# The Cool Universe:

# Herschel's First Year in Flight


## Göran Pilbratt


**AAS#216 Plenary presentation**

**Miami, 26/05/2010**

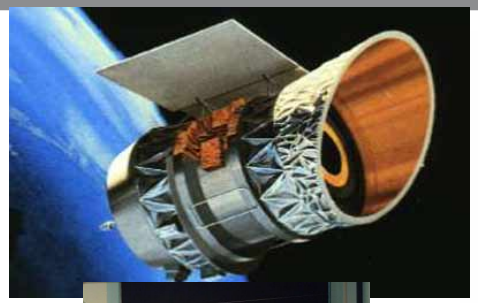
# Herschel in context – the heritage

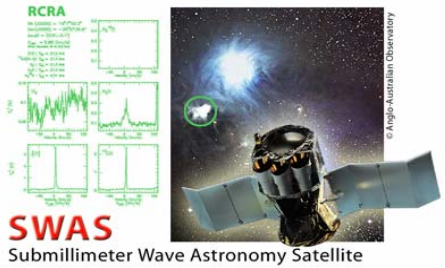
**IRAS (1983)**
- 57 cm
- 12-100 μm

**ISO (1995-98)**
- 60 cm
- 2.4-240 μm

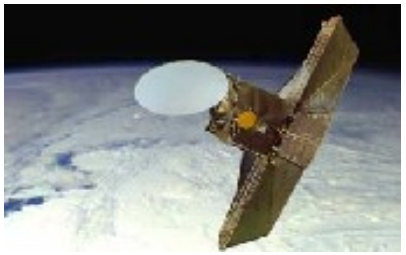
**Spitzer (2003-09)**
- 85 cm
- 3.6-160 μm
- +5 years 'warm'

**AKARI (2006-07**
- 67 cm
- 1.7-180 μm
- +3 years warm






**SWAS (1998-2004/5)**
- 55x71 cm
- 538-609 μm



**Odin (2001-06)**
- 1.1 m
- 517-617 μm

## Infrared:
- small <1 m telescopes
- wavelengths <200 μm

## Submillimetre:
- small ~1 m telescopes
- wavelengths ~600 μm

HERSCHEL SPACE OBSERVATORY

# What does Herschel offer?

## Large telescope

- 3.5 m diameter
- collecting area and resolution

## New spectral window

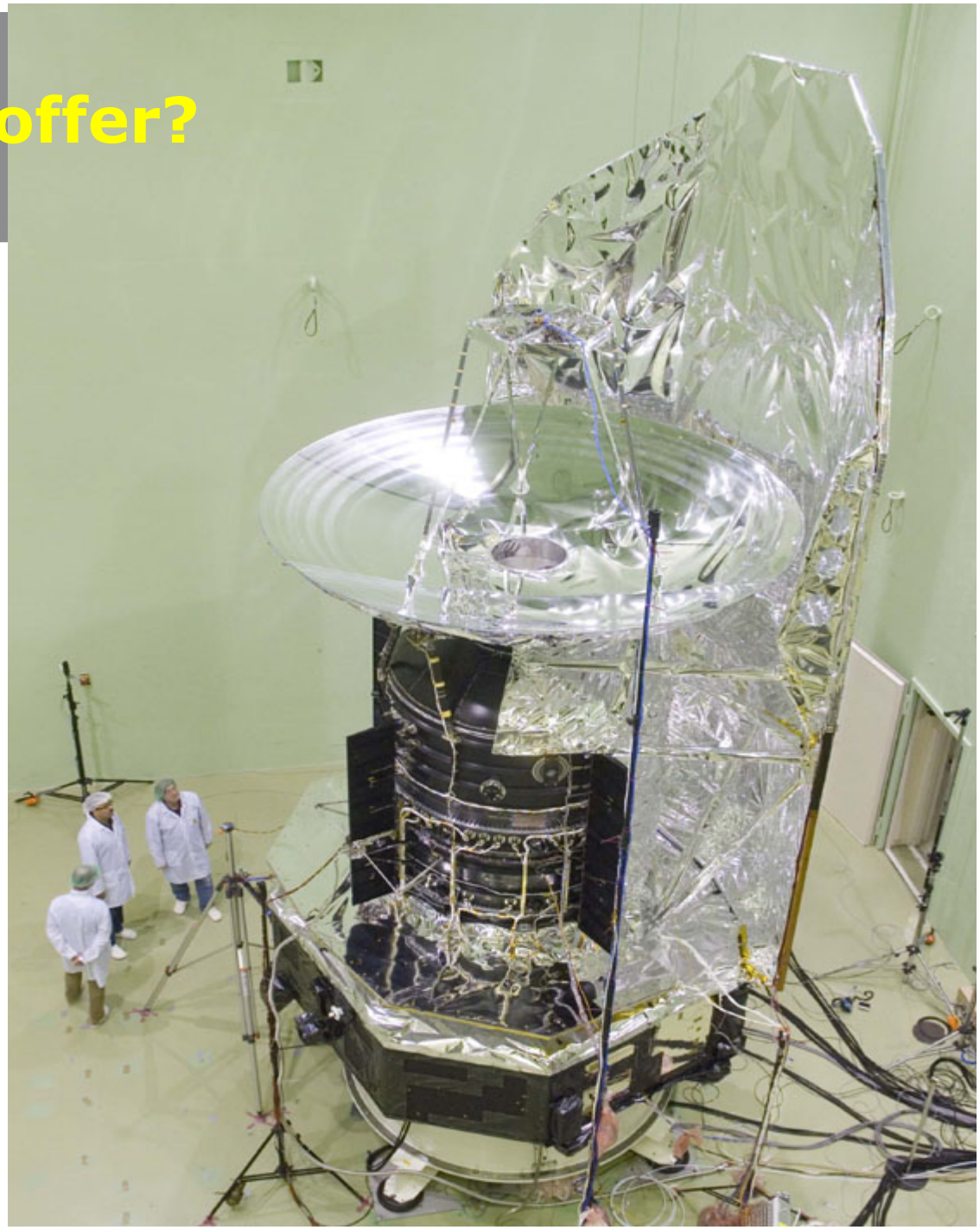
- 55-671 μm – bridging the far infrared & submillimetre – the 'cool' universe

## Novel instruments

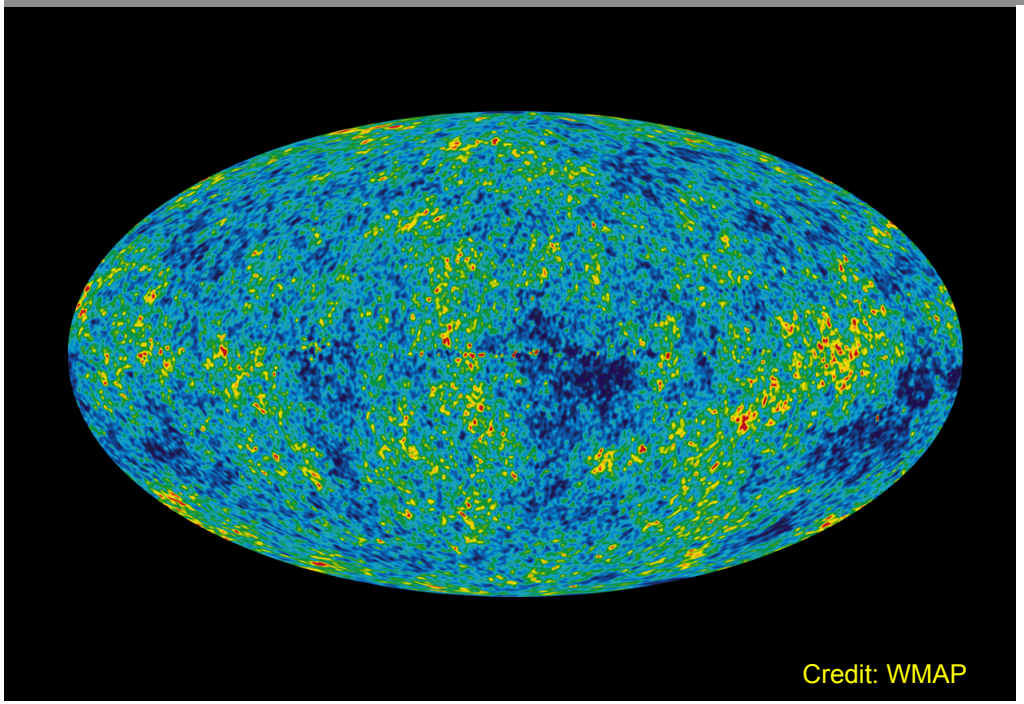
- wide area mapping in 6 'colours'
- imaging spectroscopy
- very high resolution heterodyne spectroscopy

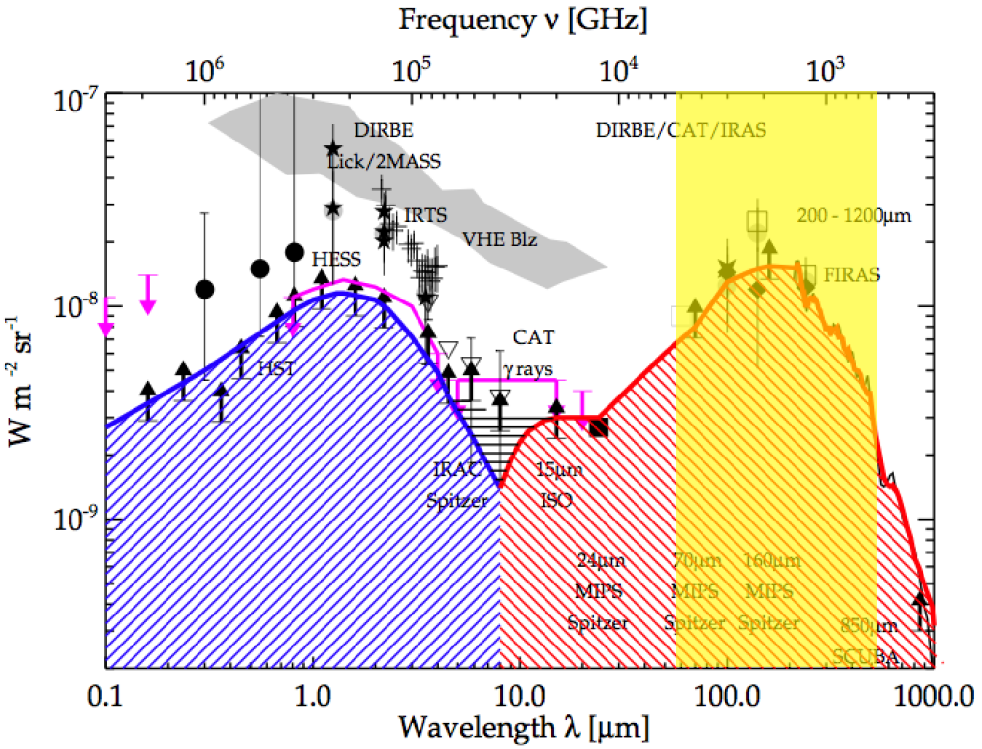
## Herschel objectives

- star formation near and far
- galaxy evolution over cosmic time
- ISM physics/chemistry
- our own solar system
- provide a unique perspective
- offer 3 years of routine observing



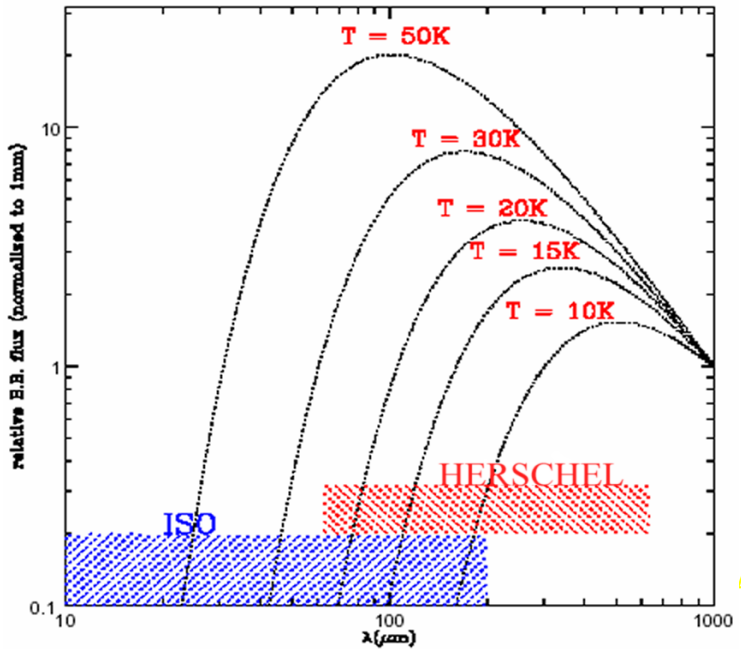
# Importance of the FIR & submm

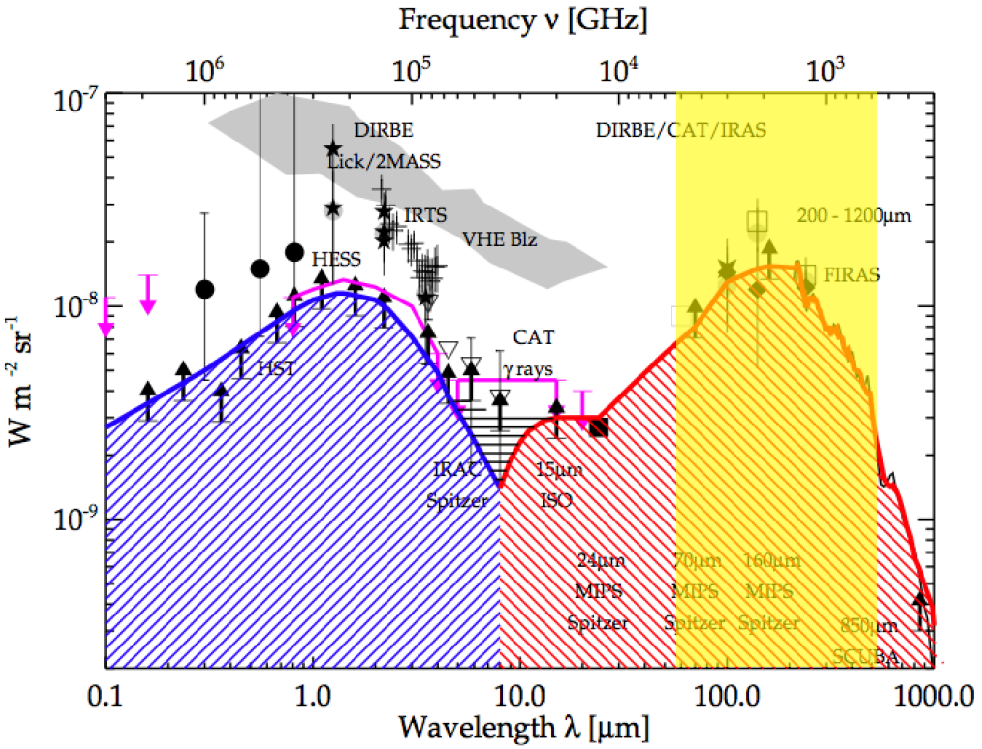



- **Half of the energy created in the Universe since the CMB has been reprocessed into the IR**
- **Herschel covers the IR peak and pushes into the submillimetre**

