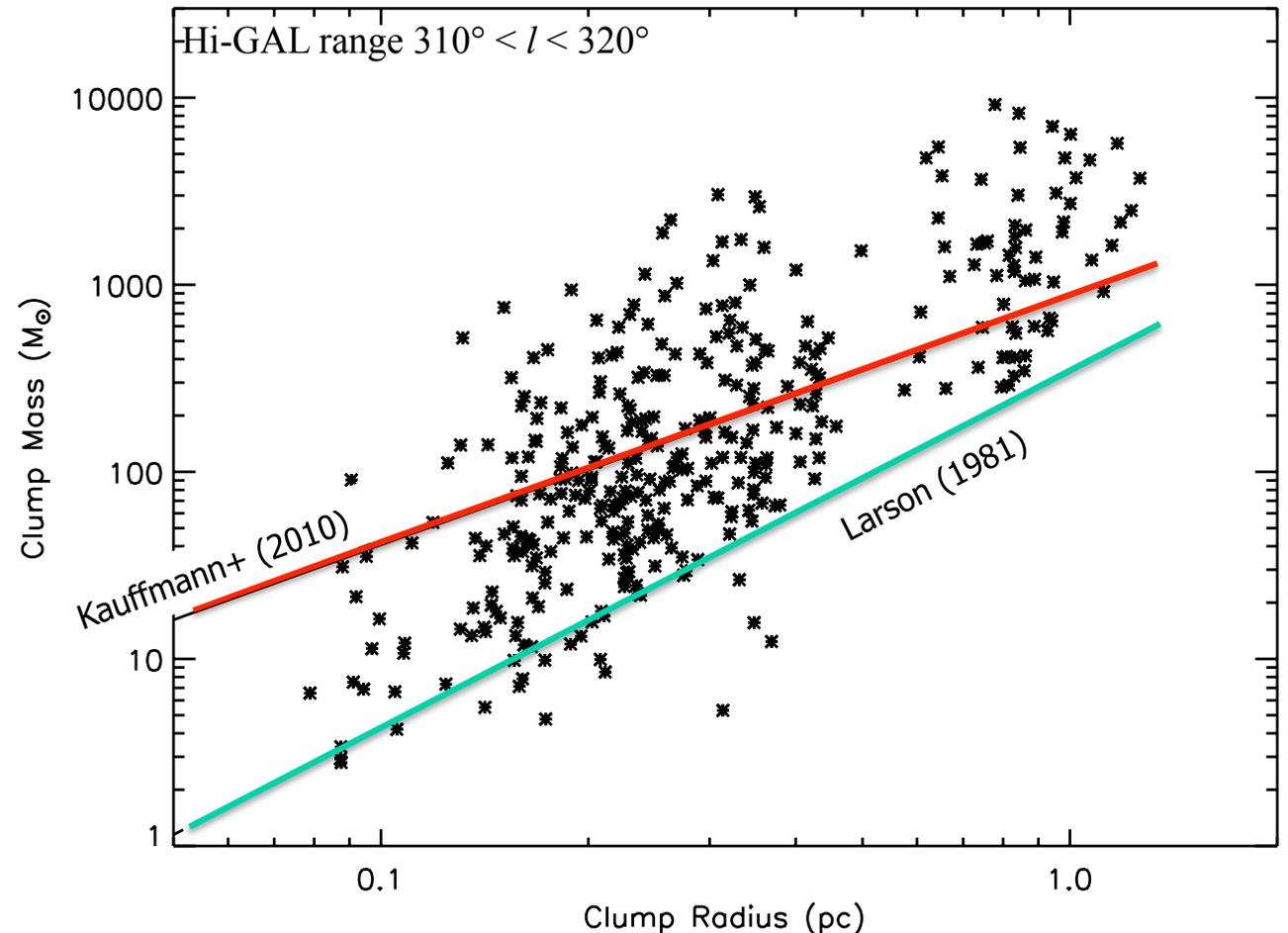


# Nature of the compact Dense Clumps

\* Hi-GAL sources with counterpart in at least 3 adjacent bands, and with known distance

