

Herschel imaging survey of OB Young Stellar objects

A guaranteed time key programme with Herschel Space Observatory 



HOBYS



F. Motte, A. Zavagno, S. Bontemps

SPIRE consortium SAG3 (85 hrs) - PACS Marseille (19 hrs) - HSC (22 hrs)



A. Abergel, P. Ade, Ph. André, L. Anderson, J.-P. Baluteau, J.-P. Bernard, L. Cambrésy, T. Csengeri, P. Cox, L. Deharveng, J. di Francesco, A. di Giorgio, T. Giannini, M. Griffin, P. Hargrave, M. Hennemann, M. Huang, J. Kirk, S. Leeks, J. Li, A. Marston, P. Martin, A. Menshchikov, V. Minier, S. Molinari, Q. Nguyen, G. Olofsson, A. Omont, P. Persi, S. Pezzuto, M. Reid, A. Rivera-Ingraham, J. Rodon, A. Roy, D. Russeil, S. Sadavoy, P. Saraceno, M. Sauvage, N. Schneider, B. Sibthorpe, L. Spinoglio, L. Testi, D. Teyssier, R. Vavrek, D. Ward-Thompson, G. White, C. Wilson, A. Woodcraft.

Science Demonstration Phase - First results

(presented by S. Bontemps)

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... special thanks for the main contributors on the SDP first look data.

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Science

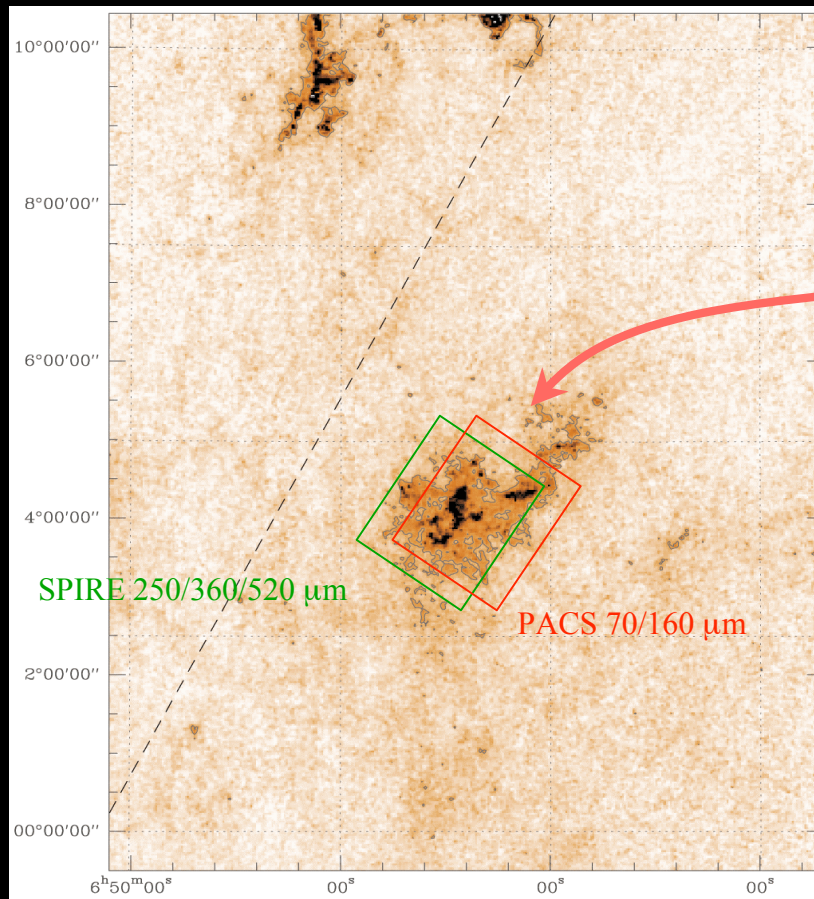
- Reveal precursors of intermediate- to high- mass stars.
- Luminosities and masses to build evolutionary diagrams.
- Assess the impact of feedback to trigger star formation.

Observation details

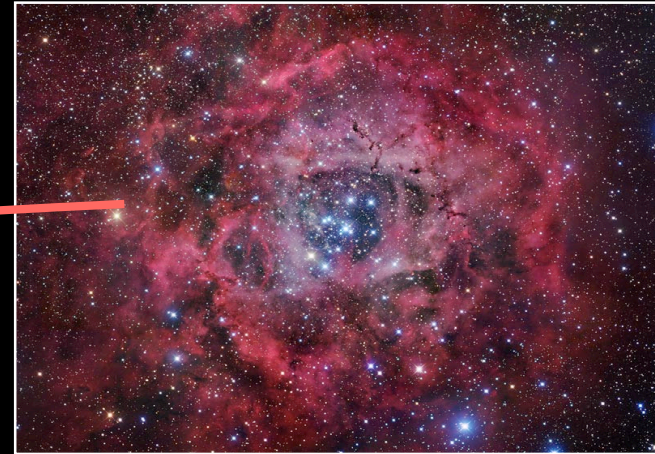
- **Parallel SPIRE-PACS mode @ 20"/sec.**
9 nearby (0.7-3 kpc) GMCs @ 70, 160, 250, 350 and 500 μm .
- **PACS maps (70/100 μm) and spectro (cooling lines).**
9 nearby HII regions with simple geometry.

Full list of targets of the survey available on the web site of HOBYS
(google “Herschel HOBYS”).