# Importance of the FIR & submm

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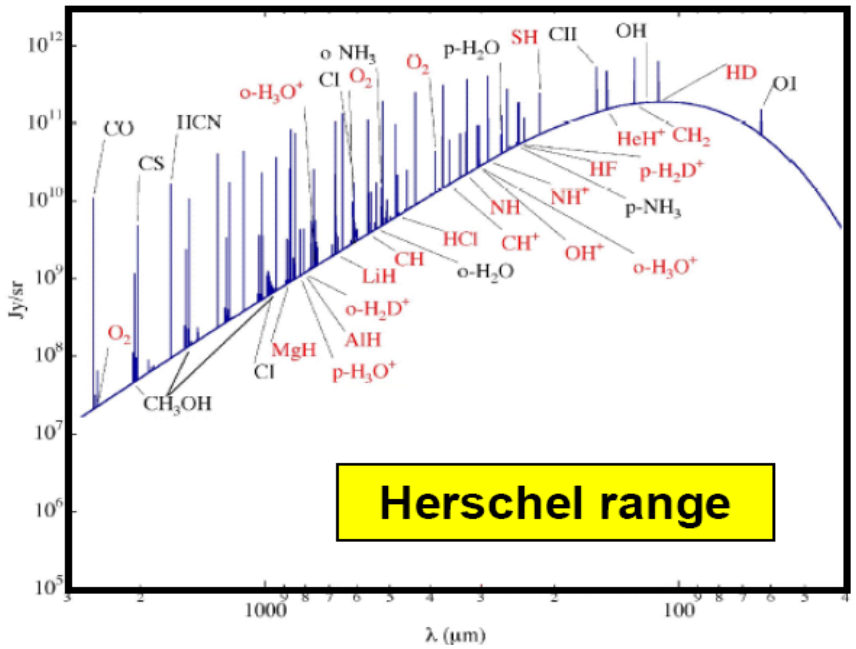


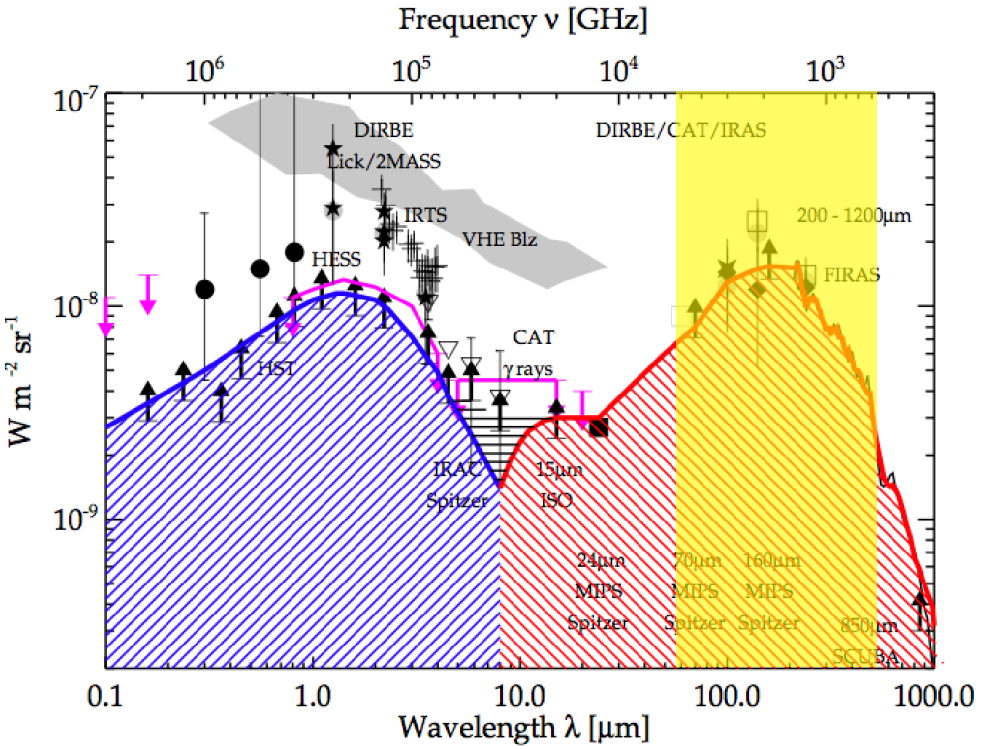


- **Half of the energy created in the Universe since the CMB has been reprocessed into the IR**
- **Herschel covers the IR peak and pushes into the submillimetre: cold black-bodies & spectral lines**

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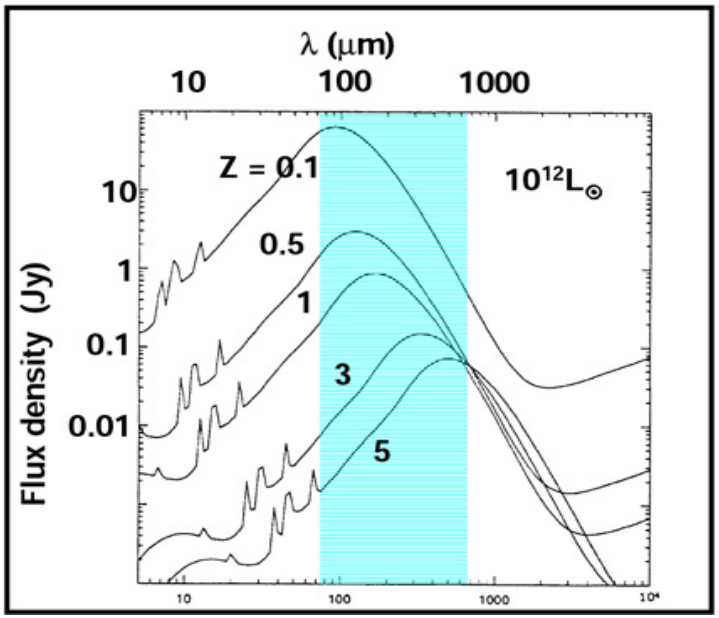


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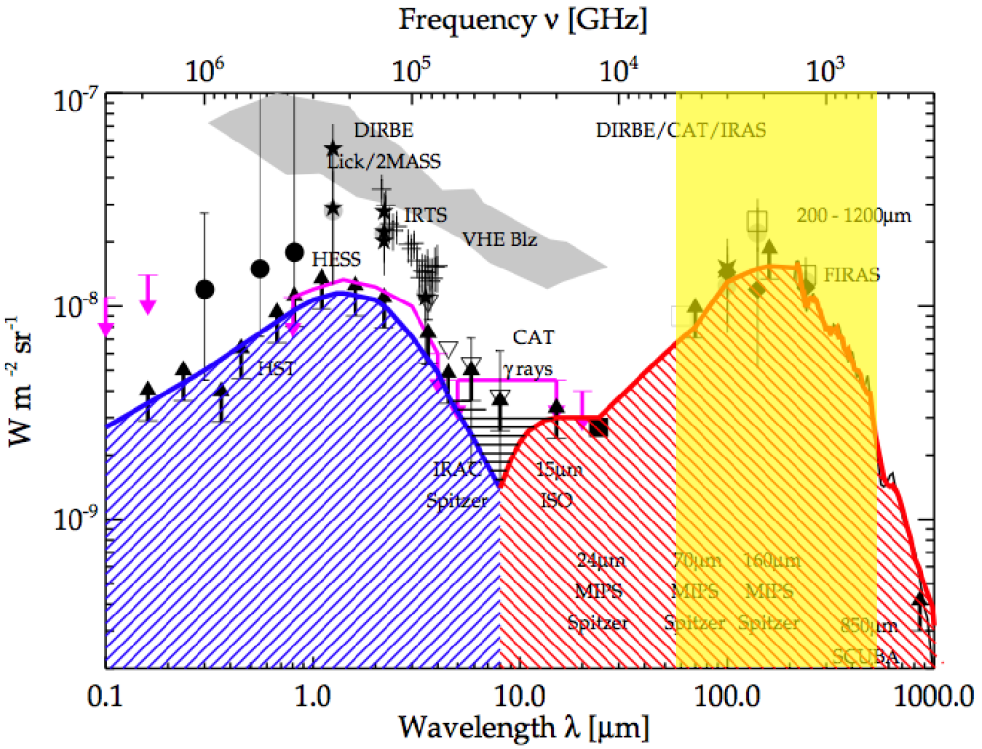


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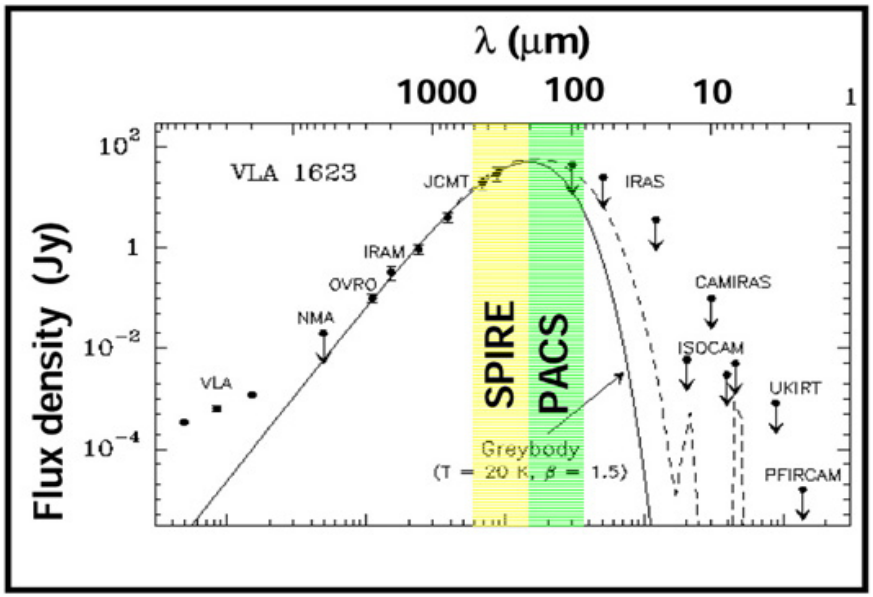
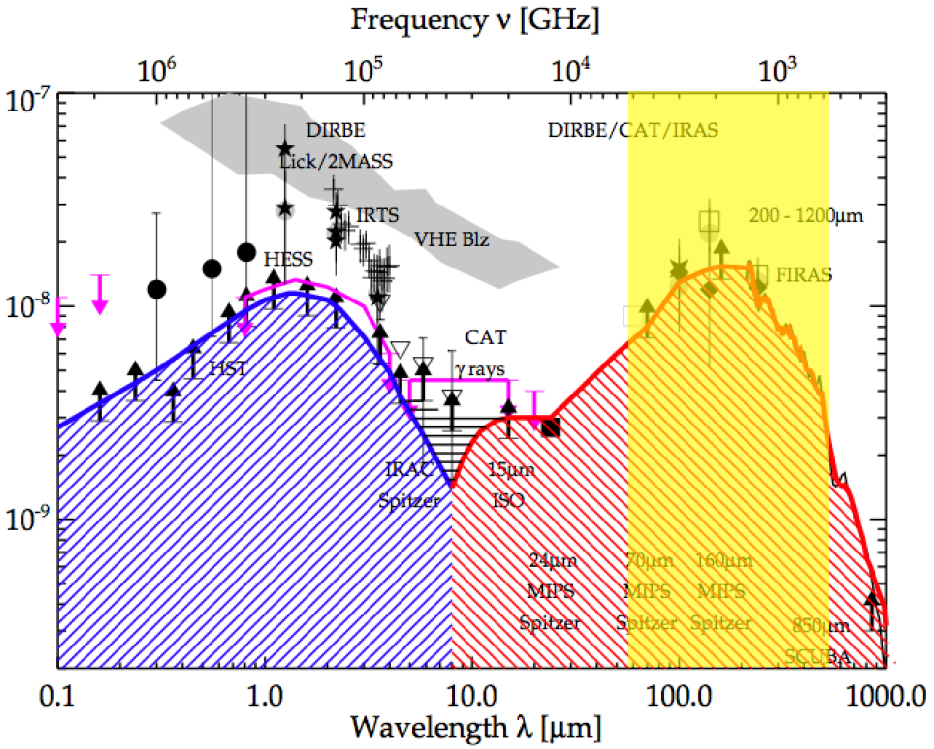
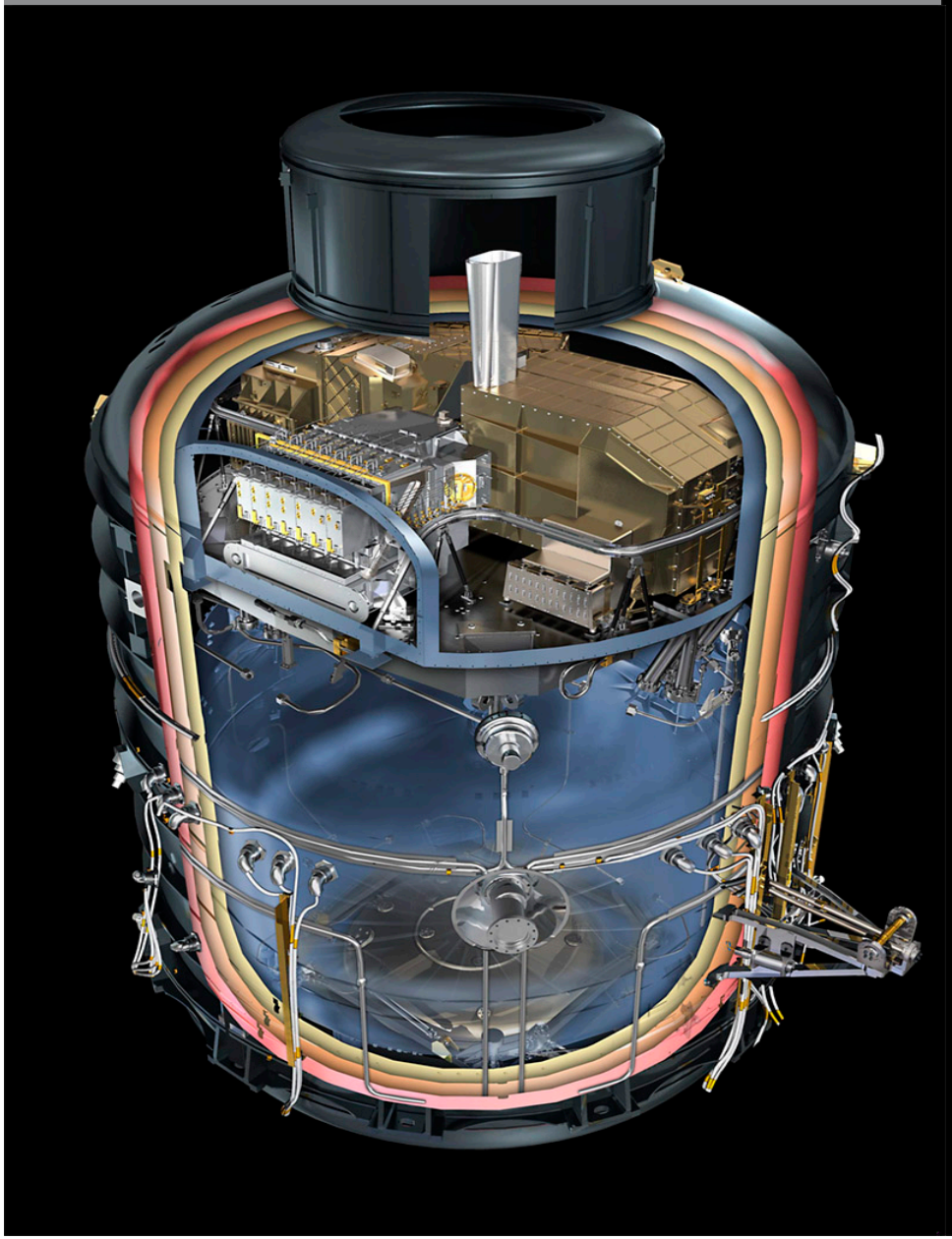



