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Results from the Herschel Gould Belt Survey in the Ophiuchus Main Cloud

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Abstract. As part of the *Herschel* Gould Belt Survey (HGBS), the Ophiuchus molecular cloud was imaged in the submillimeter range. Here, we summarize and briefly discuss the main results.

Keywords. stars: formation, mass function, ISM: structure

1. Introduction

Our understanding of star formation has greatly advanced in the past 10 years thanks to the help of large photometric multi-wavelength surveys. In particular, the *Herschel* Gould Belt Survey (André et al. 2010) represents a significant step forward towards a better understanding of the processes happening in nearby molecular clouds.

As part of the HGBS, extensive submillimeter continuum images of the Ophiuchus Main Cloud (L1688) were produced. Harbouring low-mass star formation, at 140 pc, the Ophiuchus star-forming region has been studied for more than three decades at wavelengths ranging from the X-ray (Montmerle *et al.*1983) to the infrared and millimeter domains (e.g. Wilking *et al.*1989, Motte *et al.*1998). A deep census of both prestellar cores and young protostars was obtained from the *Herschel* data using the multi-scale, multi-wavelength source extraction algorithm, *getsources* (Men'shchikov *et al.*2012). One of the advantages of *Herschel* is that it observed at wavelengths covering the peak of the spectral energy distributions (SEDs) of young protostars and prestellar cores.

2. Main Results

In the L1688 cloud, we found approximately 200 candidate prestellar cores, including 70 cores with a robust classification, and ∼200 young stellar objects including 40 embedded protostars. Among the starless cores detected with *Herschel*, the densest objects are gravitationally bound and can be considered prestellar in nature. In addition to prestellar cores, *Herschel* also detects very low-mass unbound cores (Fig. 1).

Nearly all (99%) detected prestellar cores are found in zones at $A_V \geqslant 8$ (Fig. 2), and 80% of them are detected in filaments with column densities above 5 x 10^{21} H_2 $.cm^{-2}$ as estimated by *getfilaments*.

Filaments are ubiquitous structures in star-forming regions (André *et al.*2014, Könyves *et al.*2015) and their close correlation with the presence of prestellar cores testifies to their importance in the early stages of star-formation. The detection of filaments in L1688 (Fig. 3) with different algorithms, such as DisPerSe (Sousbie 2011) and *getfilaments* (Men'shchikov 2013), is an important result in a region not previously known to be filamentary (cf. Wilking *et al.*1989).

After deriving the properties of the extracted *Herschel* cores, we obtained the distribution of prestellar cores masses or core mass function (CMF) in L1688. The resulting CMF (blue histogram in Fig. 4) is very similar in shape to the initial mass function (IMF), thus confirming the role of prestellar cores as precursors of protostars (cf. Motte *et al.*1998). The star-formation efficiency in individual cores, ϵ_{core}, is estimated to be 0.5±0.1 in this region, based on the location of the peak of the prestellar CMF (Fig. 4) compared to that of the IMF.

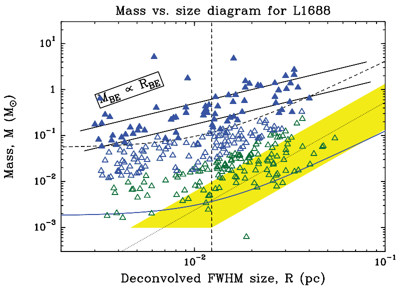

Figure 1. Mass vs. Size diagram for the starless dense cores found with *Herschel* in L1688. Robust prestellar cores are shown by filled blue triangles and candidate prestellar cores by open blue triangles. Very low-mass unbound starless cores (open green triangles) are detected but may be transient.

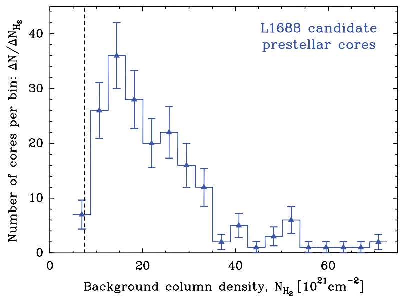

Figure 2. Number of prestellar cores per background column density bin. Most prestellar cores are formed above $A_V = 8$. This is similar to the core formation threshold found in the Aquila cloud (Könyves *et al.*2015).

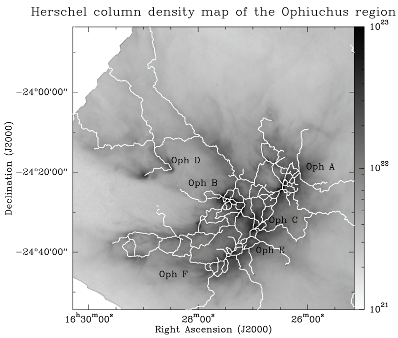

Figure 3. *Herschel* column density map of L1688 (Ladjelate *et al.*in prep). The white lines trace the filaments detected with DisPerse (Sousbie 2011). Most prestellar cores are formed along these lines, in the densest filaments.

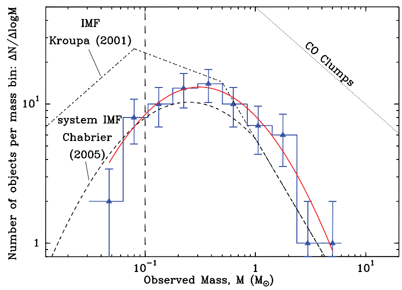

Figure 4. Prestellar core mass function (CMF) in L1688 (in red). The peak of the prestellar CMF appears to be close to 0.3 $M_\odot$ in L1688. Simulations suggest that the actual peak is at ∼0.5 $M_\odot$ because the derived masses are underestimated by ∼50 % on average (cf. Appendix B of Könyves *et al.*2015).

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