Science Demonstration Phase targets

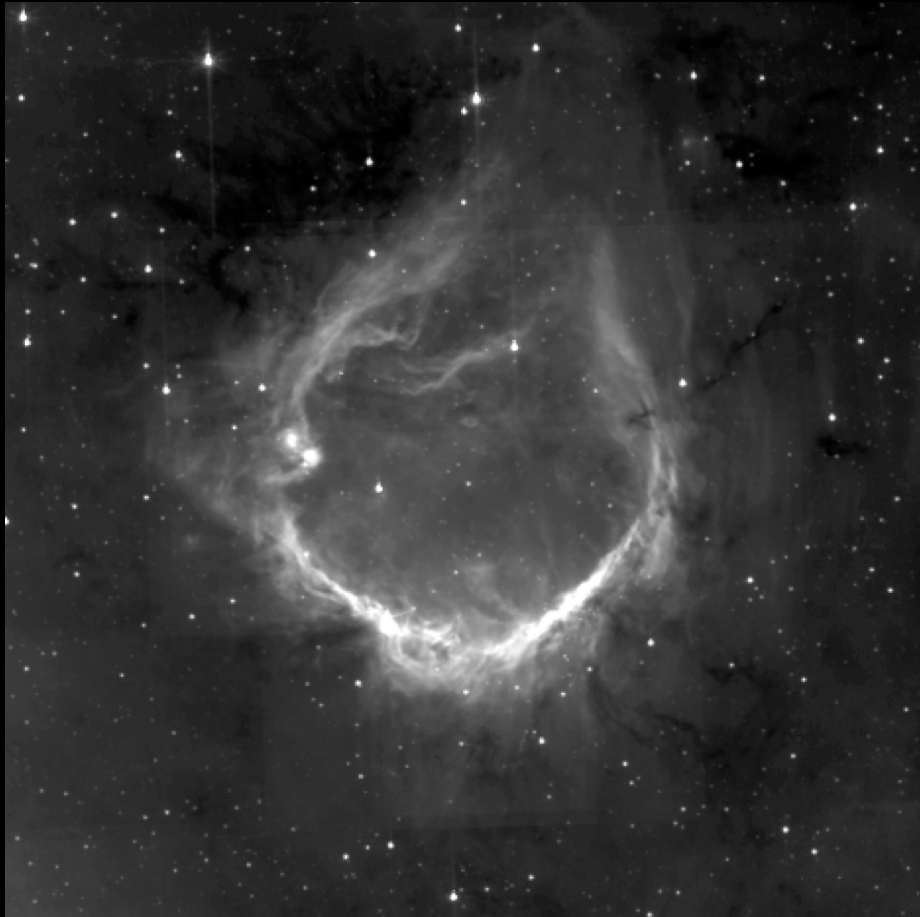


2MASS extinction map - Bontemps et al.



- The Rosette Molecular Cloud:
60' x 80' scan map in parallel mode at 20"/sec (5.3 hrs)
- An intermediate distance GMC (1.6 kpc)
- $3.5 \times 10^5 M_{\odot}$
- NGC2244 - Seven O stars clearly influencing the GMC.

Science Demonstration Phase targets



Spitzer 8 μ m - Deharveng, Zavagno et al.(2009)

- RCW120:
 - 30' x 30' scan map with PACS at 30''/sec (1.6 hrs), + PACS spectro range still pending (3.3hrs).
 - Galactic HII region.
 - d=1.3 kpc.
 - O8 exciting star.
- Sh2-104:
 - same dataset (not yet processed).

Science Demonstration Phase targets



- RCW120:
 - 30' x 30' scan map with PACS at 30''/sec (1.6 hrs), + PACS spectro range still pending (3.3hrs).
 - Galactic HII region.
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 - O8 exciting star.



SuperCOSMOS H α (red) +Laboca 870 μ m (blue) - Deharveng, Zavagno et al.(2009)

Data reduction summary

- Rosette Molecular Cloud: observed Oct. 20
 - **SPIRE**: HIPE 1.2 (default pipeline) using median baseline and naïve map-maker.
 - **PACS**: HIPE 2.0.678 with high-pass filter and Madmap. Blue channel: no deglitching and improved noise to correct drifts and jumps due to recycling, and calibration Blocks.
 - Source detection (getsources by A. Menshchikov).
- RCW120: observed Oct. 9
 - **SPIRE**: level 2 of pipeline.
 - **PACS**: improved PACS-HIPE scripts to produce maps.

