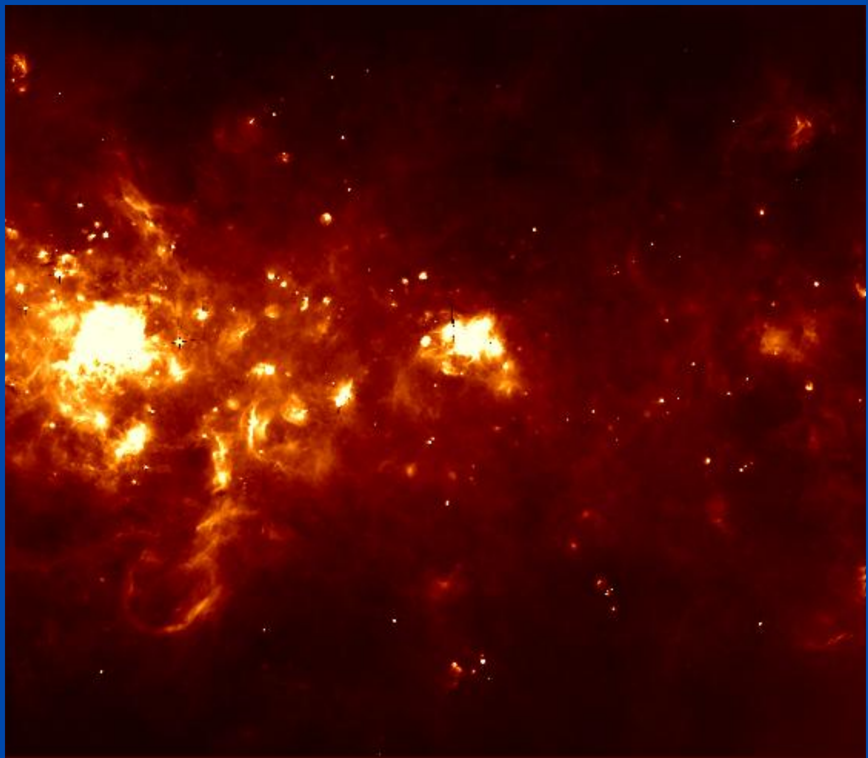
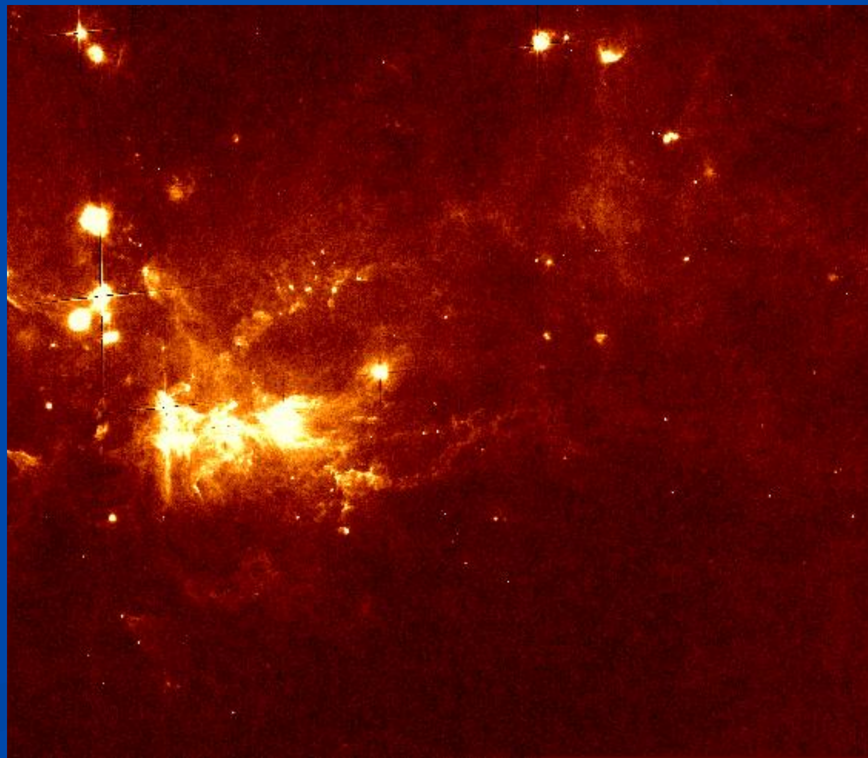
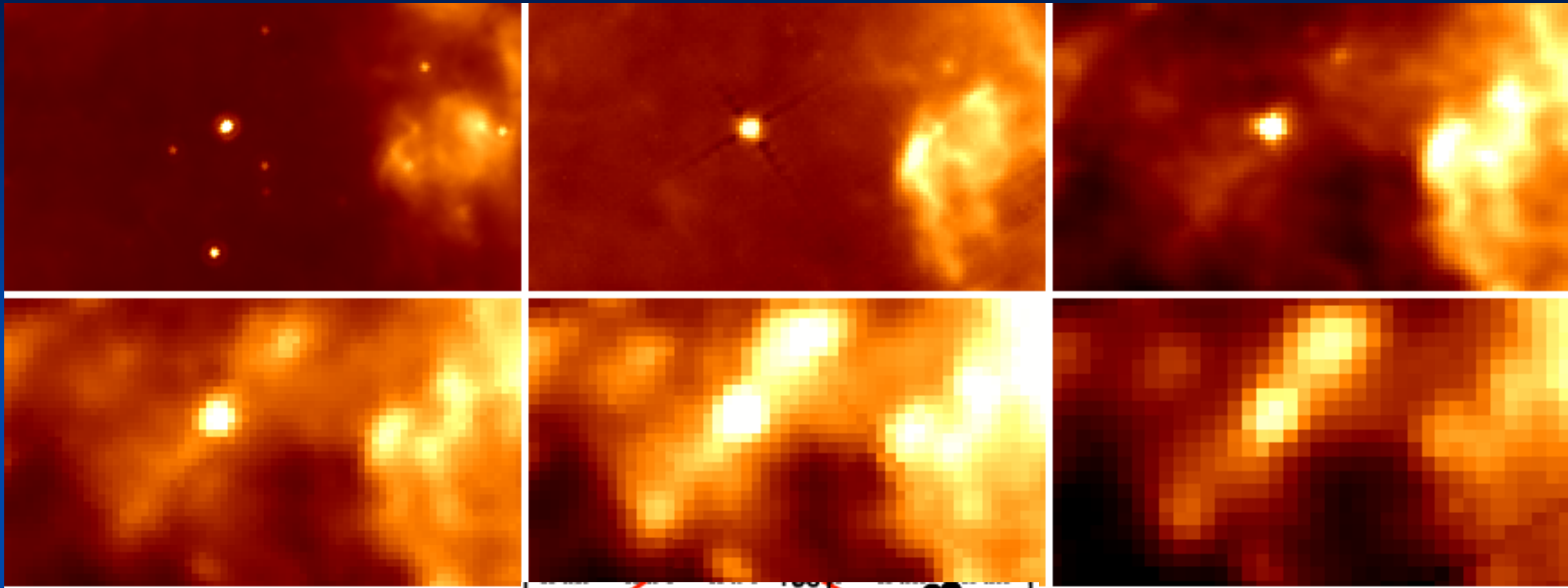
ℓ = 30º and ℓ = 59º