- **Half of the energy created in the Universe since the CMB has been reprocessed into the IR**
- **Herschel covers the IR peak and pushes into the submillimetre: IR-bright galaxies & SF early phases**

# Spacecraft



# Herschel – the machine

3 novel science instruments:
PACS, SPIRE, HIFI

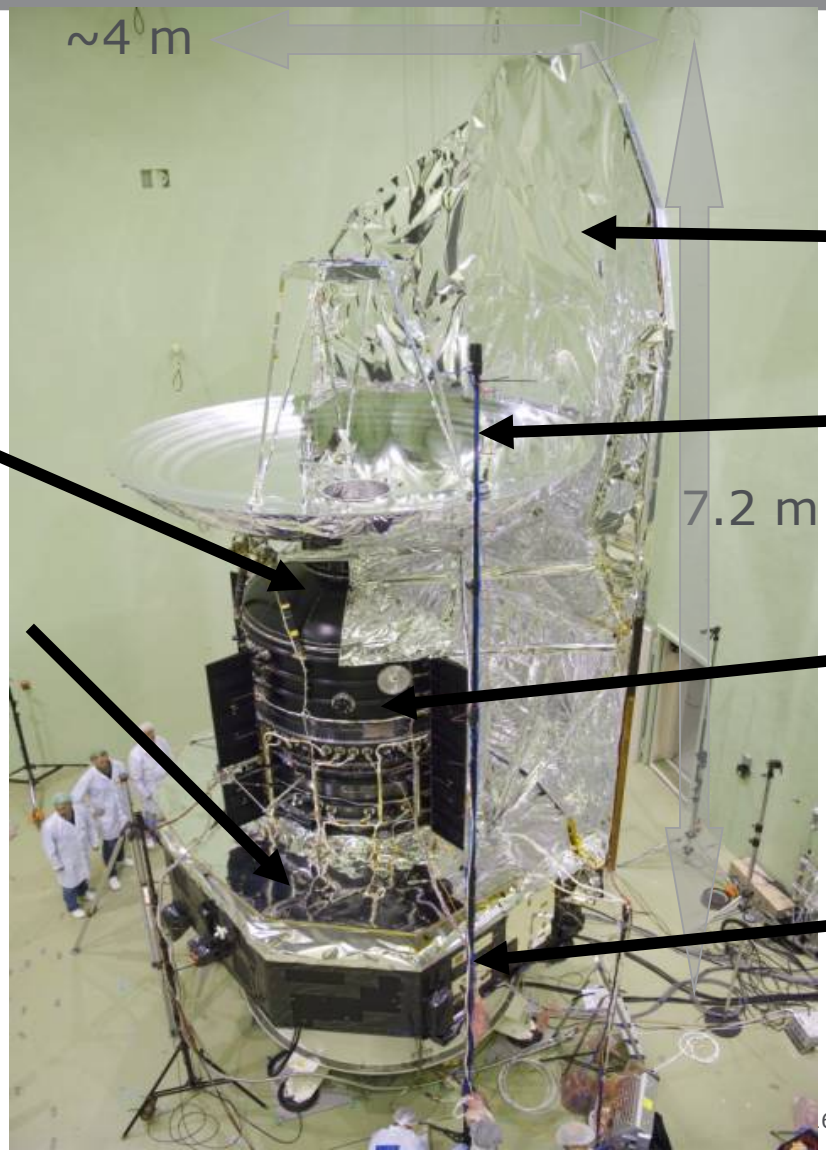
Detectors working at ~2 K and 300 mK

Warm electronics in SVM

Launch Mass: ~3400 kg

Power: ~1200 W

3-axis stabilisation




Sunshield and solar array

Telescope (3.5m)

Helium-II Cryostat (3.5 years lifetime)

Service Module

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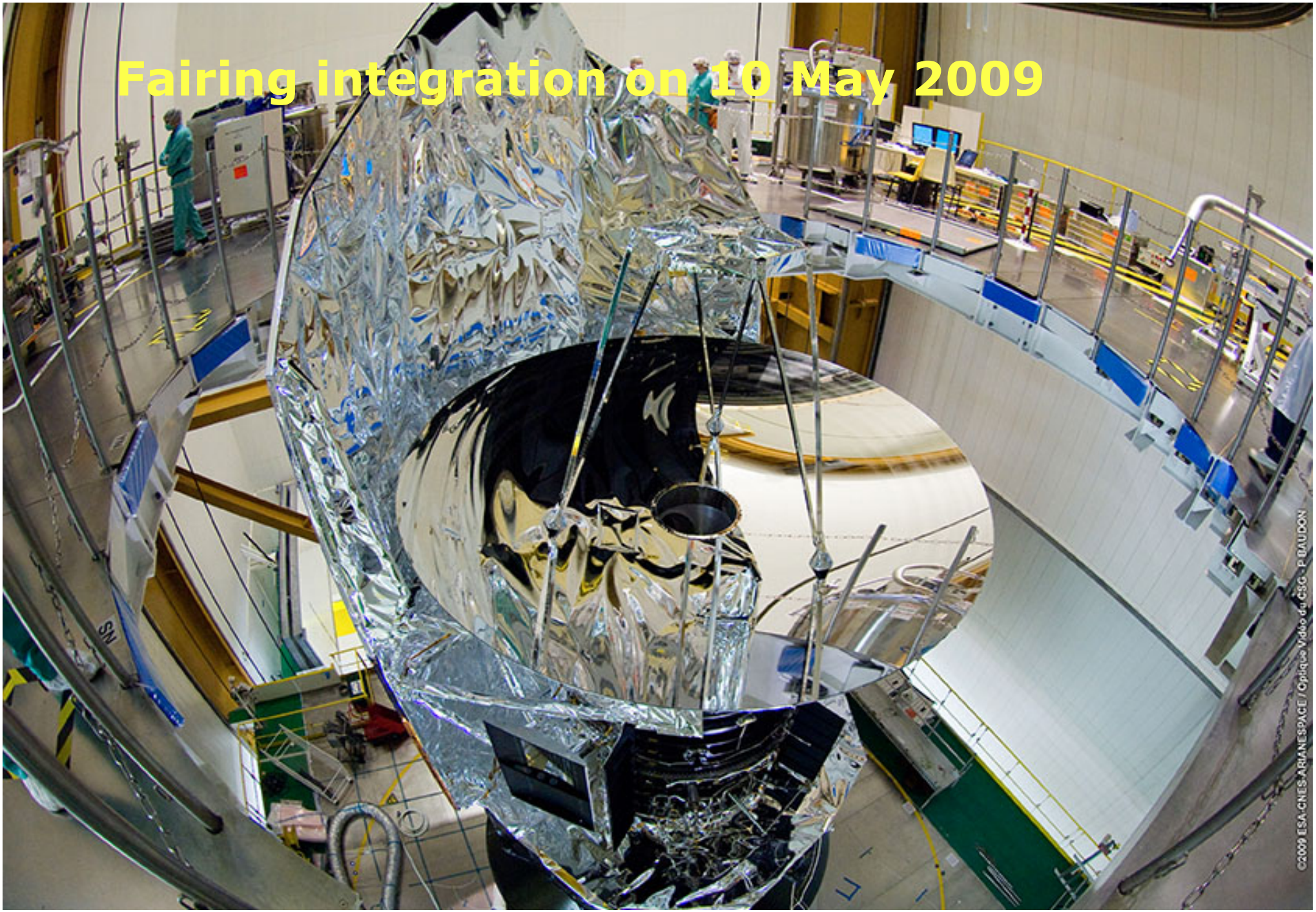
# Fairing integration on 10 May 2009



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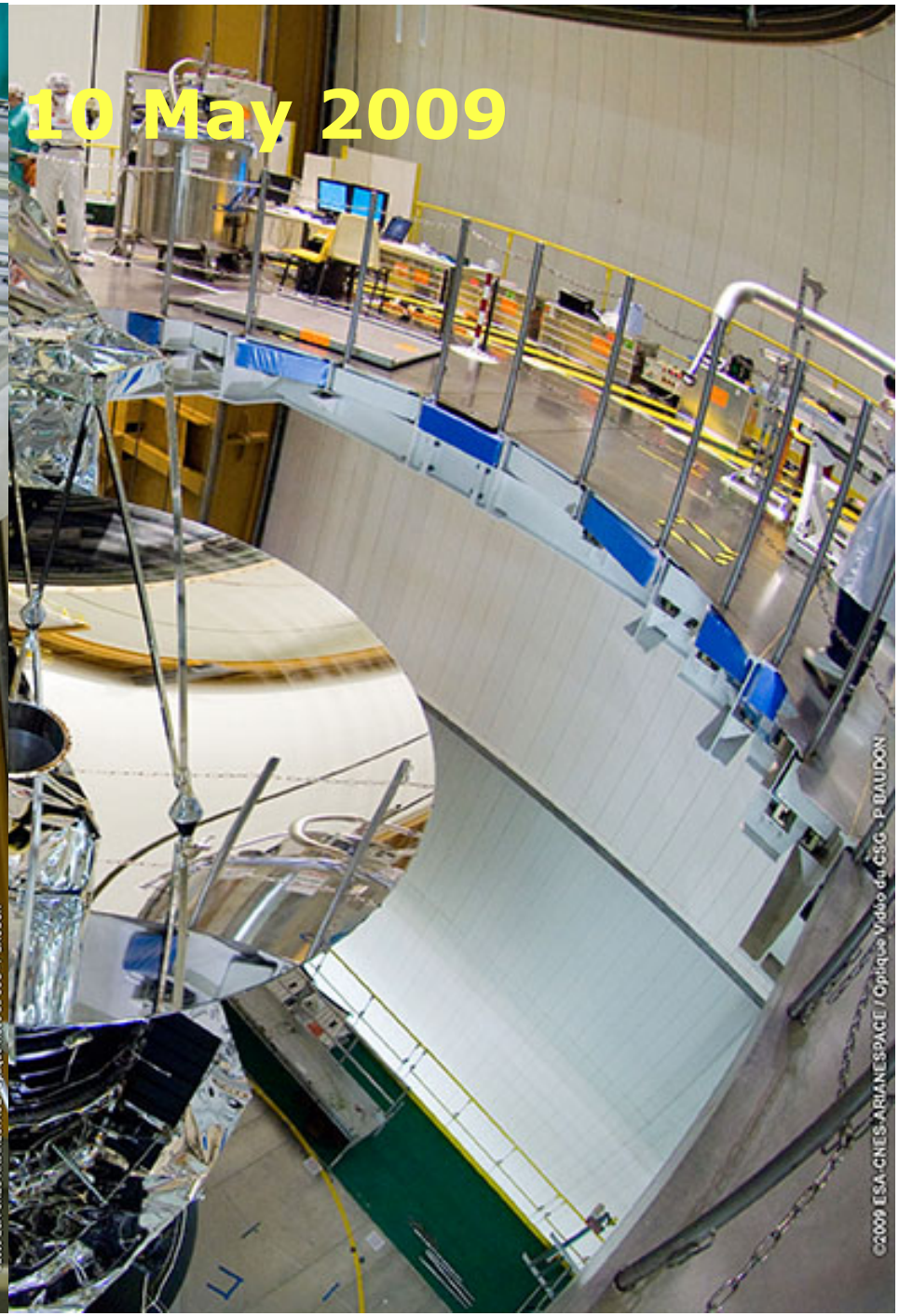


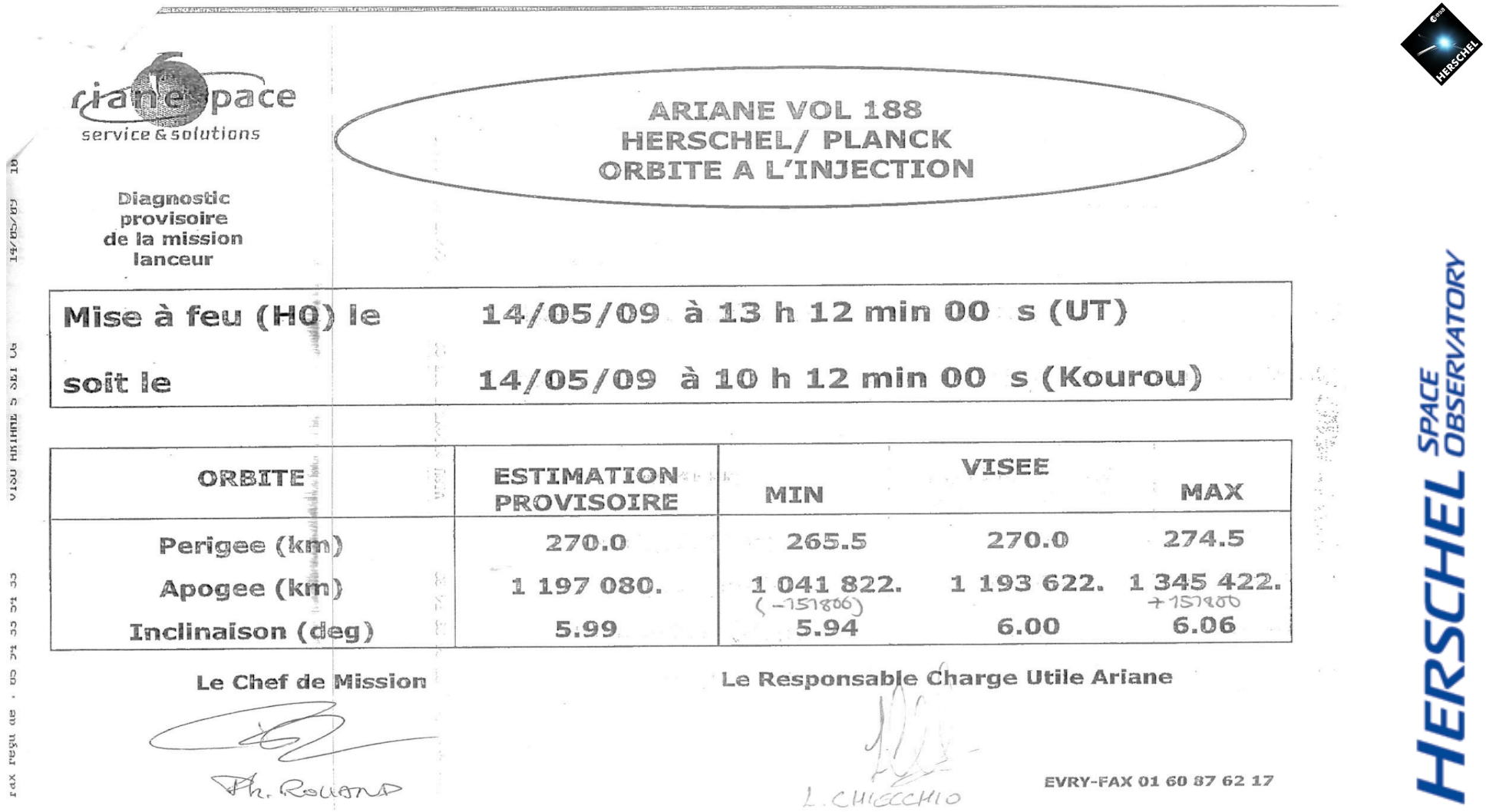
# Fairing integration on 10 May 2009


V188 rollout on 13 May 2009
esa
ariane
esa
ariane

# Launch on 14 May 2009!

# Launch on 14 May 2009!

# V188 launch on 14 May 2009



ariane space
service & solutions

Diagnostic provisoire de la mission lanceur

**ARIANE VOL 188**
**HERSCHEL/ PLANCK**
**ORBITE A L'INJECTION**

| | |
|---|---|
| Mise à feu (H0) le | 14/05/09 à 13 h 12 min 00 s (UT) |
| soit le | 14/05/09 à 10 h 12 min 00 s (Kourou) |

| ORBITE | ESTIMATION PROVISOIRE | VISEE MIN | | MAX |
|---|---|---|---|---|
| Perigee (km) | 270.0 | 265.5 | 270.0 | 274.5 |
| Apogee (km) | 1 197 080. | 1 041 822. (-151806) | 1 193 622. | 1 345 422. +151800 |
| Inclinaison (deg) | 5.99 | 5.94 | 6.00 | 6.06 |