RCW120

Herschel/PACS



100 μm



160 μm

RCW120

Herschel/PACS

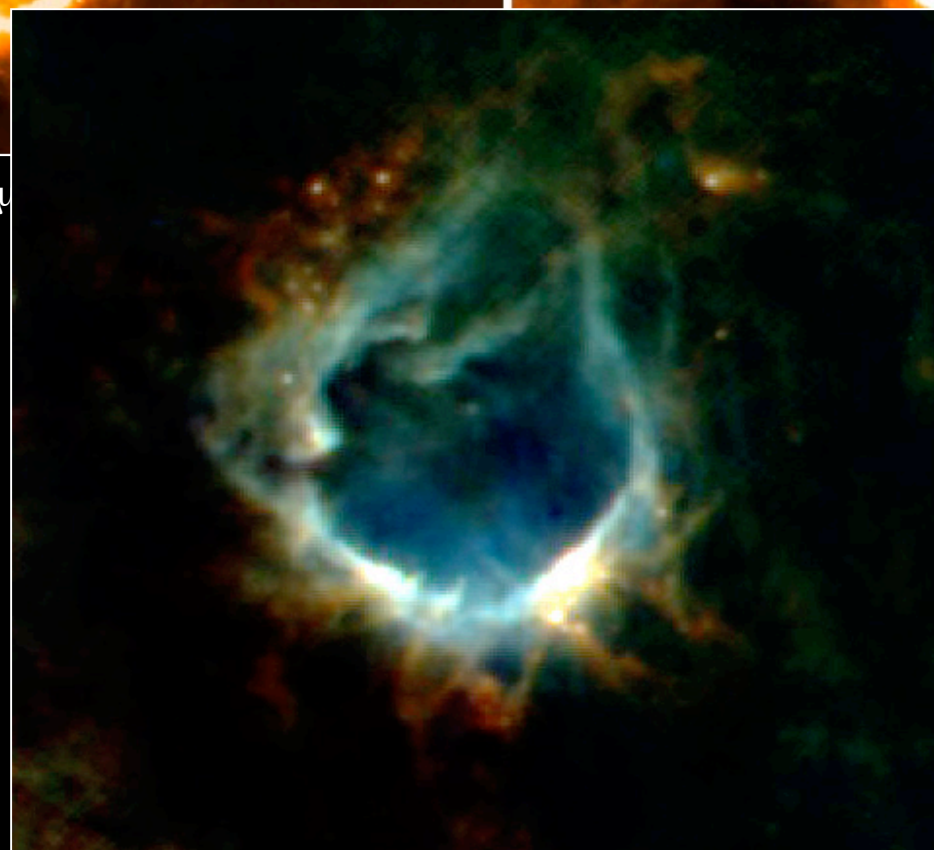


100 μ m



160 μ m

4 pc
↑
↓



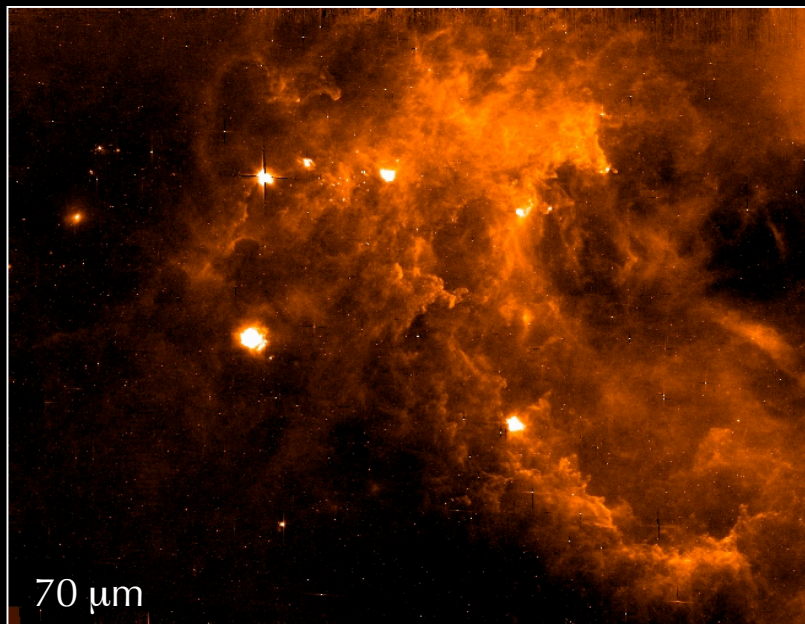
PACS+SPIRE
100, 160, 250 μ m

December 18th, 2009

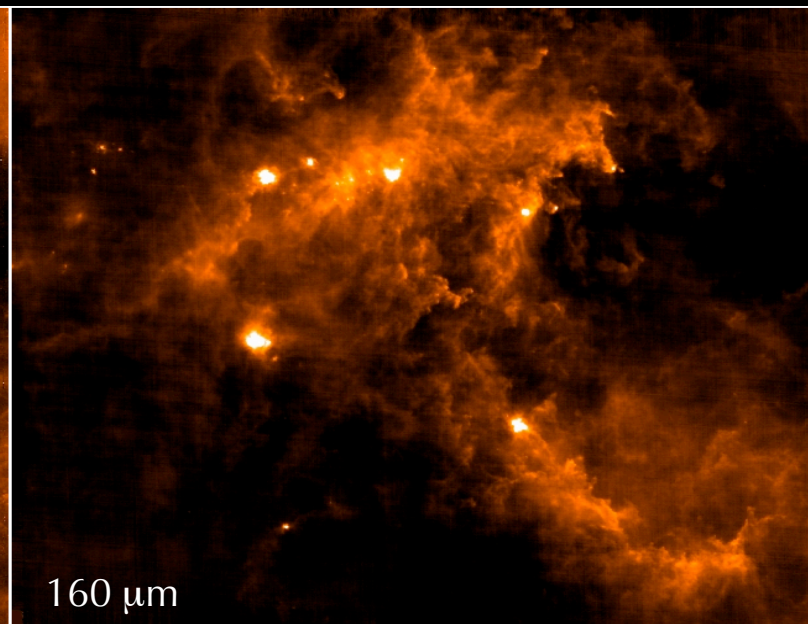
HOBYS - SDP workshop, Madrid

Rosette Molecular Cloud

Herschel/PACS



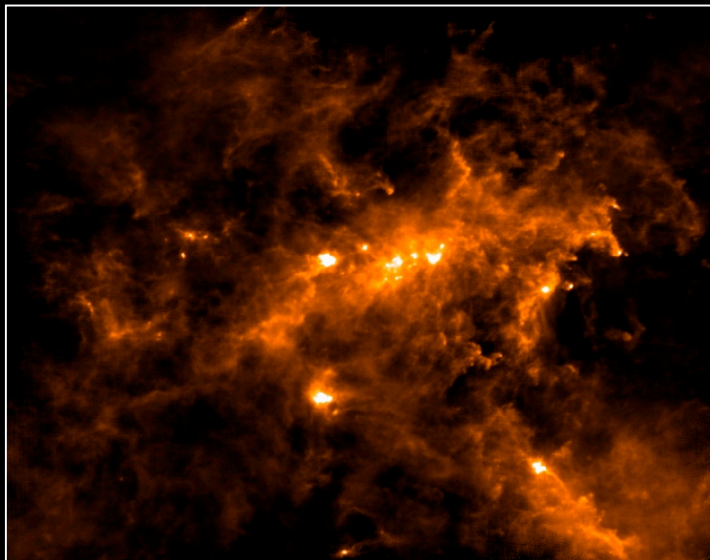