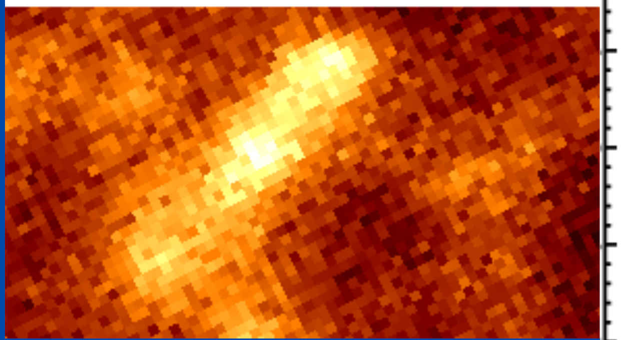
We built the SEDs of the compact sources found in the two Hi-GAL SDP fields (ℓ=30º and ℓ=59º), starting from the photometry lists obtained in the single bands.

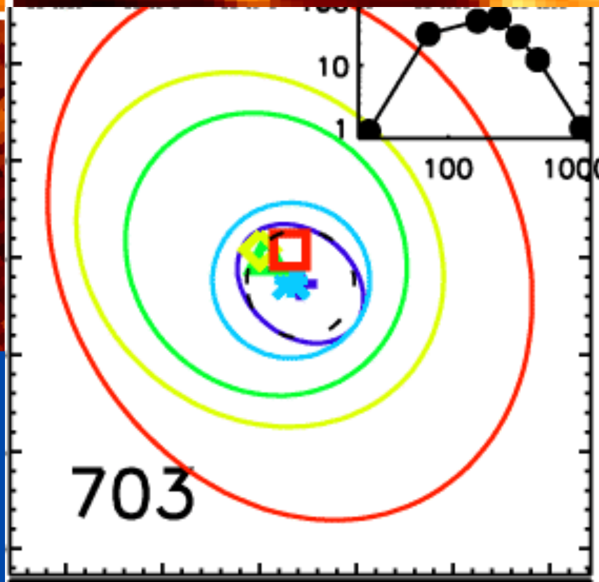




SED building



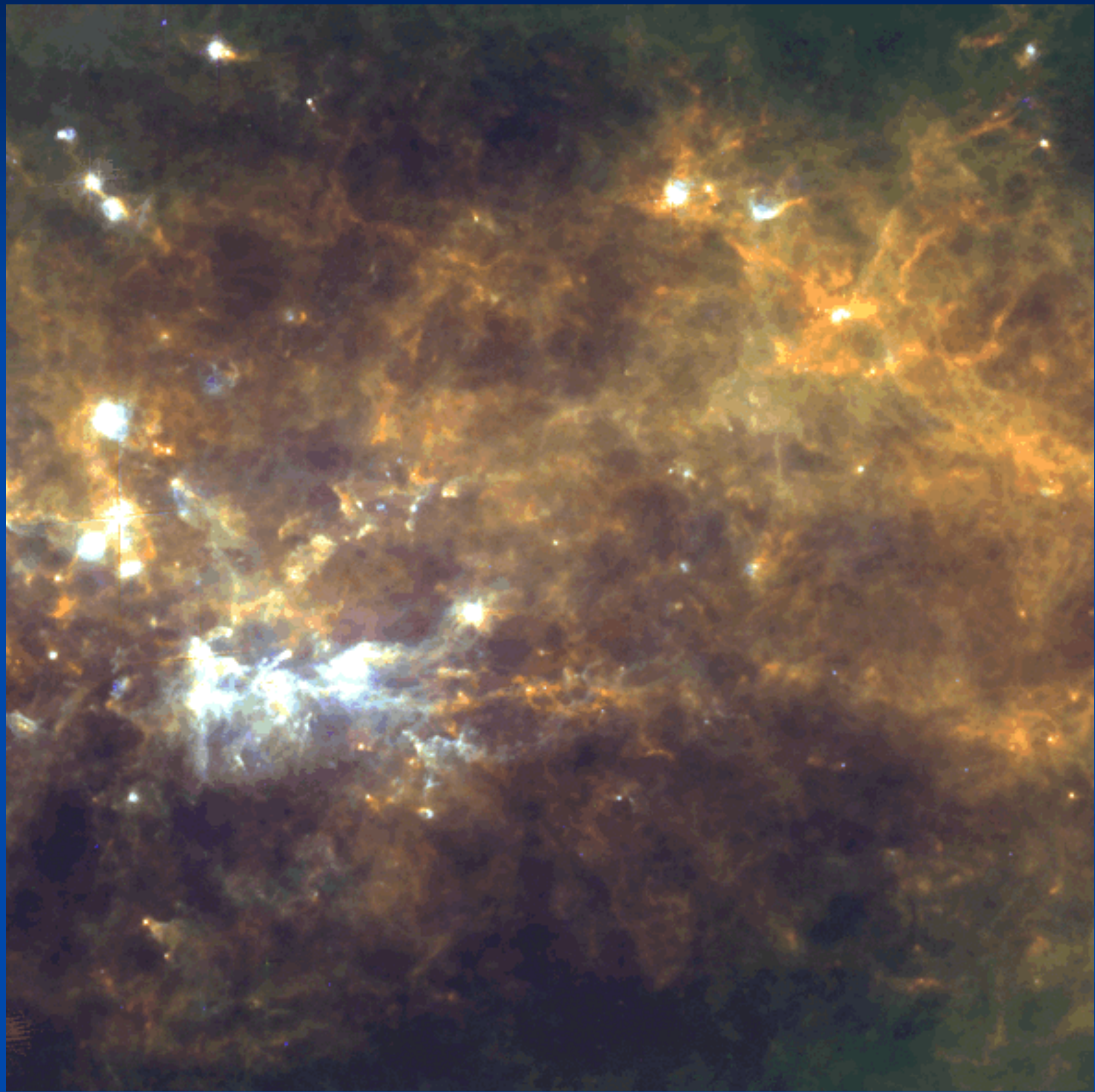




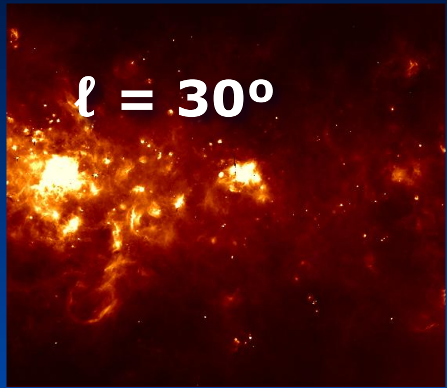
Association between λ_i and λ_{i+1} within a searching radius $R=1.22\ \lambda_{i+1}\ /\ D$.

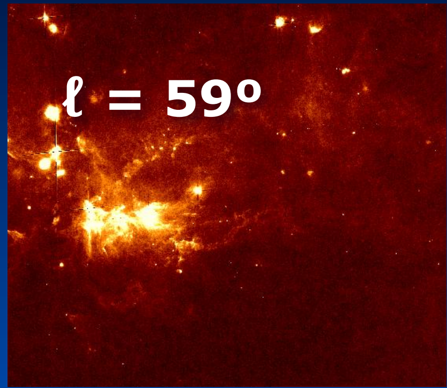
Cases of multiple associations solved by keeping the closest one.