- The majority of sources are gravitationally bound clumps according to Larson (1981).
- Herschel sensitivity is such that a solid multiband Far-IR detection in the Galactic Plane is likely a solid dense clump detection



About 40% of the clumps lie above the Mass-Size power-law proposed to discriminate structures on the basis of their ability to form massive stars (Kauffmann et al. 2010)

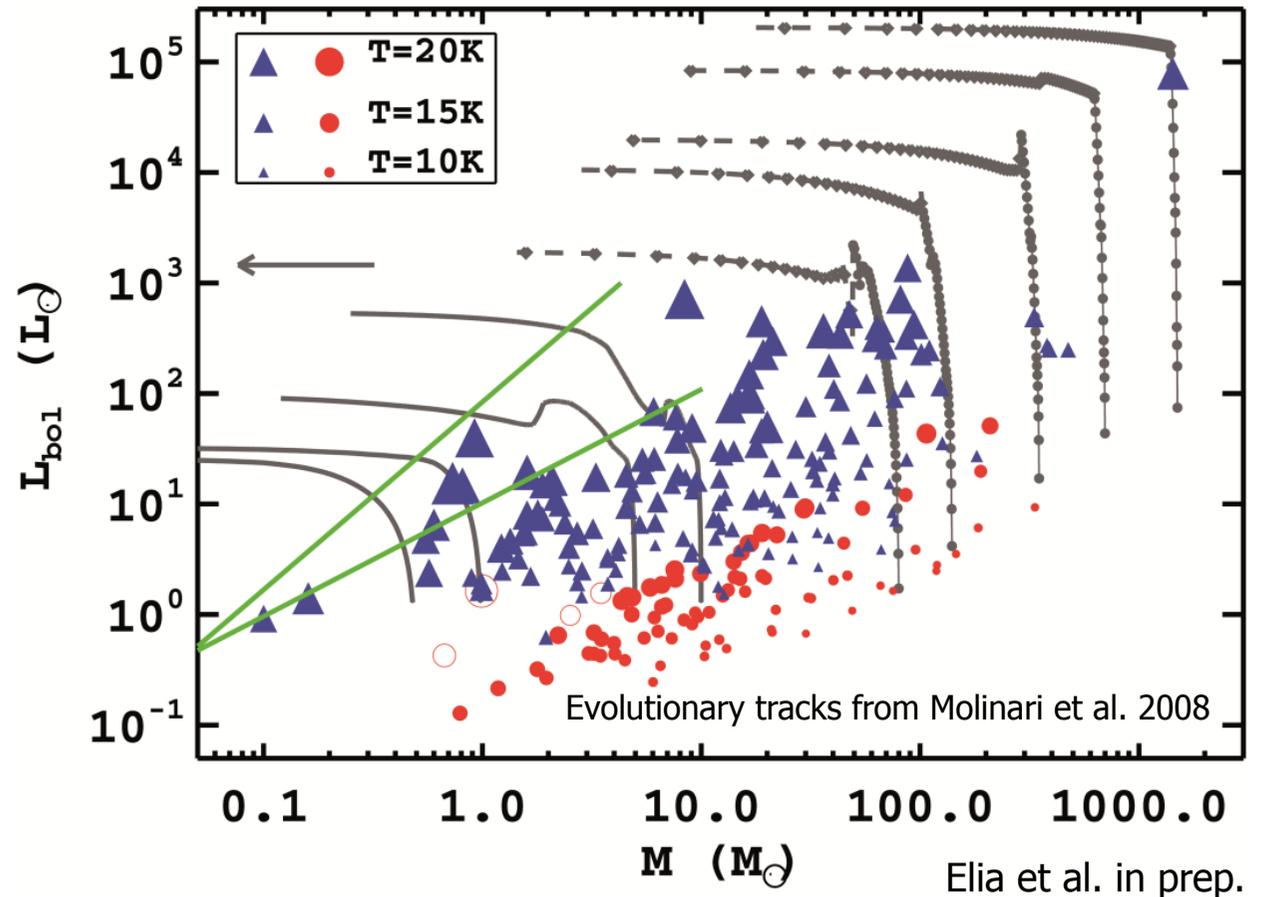
....detailed analysis underway throughout the Inner Galaxy in a series of papers in preparation by the Hi-GAL Consortium