70 μm



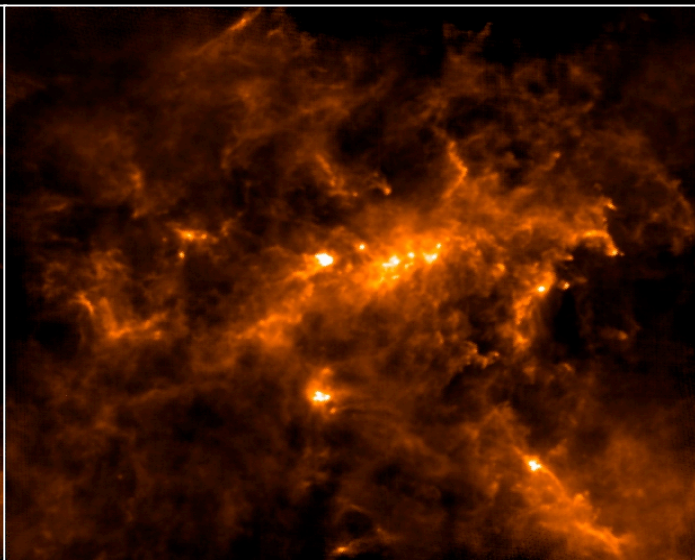
160 μm

Rosette Molecular Cloud

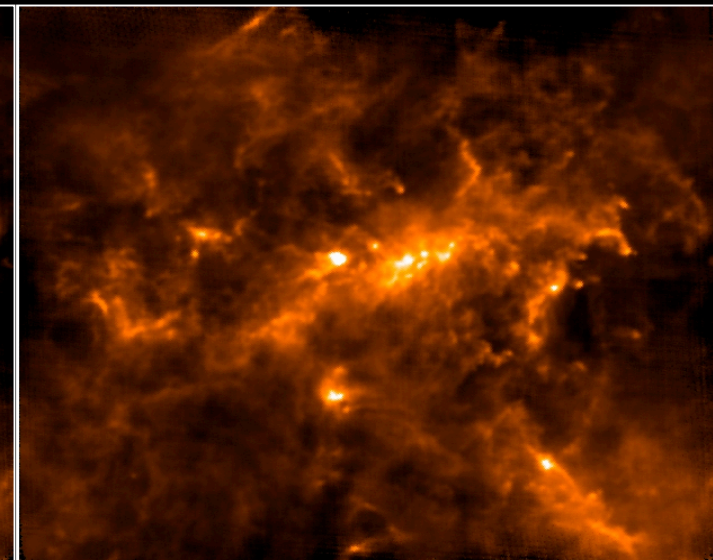
Herschel/SPIRE



250 μm



350 μm



500 μm

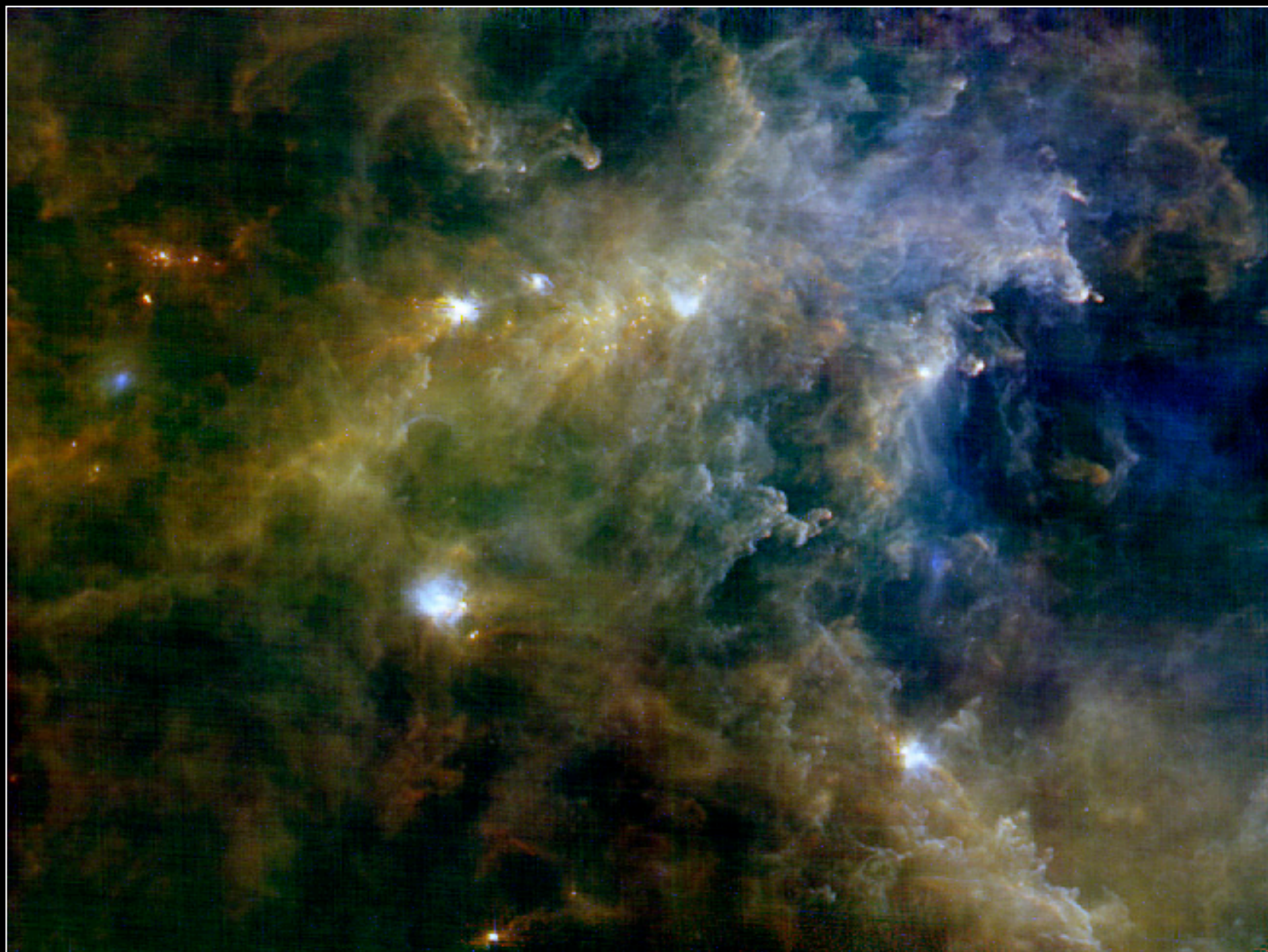
Rosette Molecular Cloud



HOBYS - SPIRE consortium

PACS 70, 160 μm

Rosette Molecular Cloud



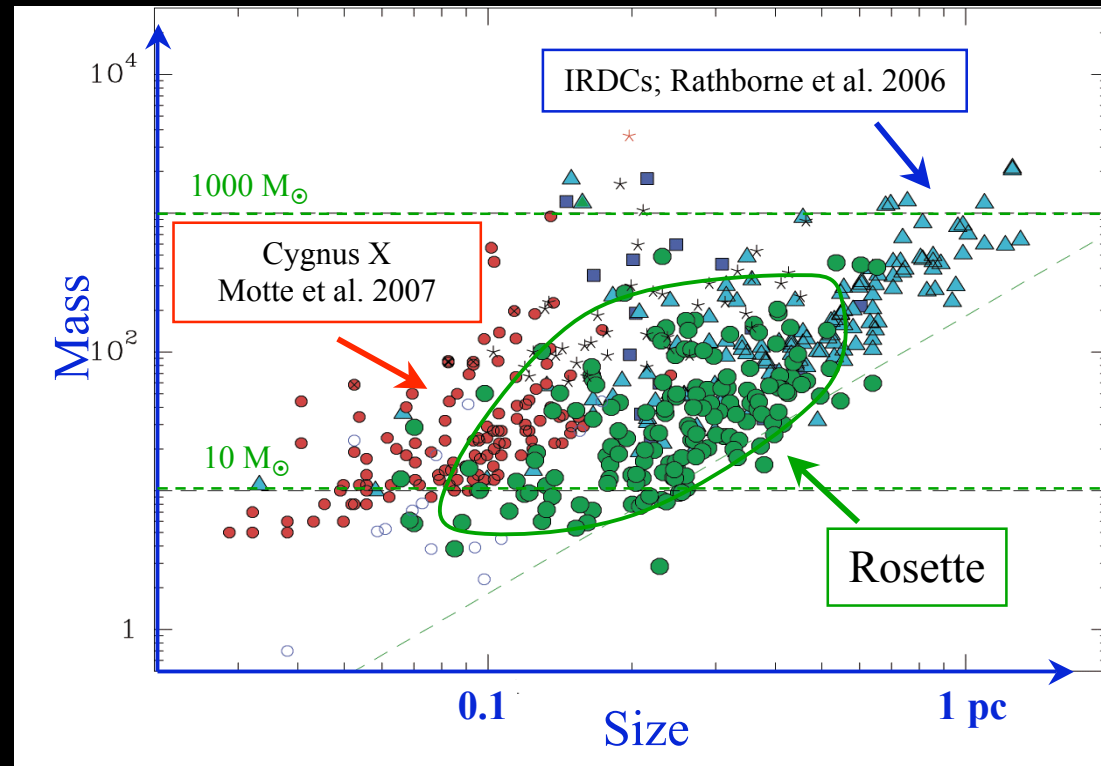
HOBYS - SPIRE consortium