ℓ = 59º



SED selection





Stage 1: All sources detected in at least one PACS/SPIRE band	**2022**	**1322**
Stage 2: Stage 1 sources excluding those with irregular SEDs	**528**	**444**
Stage 3a: Stage 2 sources identified in at least the 70, 160, 250 and 350 μm bands	**236**	**141**
Stage 3b: Stage 2 sources identified in at least three bands, but also with a known distance from Russeil et al. (P2.03)	**318**	**101**

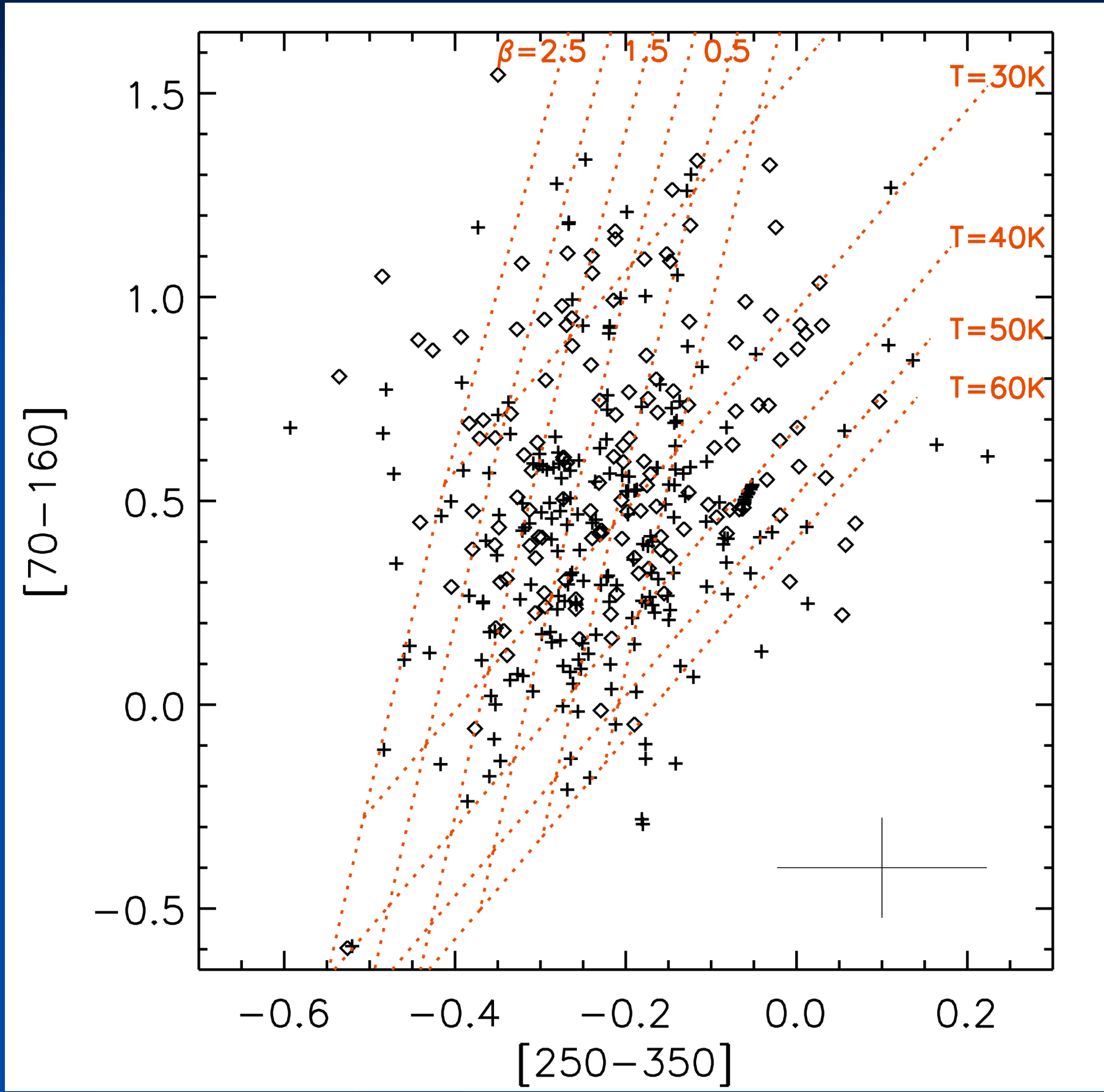
A color-color diagram

Stage 3a sources
+ l=30º
◇ l=59º

No evidence of segregation.

The colors are consistent with greybodies having temperatures in the range of 20 < T < 60 K.

A noticeable fraction of sources lies in the region corresponding to negative β values:
-the single temperature assumption is incorrect and a multicomponent fit is warranted
- perhaps we are overestimating the flux at longer wavelengths because we are associating counterparts whose size is increasing at increasing wavelengths.