Le Chef de Mission

Ph. ROLLAND

Le Responsable Charge Utile Ariane

L. CHIECCHIO

EVRY-FAX 01 60 87 62 17

HERSCHEL SPACE OBSERVATORY

# Herschel orbit


## Two LEOP maneouvres

- OCM 2009-05-15T15:28:20.654 9.01 m/s
- Touch-up OCM 2009-05-18T18:13:02.5666 1.01 m/s

## Since then nine maneouvres

- Transfer OCMs 1 & 2 total 0.90 m/s
- Station keeping OCMs 1-7 total 1.27 m/s
- Typical OCMs 4-6 weeks apart with typical Δv ~0.1-0.2 m/s

## Herschel has been in final 'orbit' since day#2!

- Orbit maintenance, but no orbit insertion (as opposed to Planck)
- LEOP OCM put Herschel on 'stable manifold' for large amplitude 'semi halo' orbit

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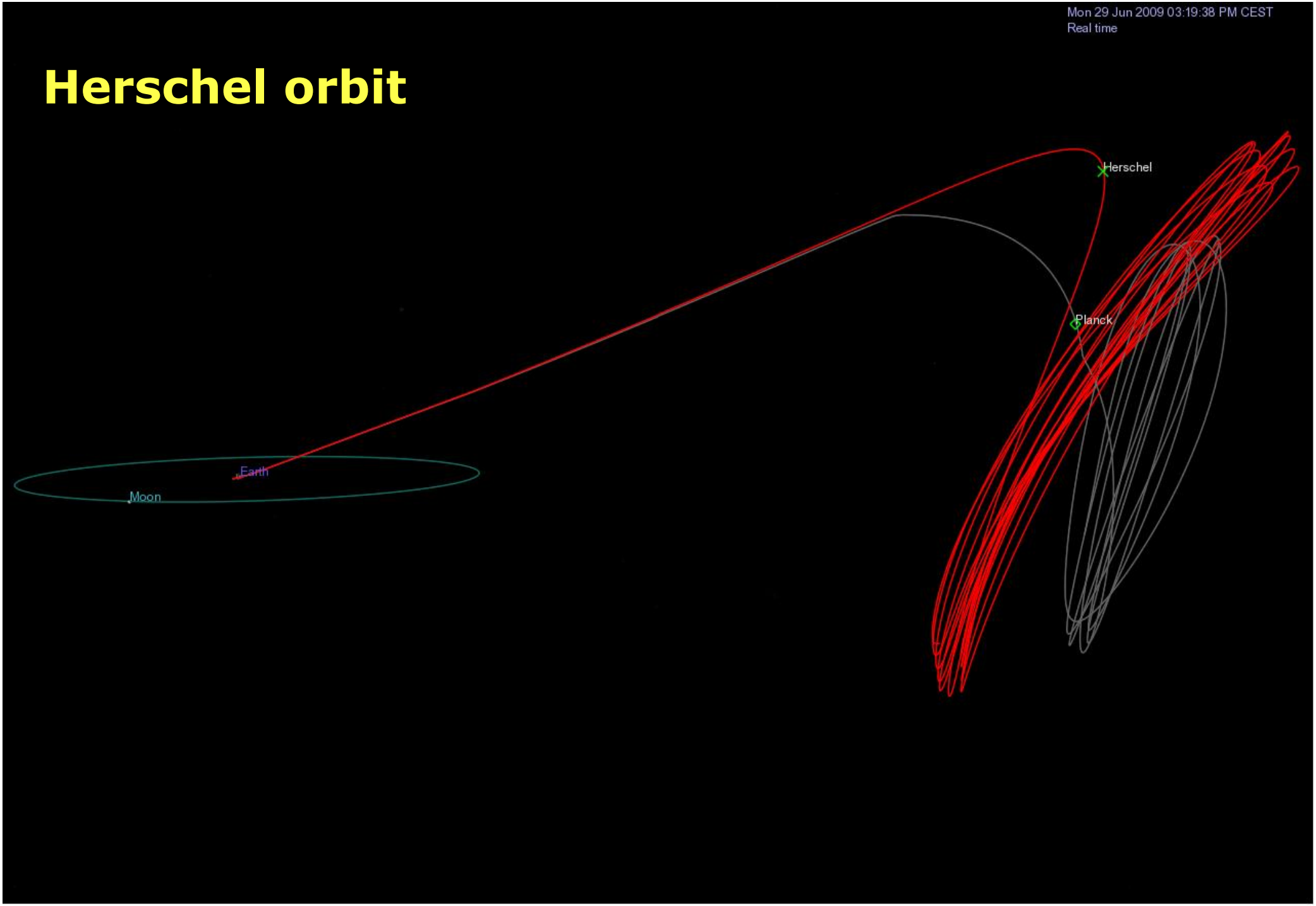
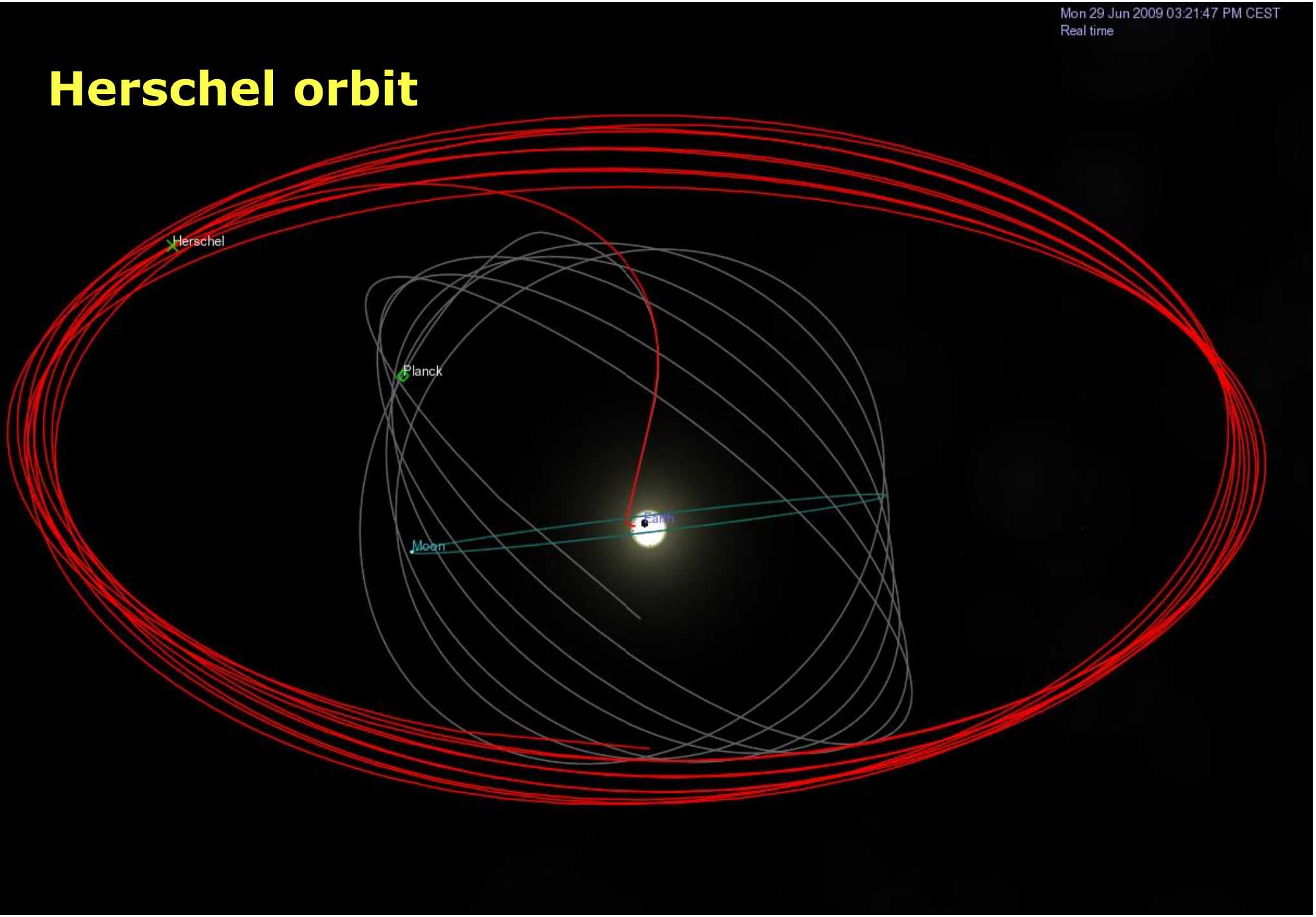
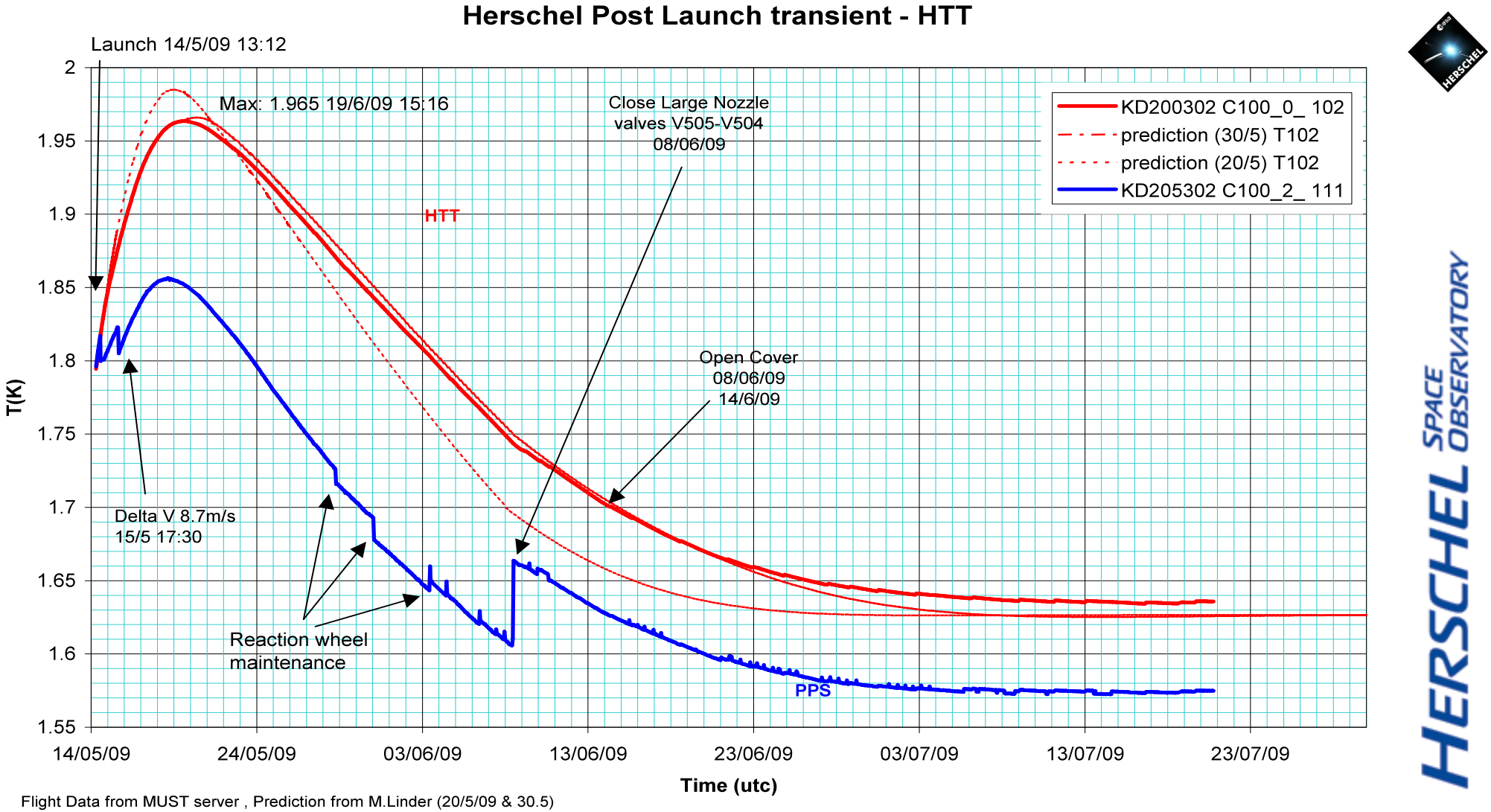
# Herschel orbit