PACS+SPIRE 70, 160, 250 μm

A population of massive dense cores in Rosette

- First source extraction (preliminary results).
- 192 dense cores in SPIRE maps.
- SPIRE bands to accurately measure cloud masses.

- Intermediate between Cygnus X and IRDCs.
- A few candidates to form high-mass stars.

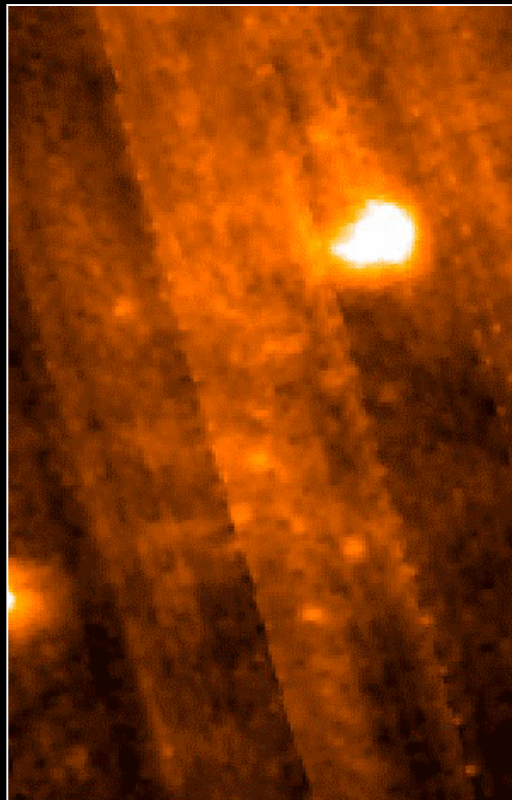
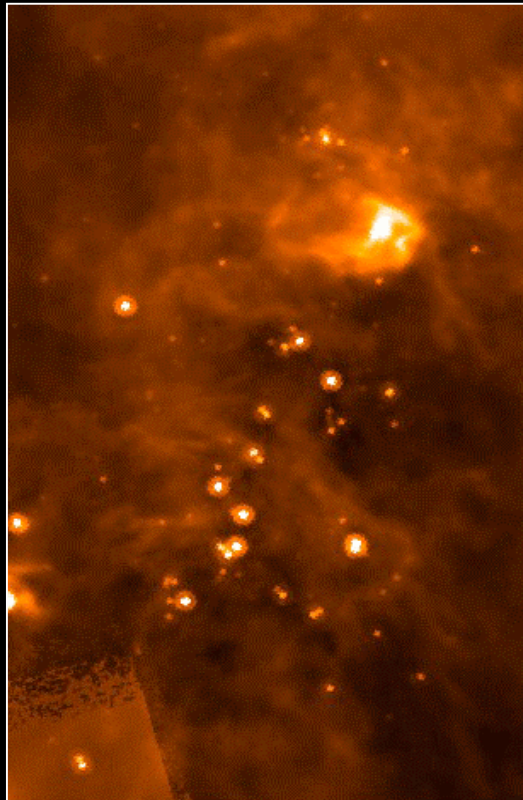