SED fitting 1

Stage 3b sources have been selected to fit, using:

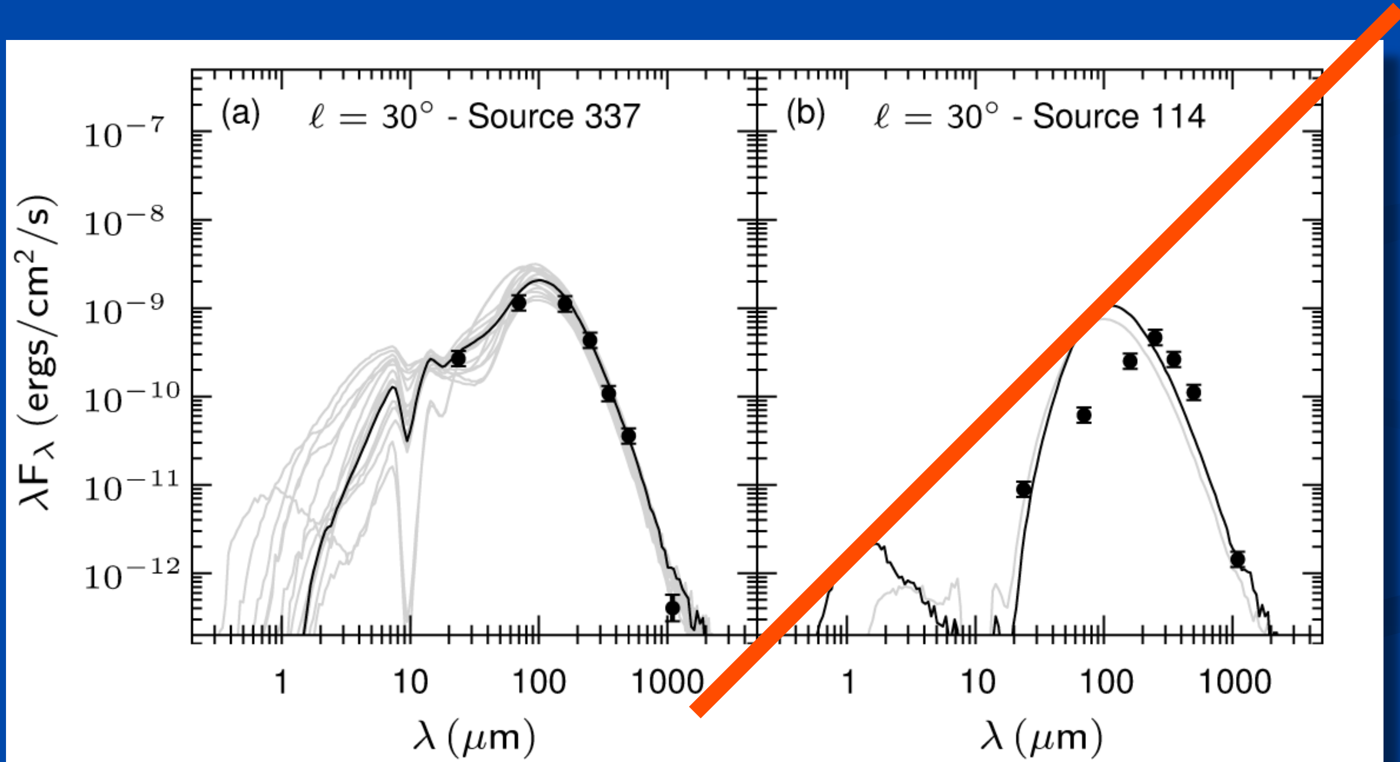
- **the grid of models from Robitaille et al. (2006) and the SED-fitting tool of Robitaille et al. (2007), based on the YSO/disk/envelope model of Whitney et al. (2003)**

- **the simple greybody model**

MIPSGAL 24 μm and BGPS 1.1 mm fluxes were also taken into account, where available