# H-R diagram analogues. L/M: Evolution ?

- **Pre-stellar Sources**  
(no  $70\mu\text{m}$  counterpart)
- ▲ **Proto-stellar Sources**  
(with  $70\mu\text{m}$  counterpart)

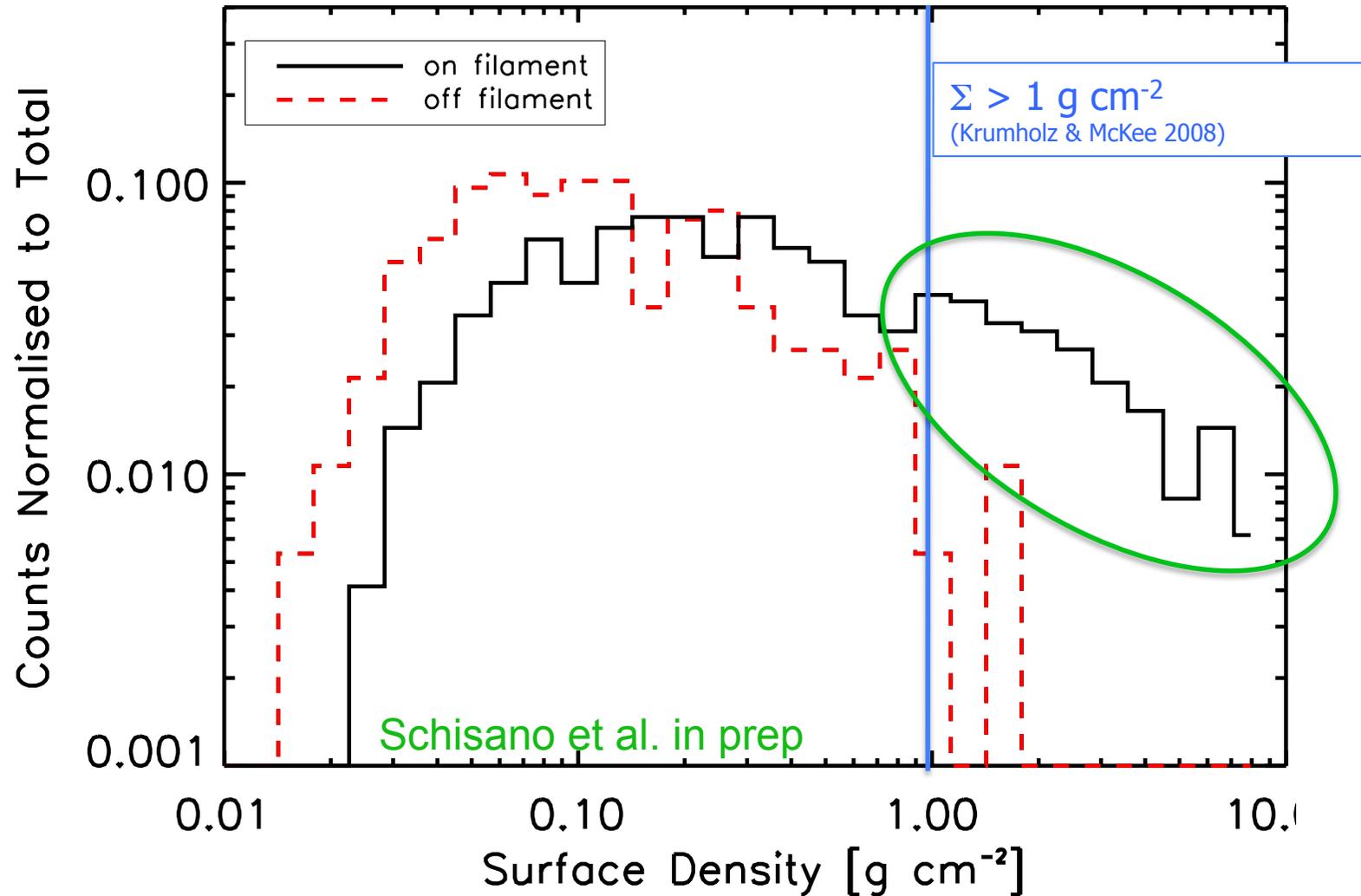
• A separation between **pre-stellar** and **proto-stellar** sources is quite clear in terms of L/M. The appearance and intensity of the  $70\mu\text{m}$  (and shortward), clearly makes the difference.