Individual Protostars

Spitzer
24 μm

70 μm

0.5 pc
↑
↓

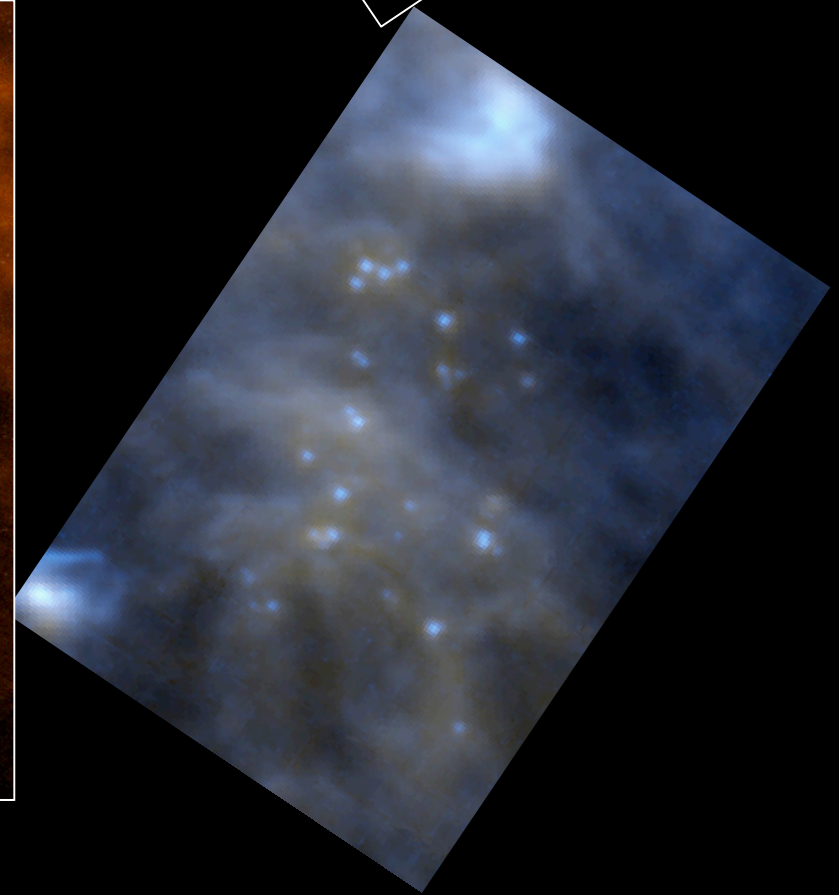
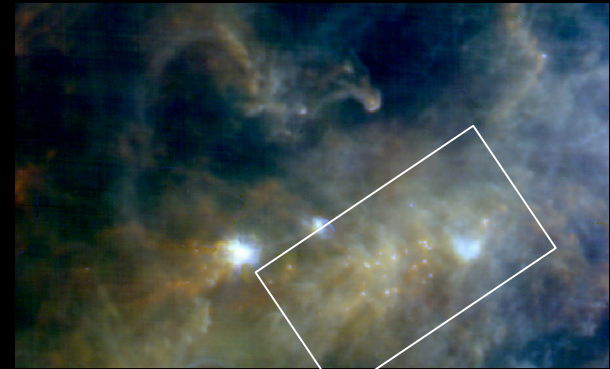
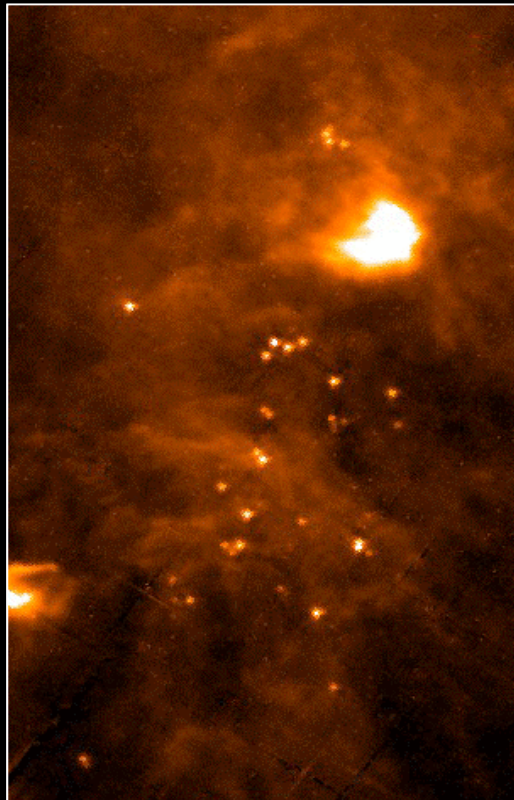
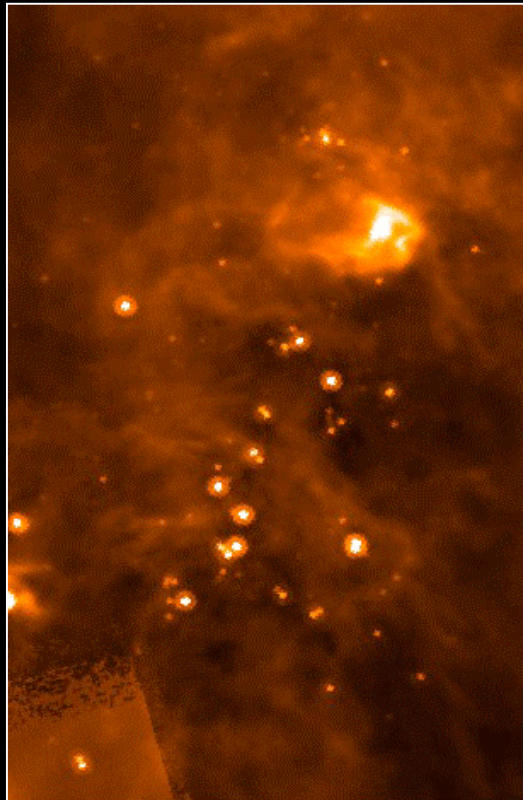