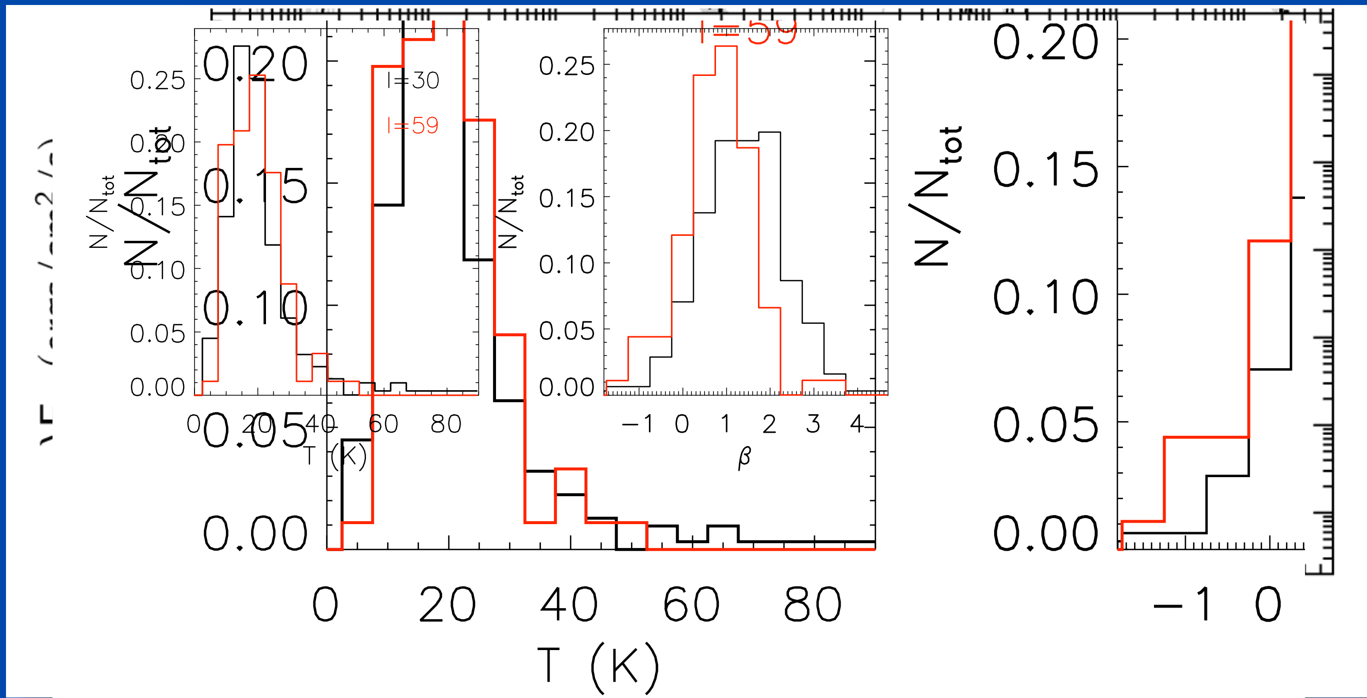
SED fitting 2

The SED-model fit provides acceptable results for 127 source in the ℓ= 30º field, and 43 sources in the ℓ = 59º field. For the remaining sources no acceptable fits were found in the entire grid of models.



SED fitting 3

A visual inspection showed that the badly fitted cases are mostly sources where the SED peaks at 160 μm. These situations