# Herschel orbit

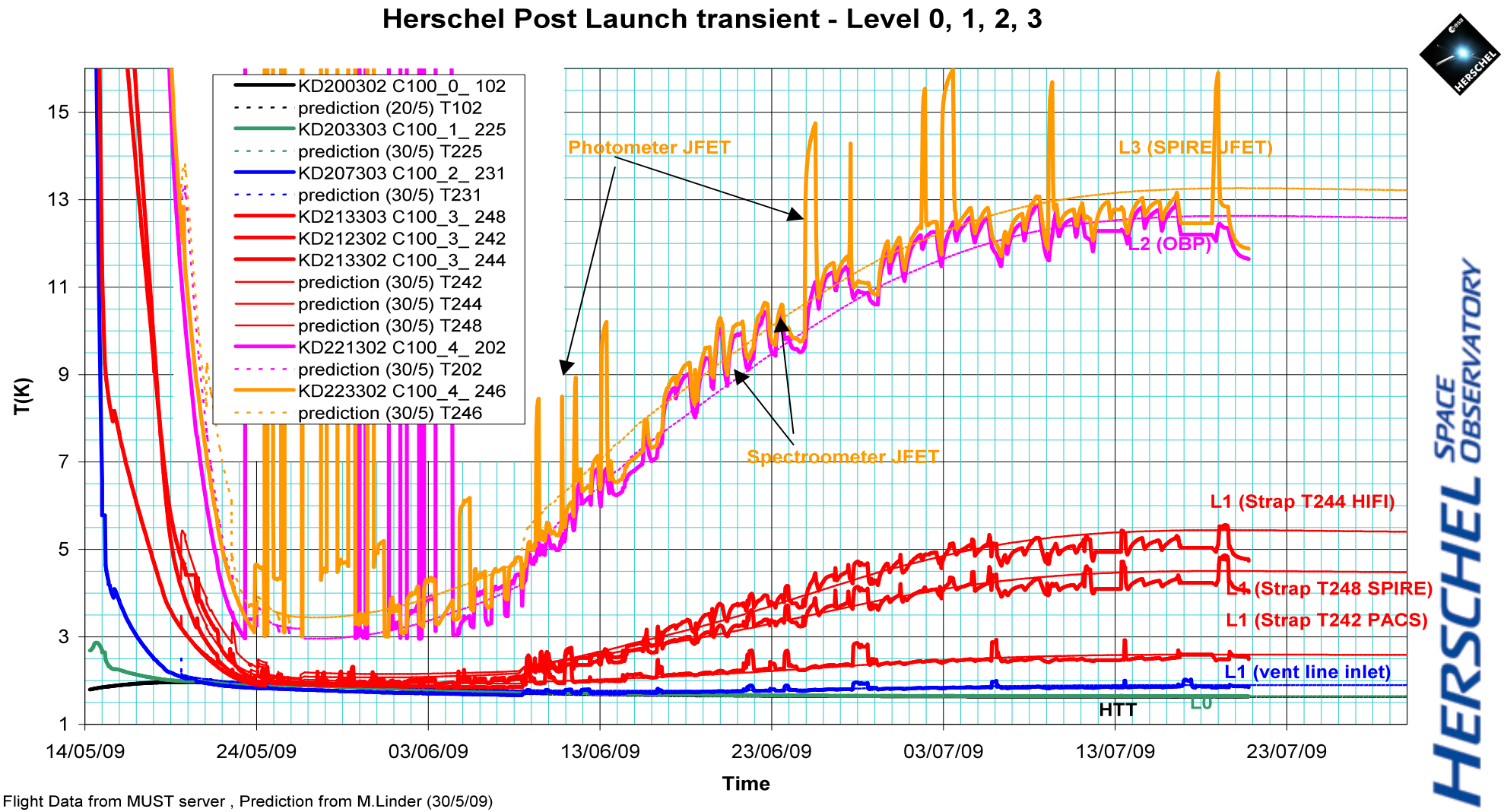


# Thermal stabilisation - HTT

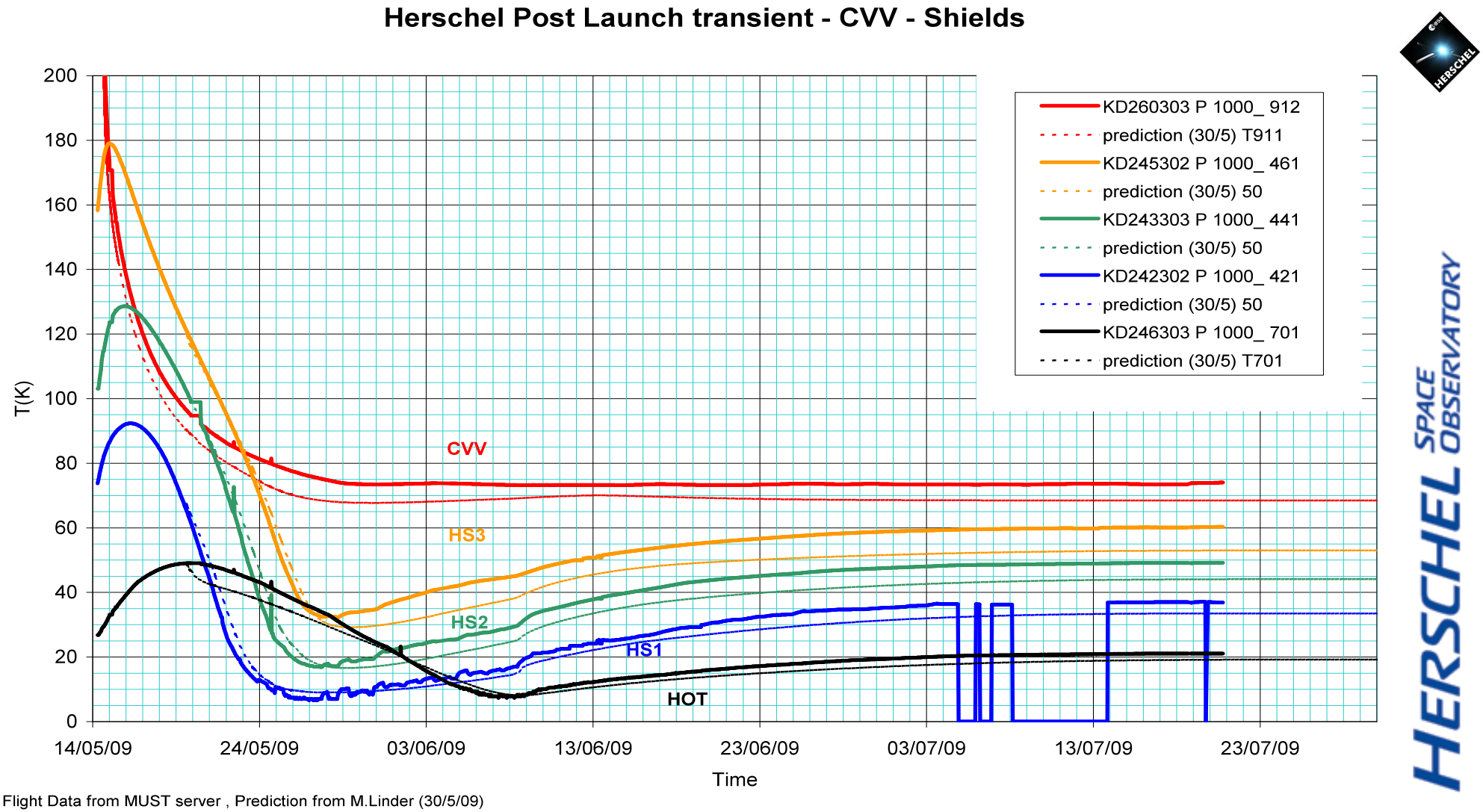



Flight Data from MUST server , Prediction from M.Linder (20/5/09 & 30.5)

# Thermal stabilisation – levels 0, 1, 2, 3

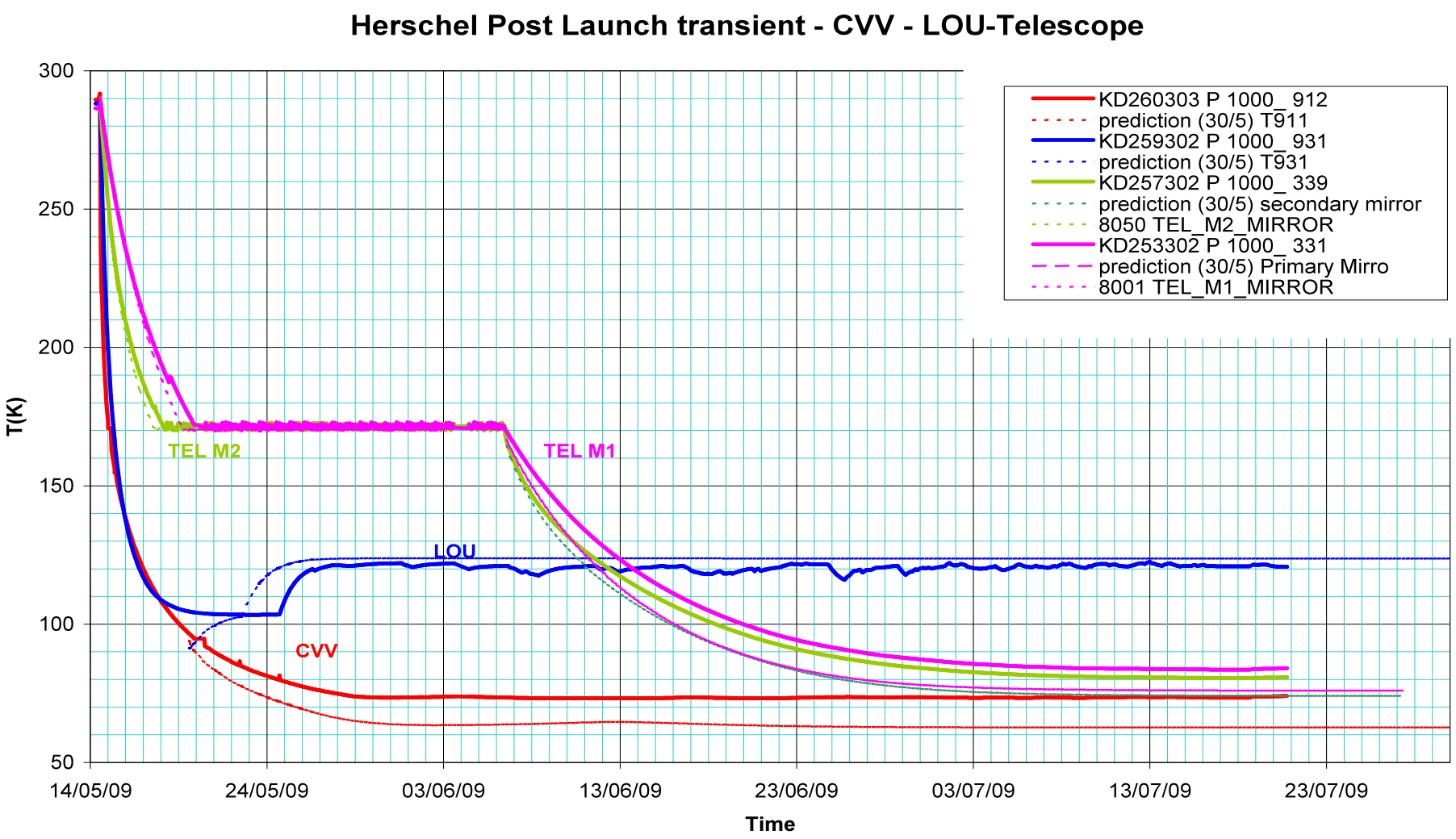


# Thermal stabilisation – CVV & shields




Flight Data from MUST server , Prediction from M.Linder (30/5/09)

# Thermal stabilisation – tel, LOU, CVV




Flight Data from MUST server , Prediction from M.Linder (30/5/09)

HERSCHEL SPACE OBSERVATORY

# Early mission phases – the Plan

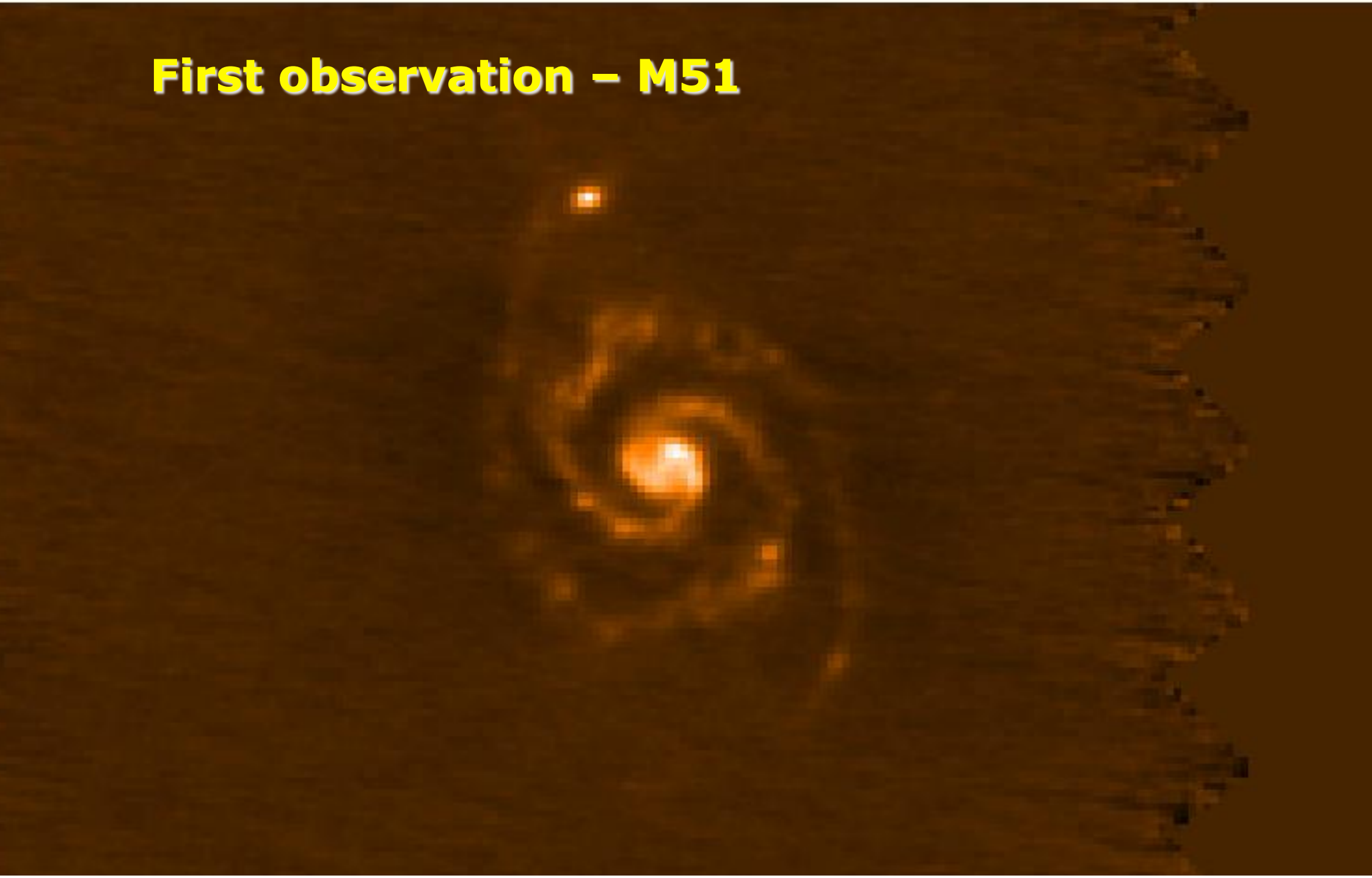

- **Launch on 14 May 2009**
- **Commissioning Phase ~2 months**
  - Functional testing
  - Cryocover opening after ~1 month
- **Performance Verification Phase ~3 months**
  - Optimisation and release of observing modes
- **Science Demonstration Phase ~1 month**
  - Execute snippets of observing programmes for verification
  - Get initial science as 'by-product'
- **Routine Science Phase**
  - Execute the Key Programmes
  - Issue inflight calls for proposals