Individual Protostars

Spitzer
24 μm

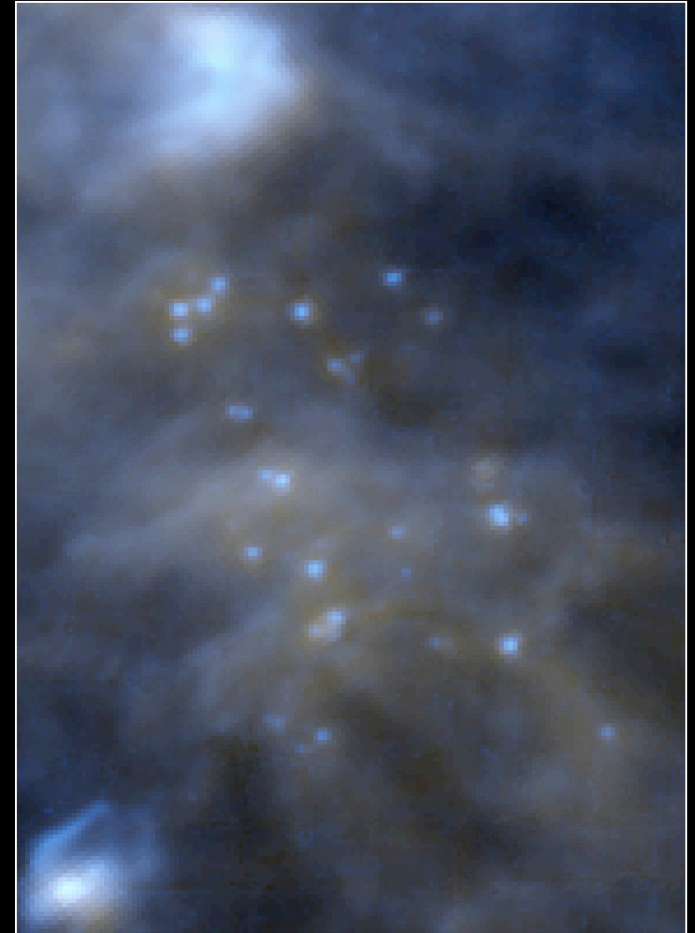
Herschel
70 μm

0.5 pc
↑
↓



Individual Protostars

- A complete census of young stellar objects.
- Tens of Class 0/I YSOs, a few cold (younger?), compact objects (not seen at $24\ \mu\text{m}$).
- From Intermediate to high-mass: statistics as expected (Rosette = 5 % of HOBYS in terms of GMC mass).
- PACS images identify individual protostars: $5''$ at 1.6 kpc is 0.04 pc/ 8000 AU.



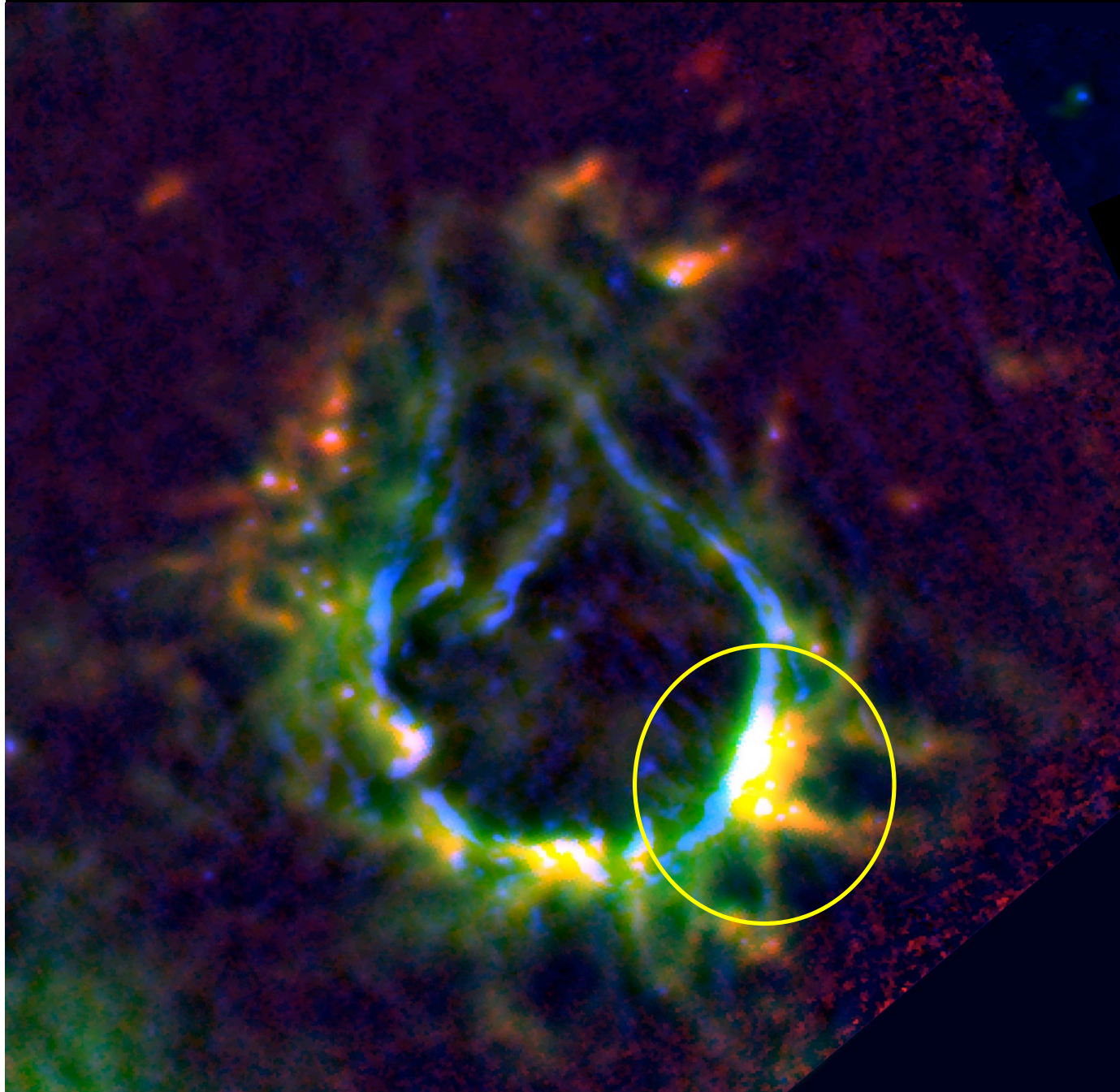
Influence of the large HII region in Rosette



- A clear gradient all over the cloud.
- Widespread influence of UV field.
- 10 pc at 10 - 20 km/s is 1 - 2 Myr.
- Cold gas close to the HII region, star formation in the central, densest regions (close to the interface of the UV bubble).