generally correspond to cold envelopes with an important fraction of the gas at temperatures T=30K, not considered in the model grid of Robitaille et al. (2006).



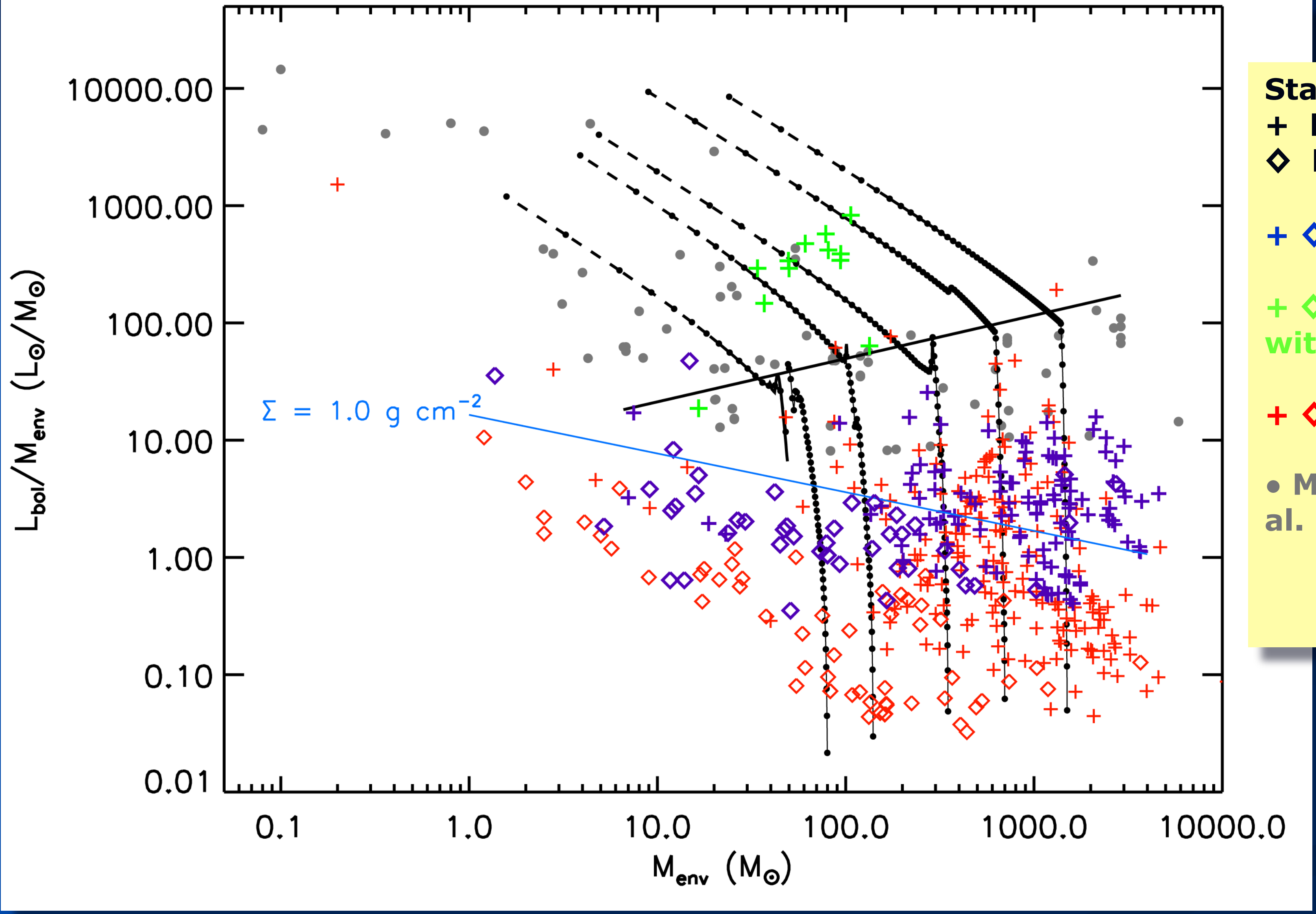
Masses and Luminosities

Both Robitaille's and grey-body fits provide us with mass estimates for sources that also have available distances, from which we can derive the FIR luminosities.