HERSCHEL SPACE OBSERVATORY

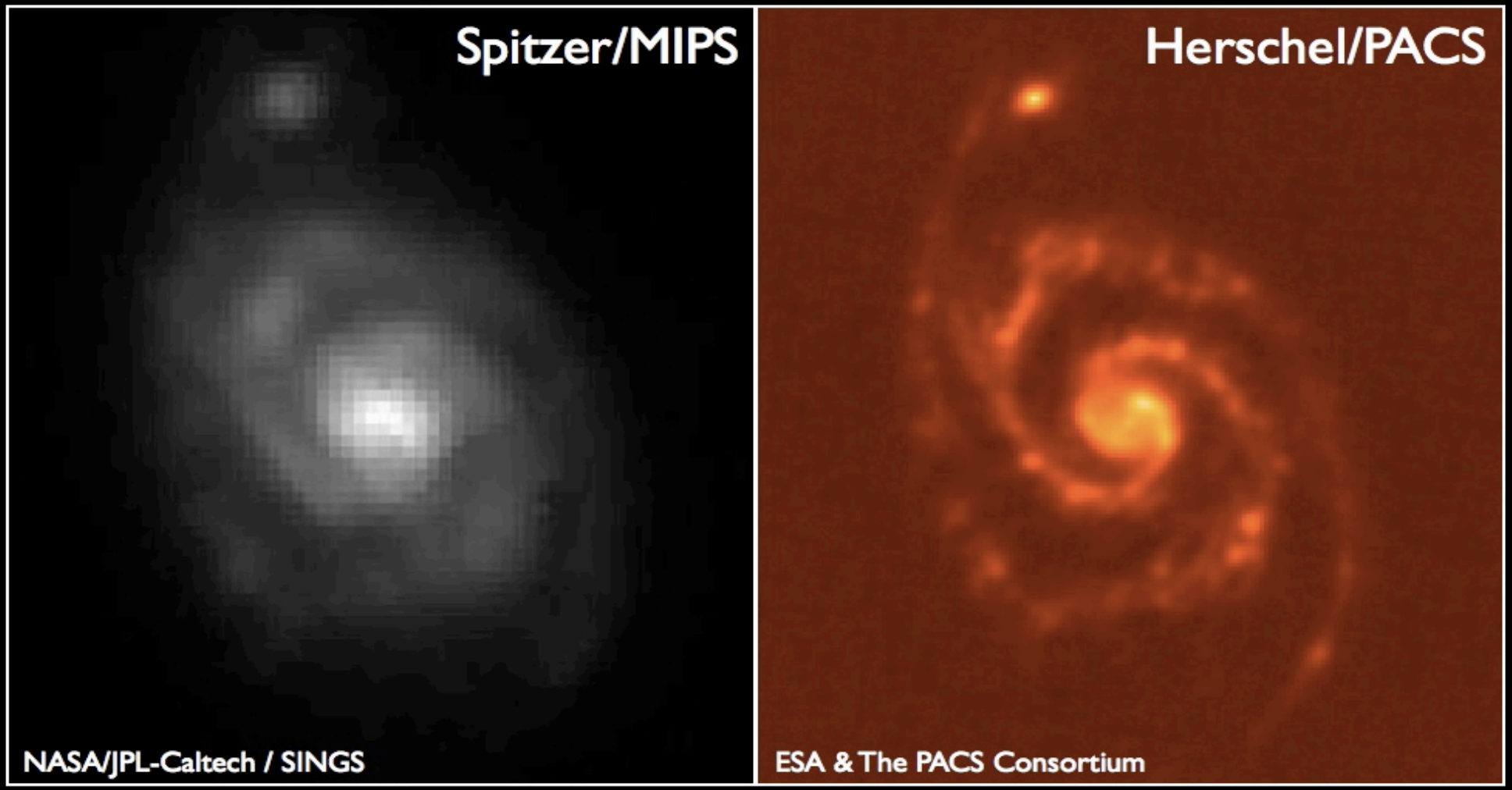

SUN307
D2
DESK-10356
Cryocover opening on 14 June 2009
Print Display
Print Details
Active Printjobs:
Abort
Display Info: ZGA09999 : Estimated Attitude Erros
PRINT DISPLAY
PRINT HISTORY
PRINT HISTORY FROM:
PRINT HISTORY UP TO / FOR:
STOP TIME
DURATION
FILE/PRINTER
ASCII FILE ONLY
PRINTER ONLY
Filename:
Browse
OK
Apply
Cancel
AUTO HARD COPY
OFF
VALUE
UNIT
VLDITY
SAMPLE TIME
MIN
MAX
LINE
1.5284e-06 rad VALID 2009.165.10.57.28.958 -0.00005 0.00005
4.0642e-07 rad VALID 2009.165.10.57.28.958 -0.00001 0.00001
5.1601e-07 rad VALID 2009.165.10.57.28.958 -0.00001 0.00001
165.10.57.44.959
0.000009
-0.000009
165.10.57.44.959
165.10.57.38 [sun307:0:HONTNdsk_RT::12582] execute: Print job started on ncp622

# … and in the evening the day after

# First observation – M51

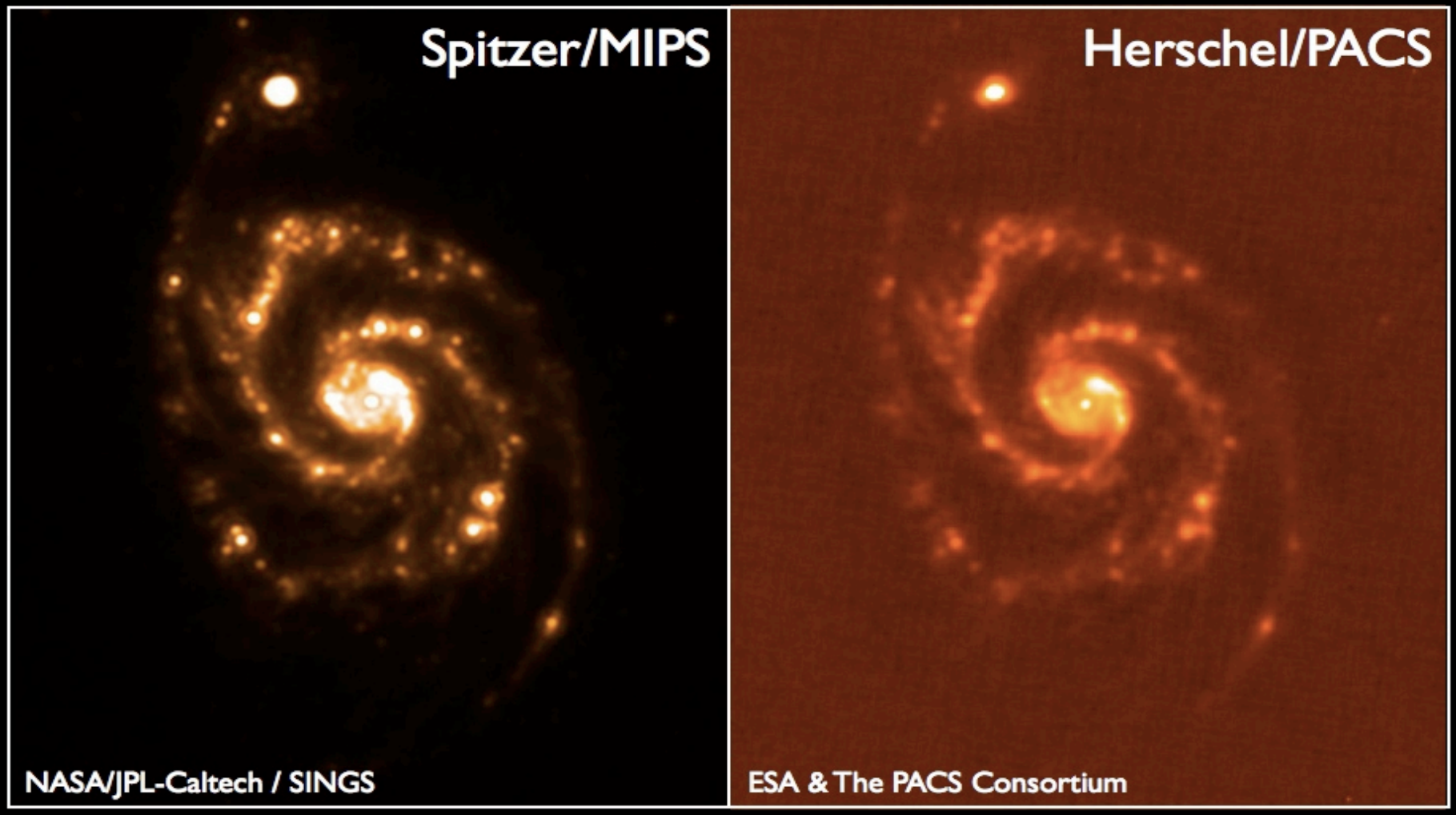


# Spitzer/MIPS & Herschel/PACS at 160 um



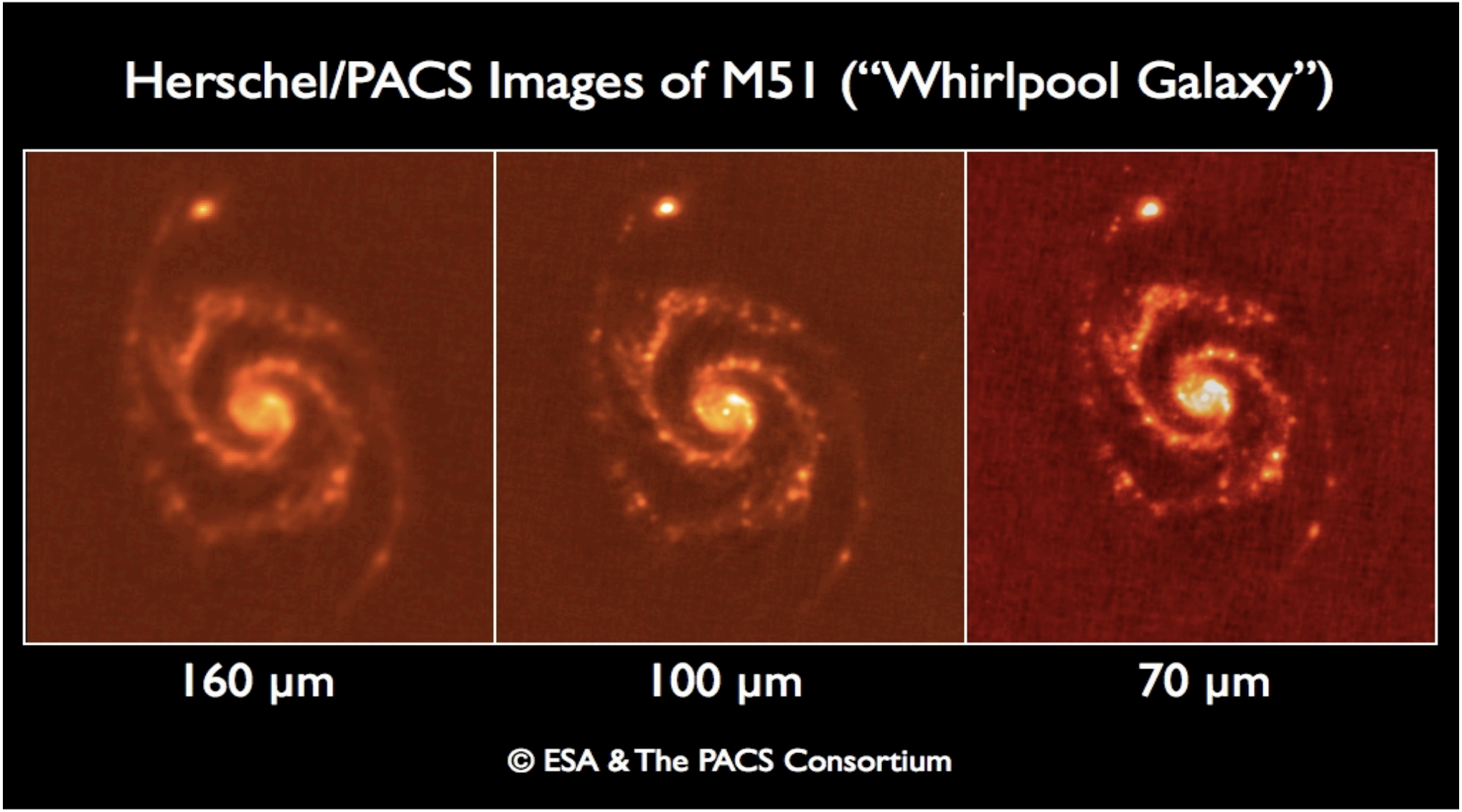

Spiral Galaxy M51 ("Whirlpool Galaxy") in the Far Infrared (160μm)

# Spitzer 24 um and Herschel 100 um

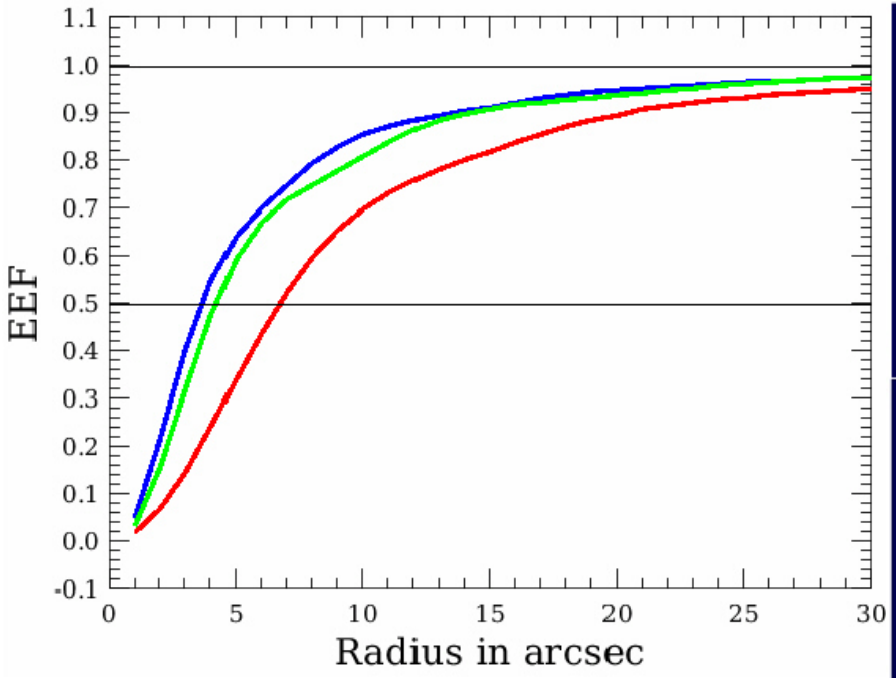



Spiral Galaxy M51 ("Whirlpool Galaxy") at 24μm (MIPS) and 100μm (PACS)