• Within each class, there is a clear trend of L/M with Temperature (estimated using only  $\lambda \geq 160\mu\text{m}$ )



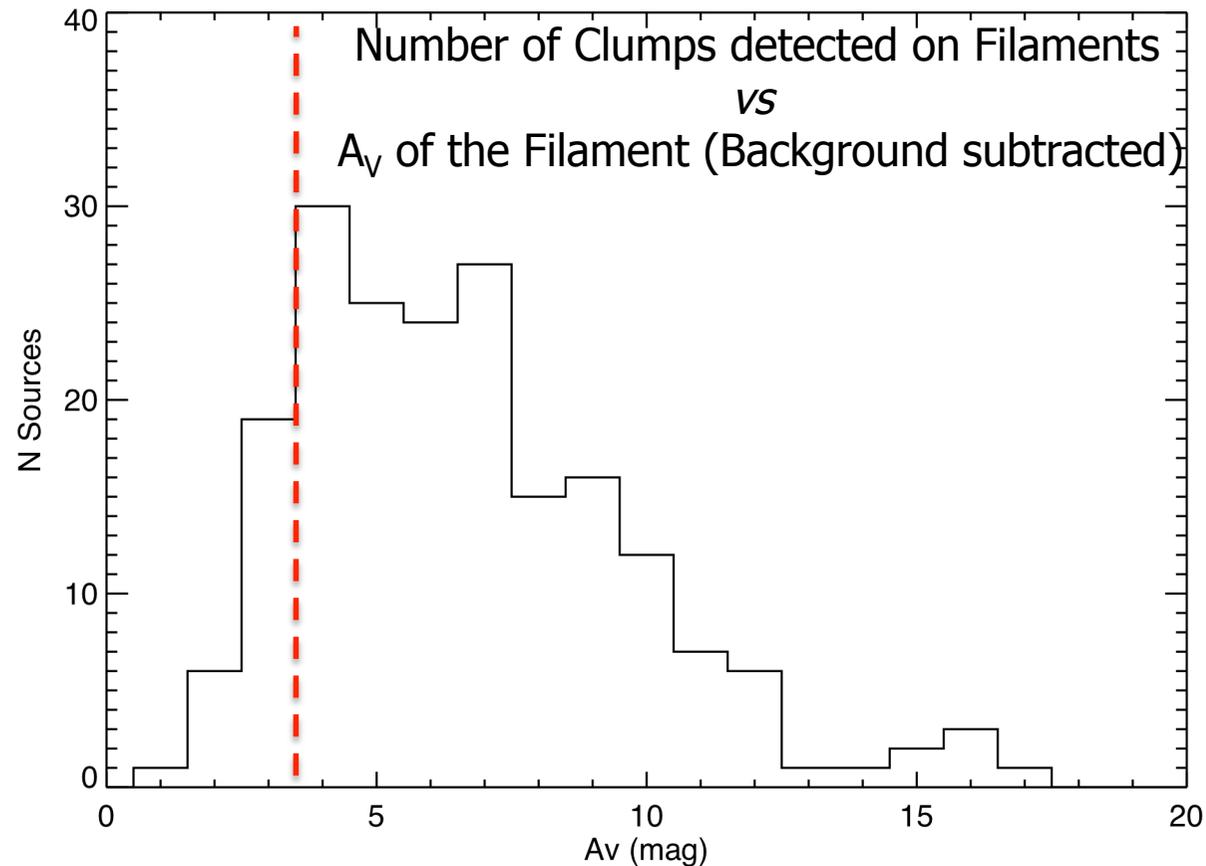
Star Formation drives up the energy budget in the clump, raising its global temperature and luminosity. This can be ideally followed in the [L,M] diagram

