Intermediate to high-mass star formation in the Rosette Molecular Cloud and in Isolation as observed by *Herschel* and the PdBI

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The first results of the HOBYS Herschel imaging survey were obtained for the Rosette molecular cloud. Complementarily, the EPOS key programme observed isolated cluster-forming clumps selected using the ISOSS 170µm survey. Furthermore, interferometric observations were accomplished using the IRAM PdBI. The presented target regions are within a distance of about 2kpc and thus Herschel provides information on scales below typical clump sizes (<0.1pc). By revealing the differences in the nature of the presumed progenitors of high-mass stars and/or clusters, we aim to constrain the conditions under which intermediate- to high-mass stars form.

The OB Young Stellar Objects census of HOBYS

The ***Herschel* OB young stellar objects survey (Motte, Zavagno, Bontemps et al.)** observes massive molecular clouds in order to:

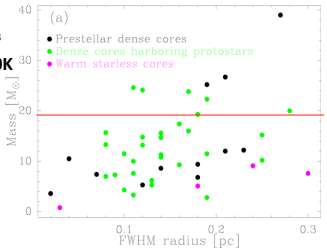
- **discover the precursors of OB stars (protostars & prestellar cores)**
- **measure their mass and luminosity**
- **assess the importance of triggering**

Studies of molecular complexes within 3kpc provide statistics for precursors of OB stars with 8 – 50$M_\odot$. Up to 3kpc, Herschel provides sufficient angular resolution to identify high-mass protostars (0.1 pc).

HOBYS first results

The clustered environment (of most of the HOBYS fields) makes the analysis at the best spatial resolution critical: Dense cores are defined using 160µm. SEDs built with up to 5 *Herschel* fluxes and 5 *Spitzer* fluxes give L_{bol} = 10 – 4000$L_\odot$. The 46 most massive dense cores in Rosette have been analysed:

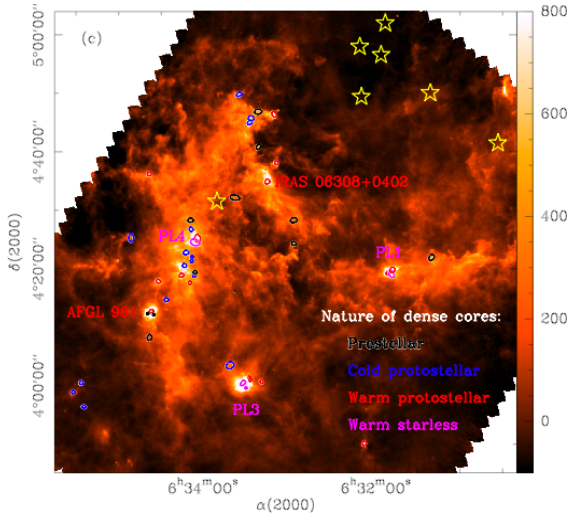
- **0.02 - 0.3 cloud structures**
- **averaged density: few 10^5 cm^{-3}**
- **averaged temperature: 12 – 40K**
- **M < 40$M_\odot$**



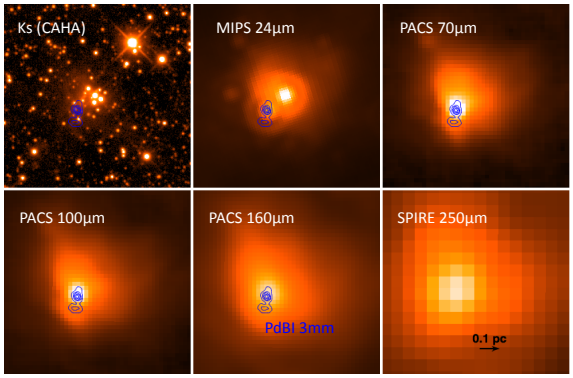
Nine candidate high-mass star-forming cores (M > 20$M_\odot$):

- 2 IR-bright protostellar cores
- 4 IR-quiet protostellar cores
- 3 prestellar cores (0.22pc, 13K, 30$M_\odot$)

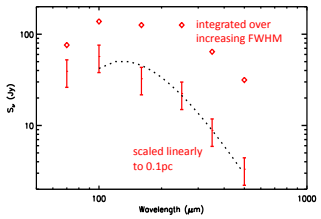
For comparison: Not a single prestellar core identified in Cygnus-X (Motte et al. 2007) or NGC 6334 (Russeil et al. 2010, in prep.).



Rather isolated cluster-forming clump observed by the EPOS key programme (Krause, Henning et al.): ISOSS J20153+3453



The near-infrared shows a cluster of already formed young stellar objects. The brightest sources dominate also the mid-infrared (shown here: 24µm). However, the far-infrared and submillimetre emission is dominated by one or more objects further in the south-east. The whole cluster appears embedded in an envelope. The 3mm continuum observed with the PdBI (contours) reveals 2-3 compact sources coinciding with the far-infrared peak. The HCO^+ data cube also traces the outflow activity of these objects (not shown).

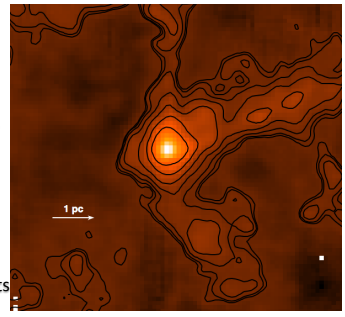


A first estimation of the clump parameters is possible using the measurements of the integrated flux. For comparison with the Rosette cores we scale the fluxes linearly to a size of 0.1pc. A dust temperature of 25K results in a mass of 10-20$M_\odot$ for the dense central part.

Future work: Compare the detailed properties of cluster-forming clumps

1) Using the short-wavelength *Herschel* data in combination with our PdBI maps, we will determine the substructure of clumps in both HOBYS and EPOS fields and compare e.g. the degree of fragmentation.

2) The Herschel maps reveal the structure of the environment: ISOSS J20153+3453 possibly lies towards a region where filaments merge.



References

Motte et al., 2007, A&A, 476, 1243

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