# Herschel at 160, 100 , and 70 um

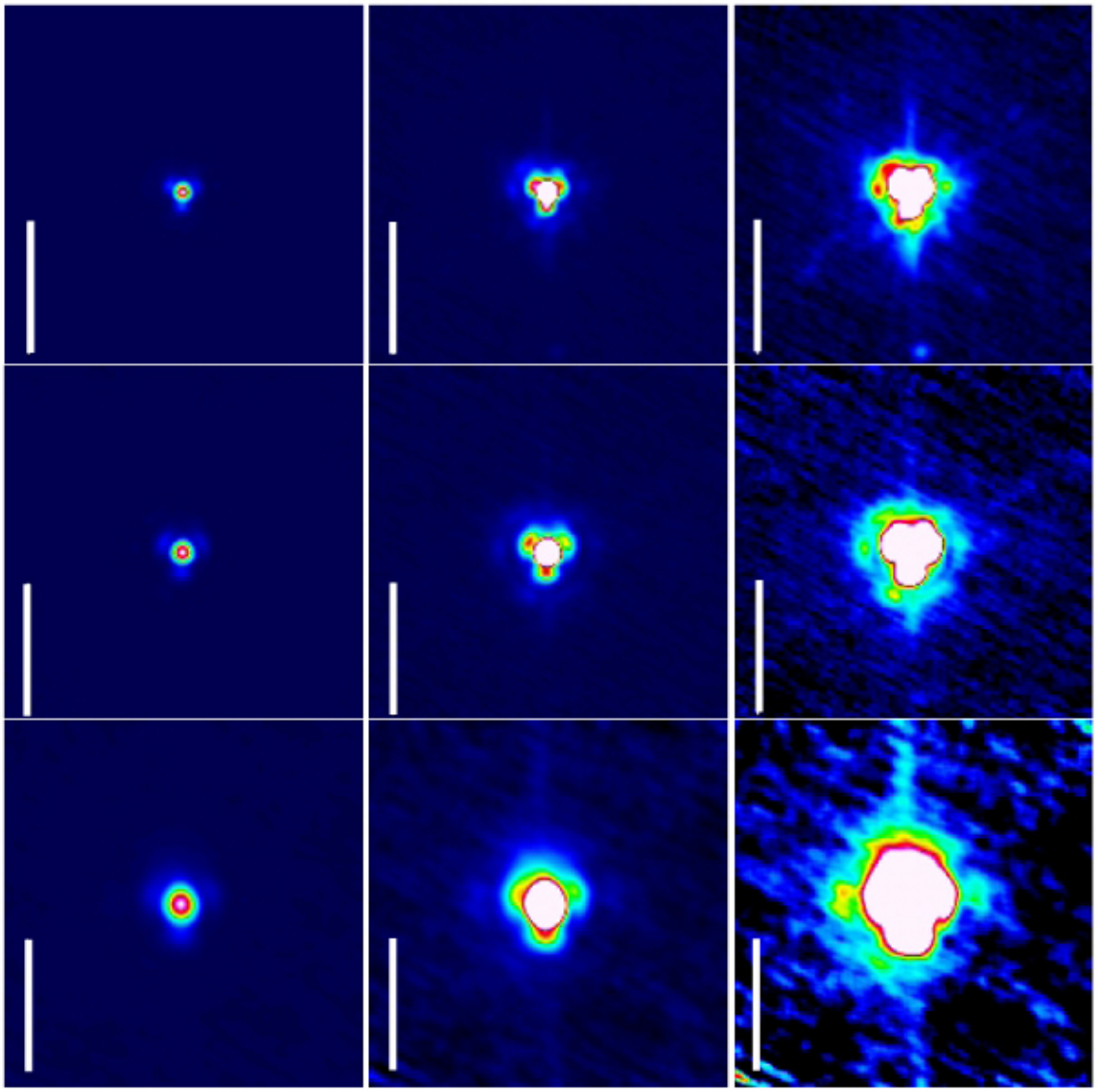


# Encircled energy and PSF by PACS

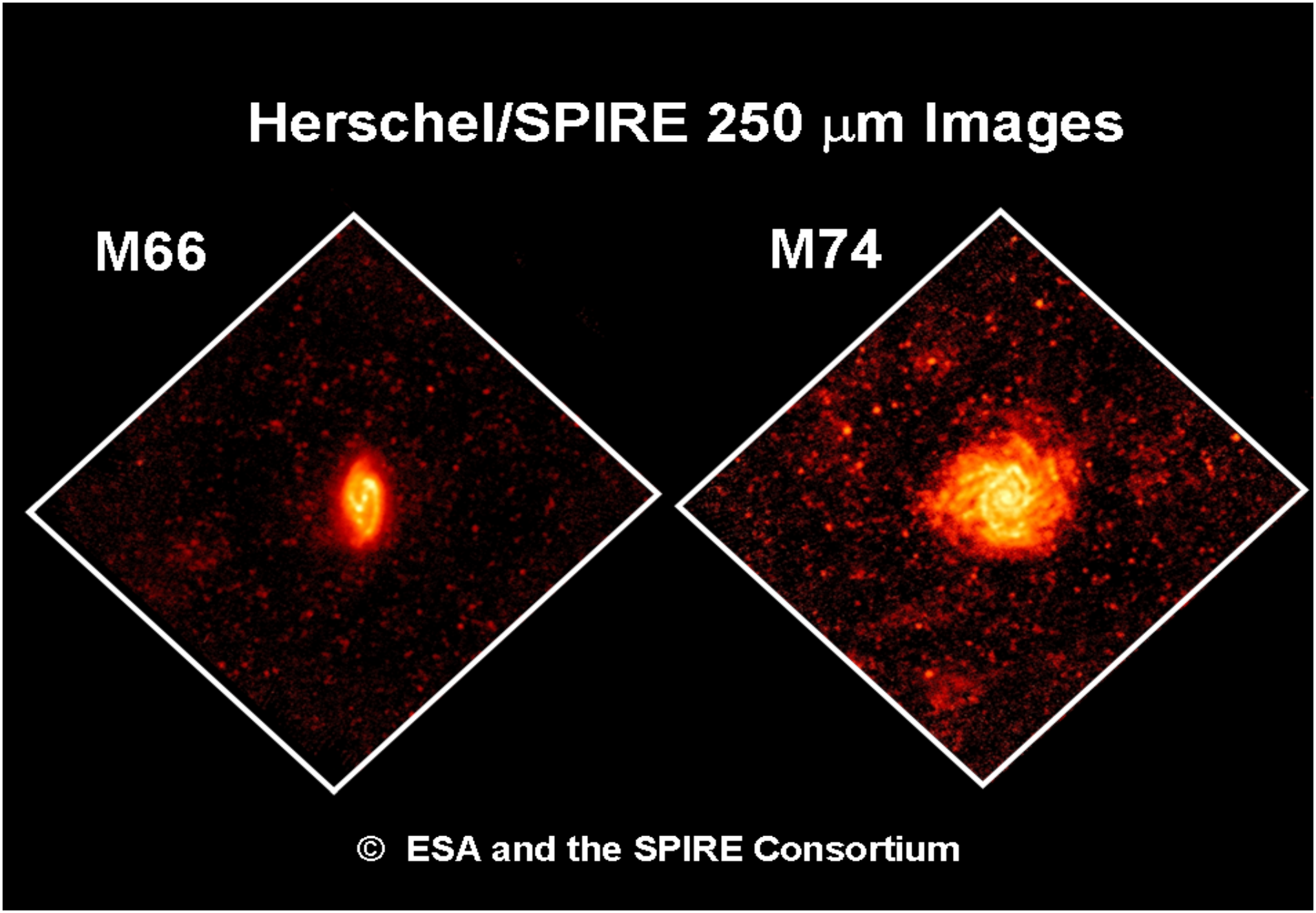



EEFs in blue (70), green (100), and red (160) um bands

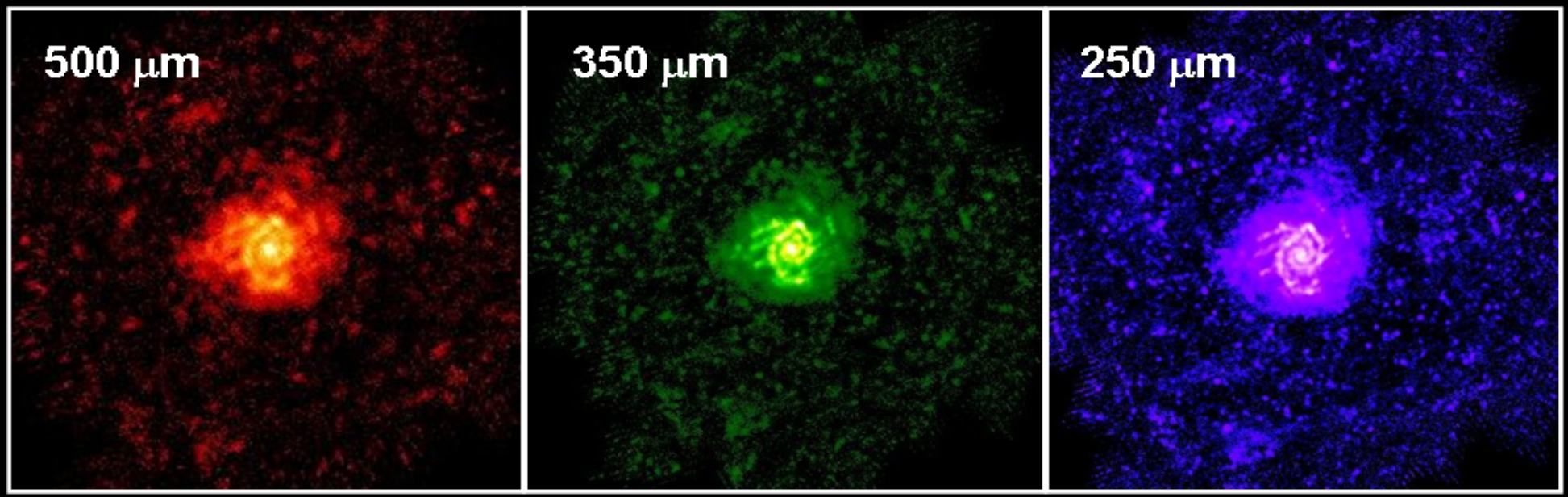
PSFs based on Vesta observations; top->bottom: blue, green, & red bands; left->right: scaled to peak, 10% and 1%