# Compact Clumps surface density



**Dense Clumps** with super-critical surface density  $\Sigma > 1 \text{ g cm}^{-2}$  potentially able to form High-Mass stars, are preferentially found on filaments

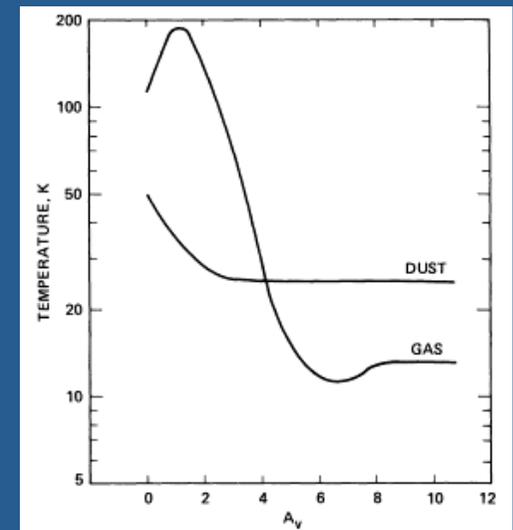
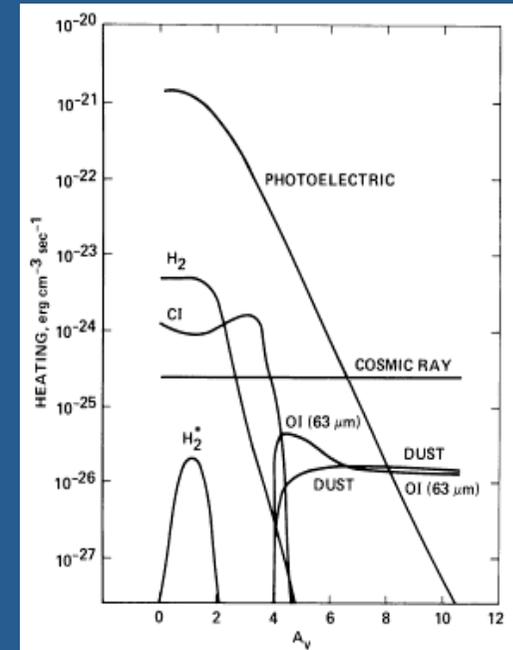
# A threshold for clump appearance



A threshold at  $A_V \approx 3-4$  is found, lower than towards nearby star forming regions (André+10, about  $A_V=7$ ):

- are we looking at a different process ?
- beam dilution effects (our regions are more distant) ?
- different assumptions of background subtraction ?

Tielens & Hollenbach 1985



# Hi-GAL is pushing Galactic Star Formation into the Mega-Source era: are we ready for the consequences ?

- Reliable bolometric luminosities are at the foundation of SFR estimates. Herschel spatial resolution improves an order of magnitude over IRAS, with the result that the bandmerging of Far-IR compact sources in the Galactic Plane is now a tractable nightmare...but yet a nightmare.
- Hi-GAL mostly reveals clumps/protoclusters for  $d \geq 1$  kpc systems; a factor 10 jump in accessible spatial resolution is needed to resolve the high-mass end of the mass function
- Improve diagnostic evolutionary tools: e.g. HII regions tracers like OIII, NIII and sensitive radio continuum to pinpoint the arrival on the ZAMS
- Chemical fingerprinting is the essential complement to the SED continuum characterization.

Rapid-fire & sensitive multiband continuum (full SAFARI range) and spectroscopic snapshots (single-dish and interferometry) for (tens of) thousands of clumps:

Hi-GAL catalogues will be the master target list to select source samples of your choice