These physical quantities can be exploited to obtain information about the evolutionary stage of the studied cores.

The parameters obtained with the Robitaille's fit were preferred where available (good fit).

L/M vs *M* diagram



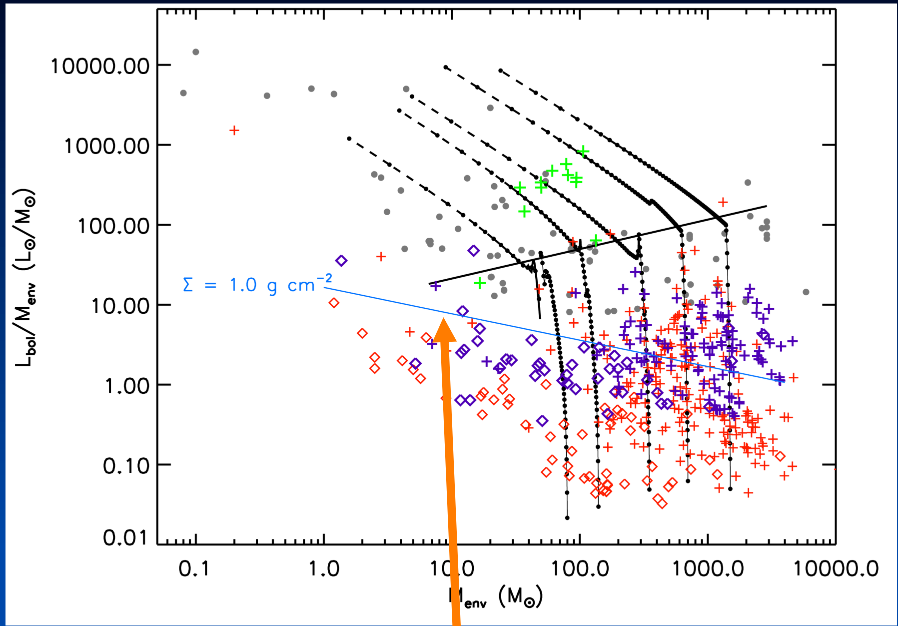
Stage 3b sources
+ l=30º
◇ l=59º

+ ◇ Robitaille fit

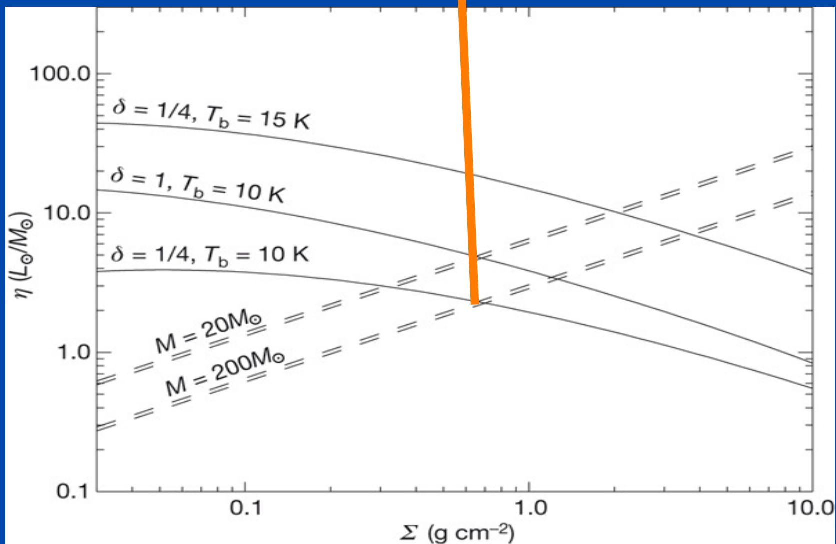
+ ◇ Robitaille fit with ZAMS

+ ◇ Grey-body fit

• Molinari et al. (2008) sources

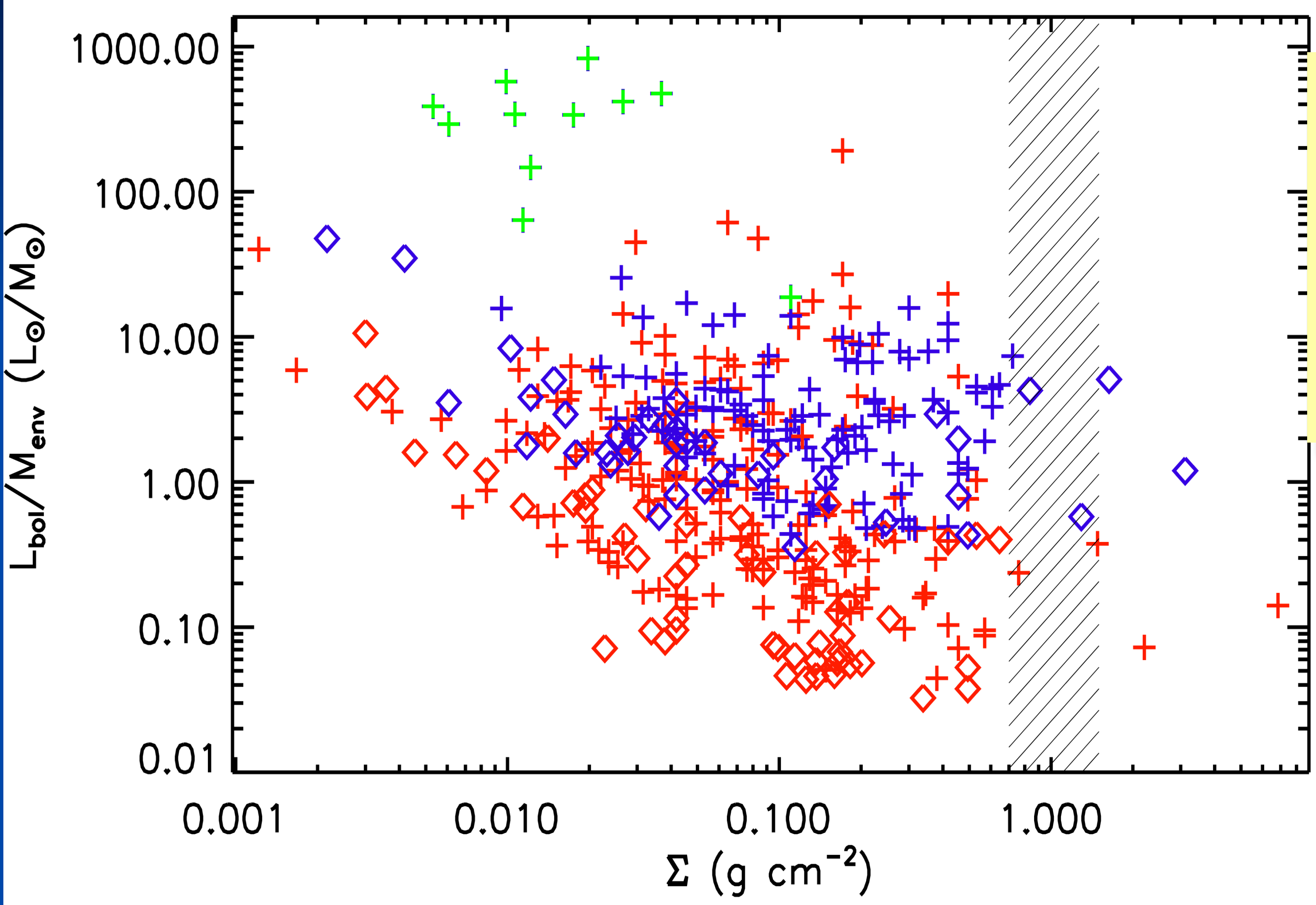


With the present data it is not possible to ascertain if all detected cores are actively forming stars or if the population fraction at very low *L/M* may be in a pre-protostellar phase. High *L/M* ratios, however, are difficult to explain without an actively forming high-mass star.



The *L/M* threshold corresponding to the critical core surface density of 1 g cm^{-2} for the formation of massive stars has been derived following Krumholz & McKee (2008).

Core surface density



Stage 3b sources
+ l=30º
◇ l=59º

+ ◇ Robitaille fit

+ ◇ Robitaille fit with ZAMS

+ ◇ Grey-body fit

Conclusions

The SEDs built with Hi-GAL fluxes can be used to characterize the evolutionary stage of the cores detected in two Hi-GAL fields. This very preliminary study provided us with the following results:

- **The *M* and *L* values obtained from the SED fitting can allow comparisons with evolutionary models.**

- **A first analysis suggests that most of the cores are in a very early stage, and only a fraction of them is compatible with ongoing high-mass star formation activity.**

- **The sources compatible with a ZAMS lie in fact in a region of the *L/M* vs M diagram corresponding to a more evolved stage.**

- **Most of the derived core surface densities are below the theoretical value expected for starting high-mass star formation.**

Future work

• Source extraction needs to be more articulate, providing more information about the possible point-like or clump-like appearance of the detected sources.

• The effects of source blending and/or false associations must be taken better into account at the band merging stage.

• Articulate radiative transfer models as that of Withney et al. (2003) should be used in a larger number of cases. To do this, the Robitaille et al. (2007) model grid has to be extended in order to reproduce colder and earlier-stage objects.

• NIR observations (e.g. GLIMPSE) have to be considered to better ascertain the nature of the detected "cores".

A better SED definition and fit will provide us with more reliable physical parameters of the Hi-GAL compact sources, then better comparisons with the theoretical models.