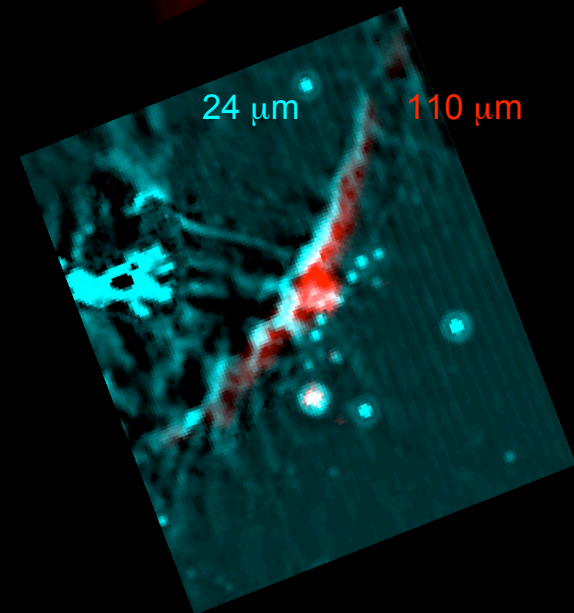
HERSCHEL RCW 120

A massive class 0?



110 μm

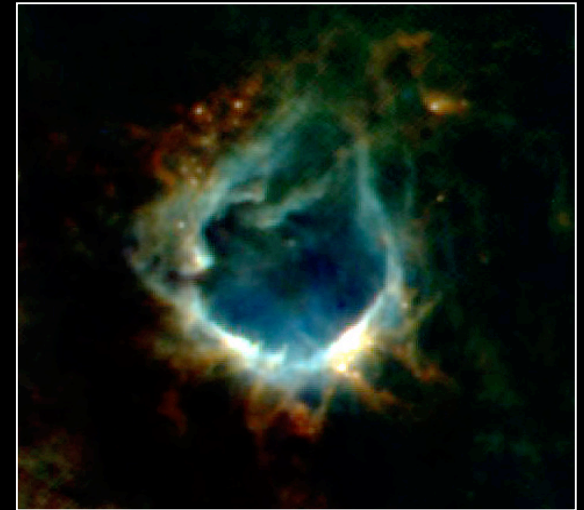
870 μm



PACS 110 μm unsharp image SPIRE 250 μm APEX 870 μm

Conclusions

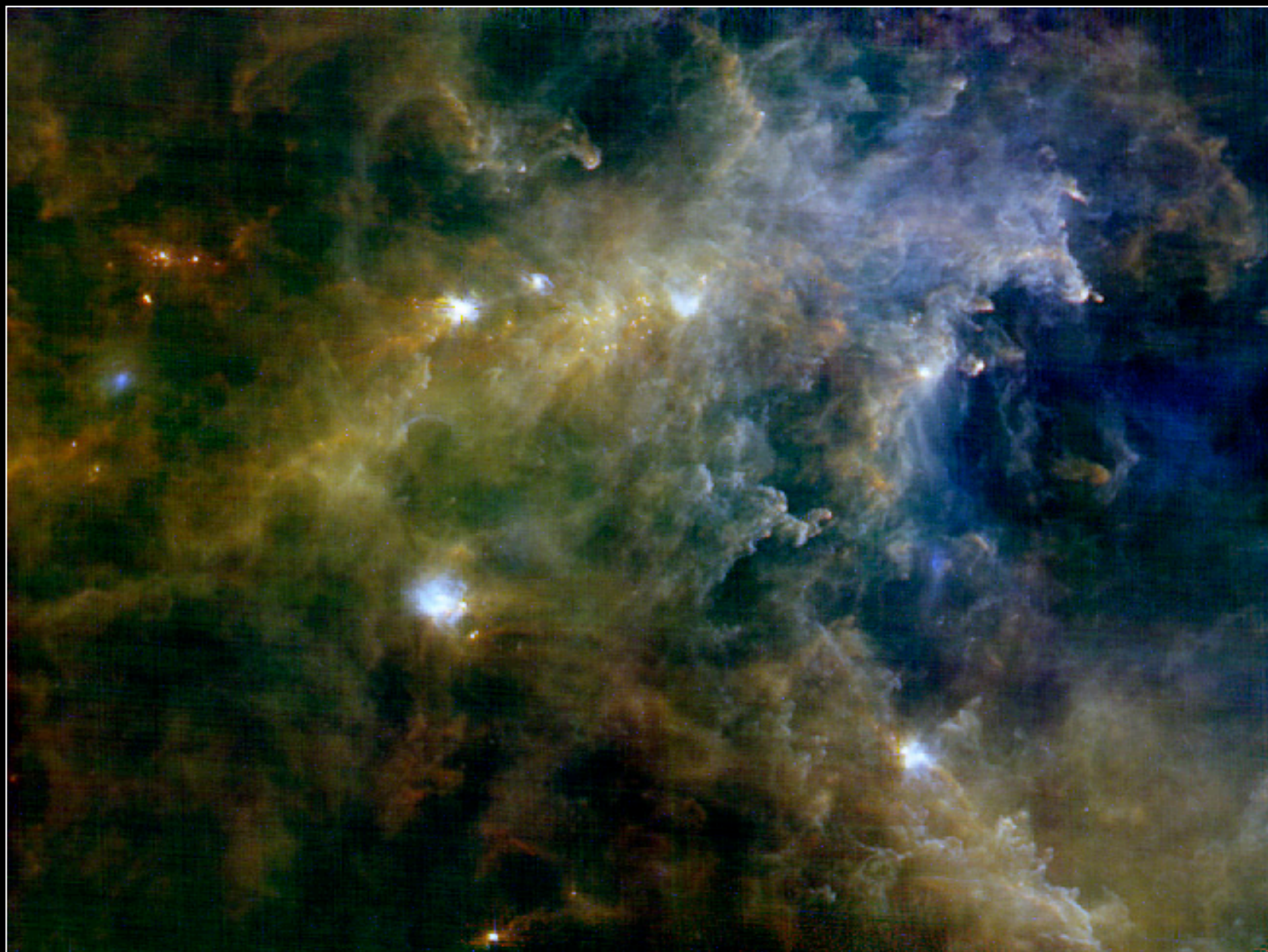
- Parallel mode is very efficient.
- PACS and SPIRE are **complementary**.
- Pipelines are performing well.
- Large scan maps are the way to go ...



- Population of Massive Dense Cores.
- Low- to High-mass Protostars.
- Feedback is clearly important.
- A massive **Class 0** in RCW120?

... many thanks to the
Herschel teams for the wonderful telescope
the SPIRE and PACS technical teams for two great instruments.

Rosette Molecular Cloud



HOBYS - SPIRE consortium

PACS+SPIRE 70, 160, 250 μm