# SPIRE 'First light'

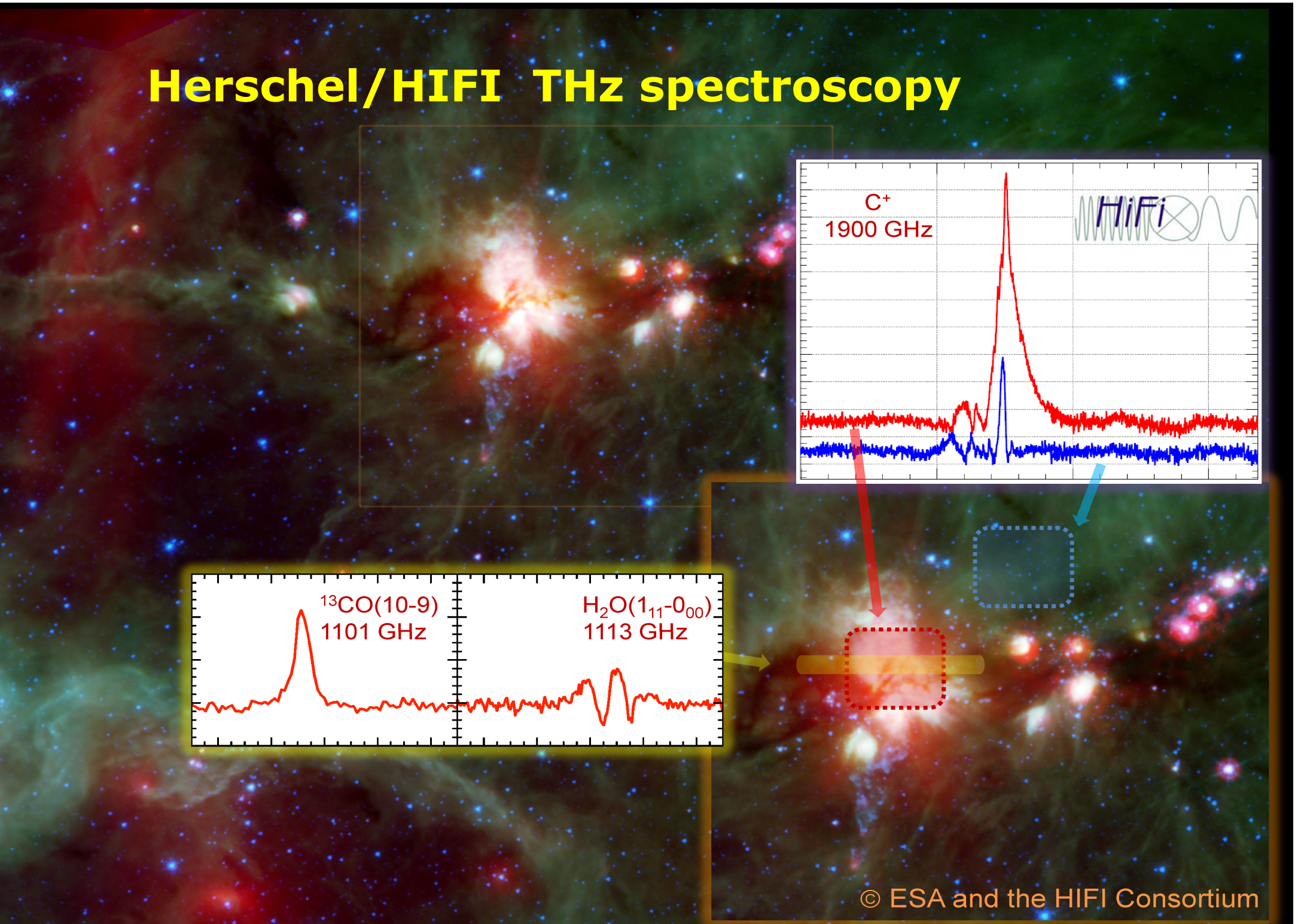

Herschel/SPIRE 250 μm Images
M66
M74
© ESA and the SPIRE Consortium

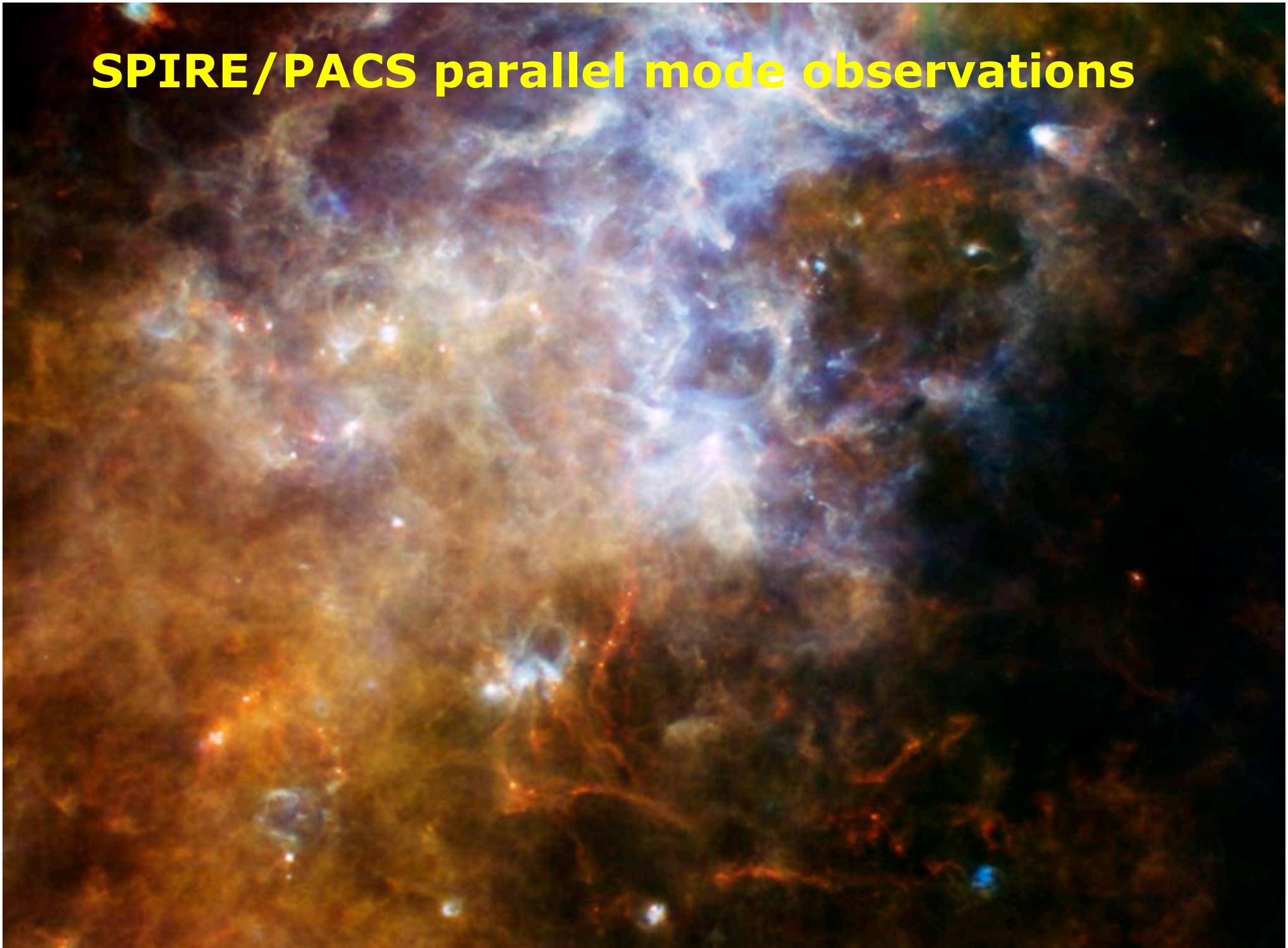
# Herschel/SPIRE at 500/350/250 um



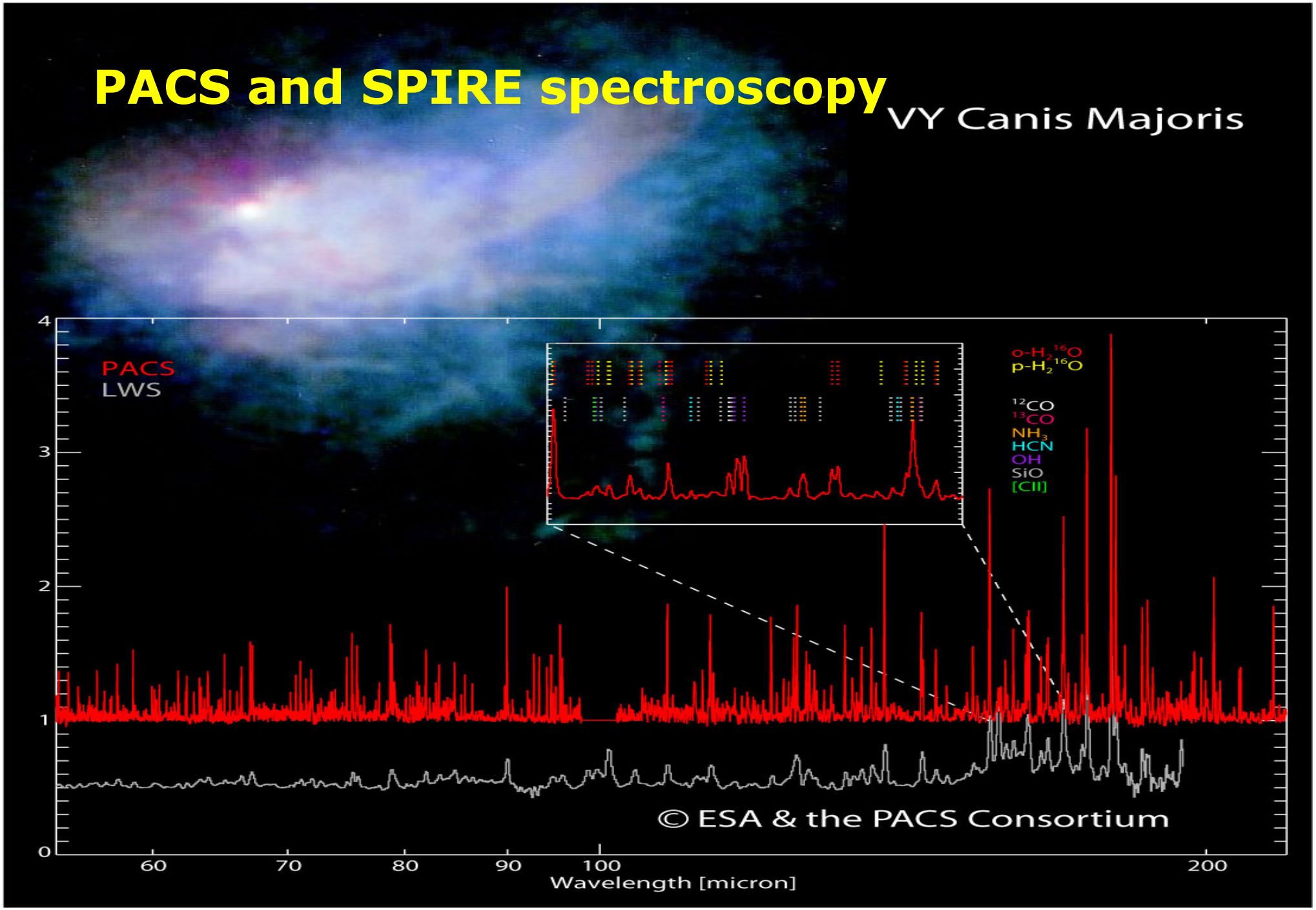
# HIFI 'First light'

# Herschel/HIFI THz spectroscopy

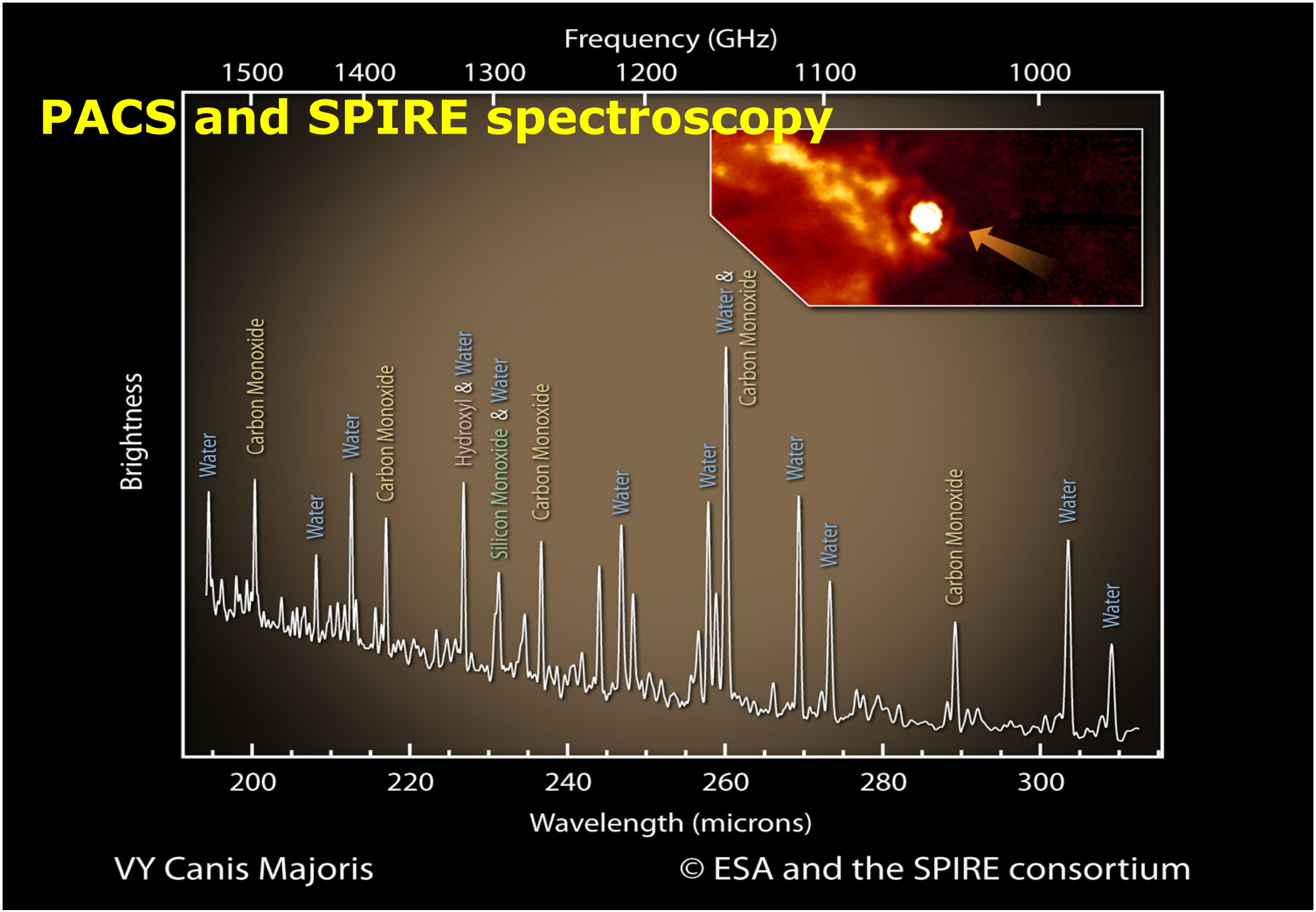



SPIRE/PACS parallel mode observations

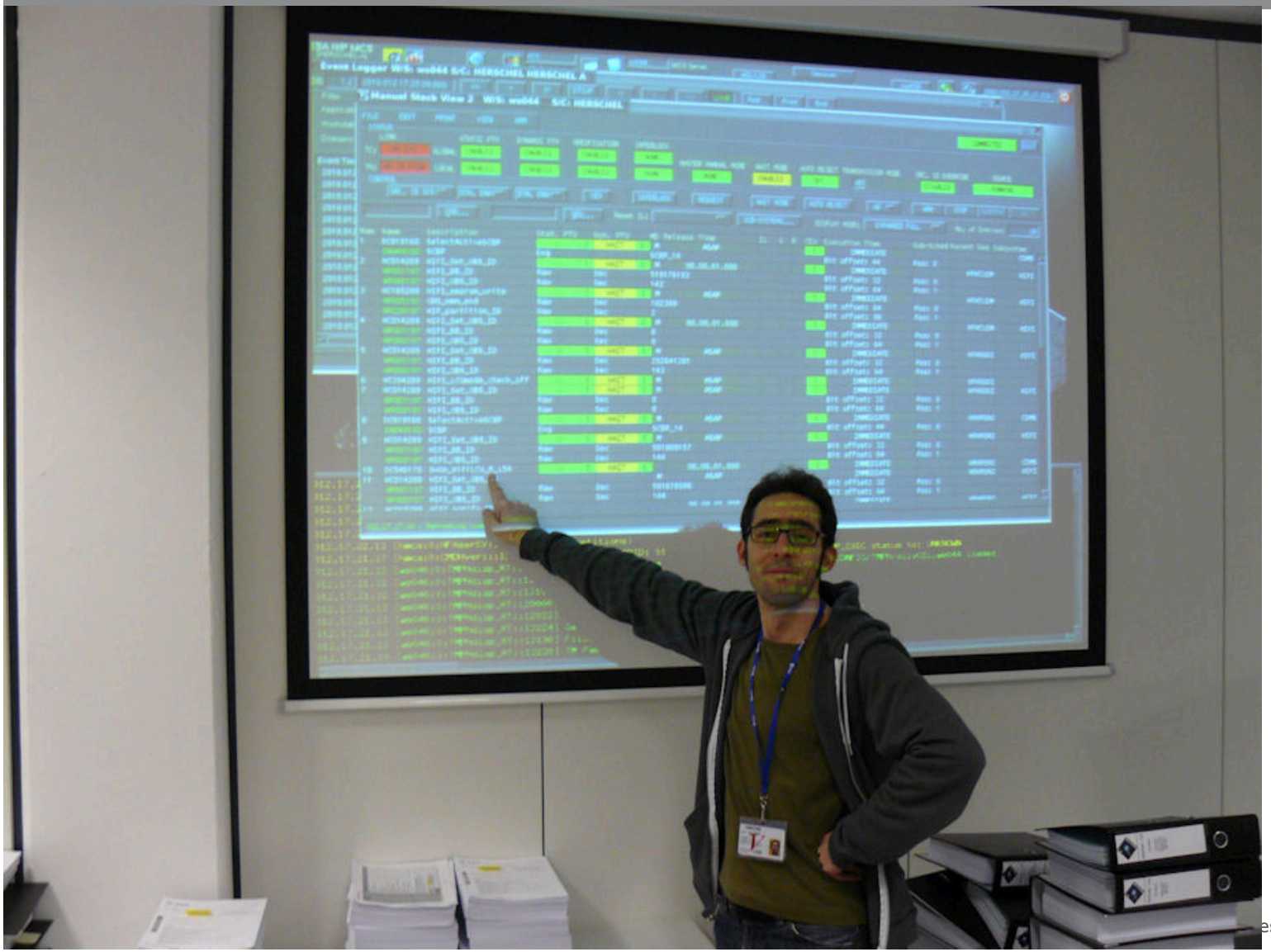
# PACS and SPIRE spectroscopy



# PACS and SPIRE spectroscopy



# No HIFI 2 August 2009–10 January 2010



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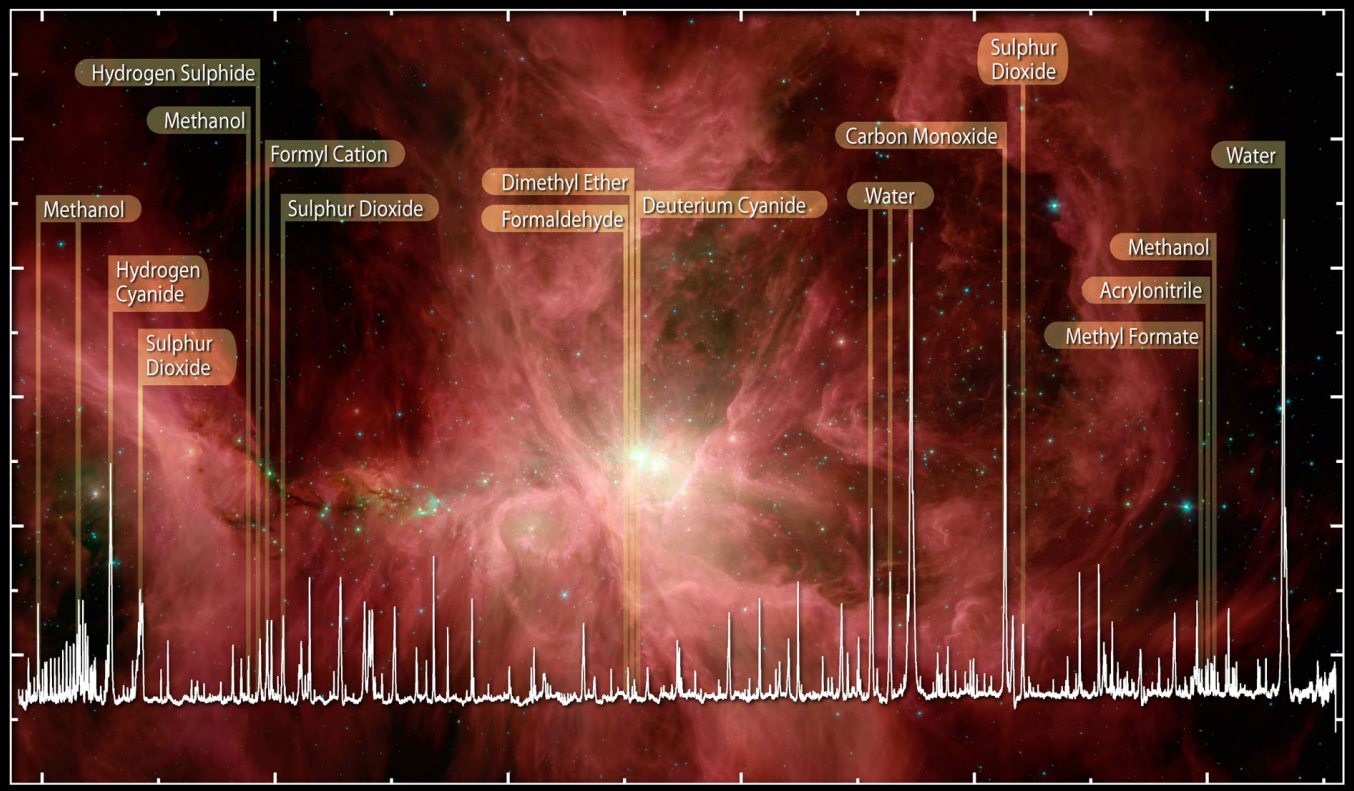



HIFI Spectrum of Water and Organics in the Orion Nebula

# Taking stock – status observing


## Launched on 14 May 2009

- 14 June 2009 - cryo-cover opening, followed by first observation
- 15 July 2009 - Performance Verification Phase commenced
- 2 August 2009 - HIFI anomaly
- 12 September 2009 – first Science Demonstration Phase observation
- 18 October 2009 – first Routine Science Phase observation

## SDP Initial Results workshop 17-18 December 2009

- 10-14 January 2010 – HIFI turned on
- February-April 2010 – HIFI catching up, allocated 50% of the time
- 9 March 2010 – HSA and HIPE publicly available
- 31 March 2010 – submission deadline A&A Special Issue papers

## HIFI Initial Results workshop 12-13 April 2010

## Herschel First Results symposium 4-7 May 2010

- 14 May 2010 – deadline for Key Programme AORs
- 15 May 2010 – acceptance deadline for A&A Special Issue papers
- May 2010 – approximately 25% of the KPs have been observed

HERSCHEL SPACE OBSERVATORY

# ESLAB 2010 and A&A

## ESLAB

- Held in ESTEC 4-7 May 2010
- 415 participants actually registered onsite – may be biggest meeting ever held in ESTEC
- 99 oral presentations
- 100+ posters
- Press event on 6 May

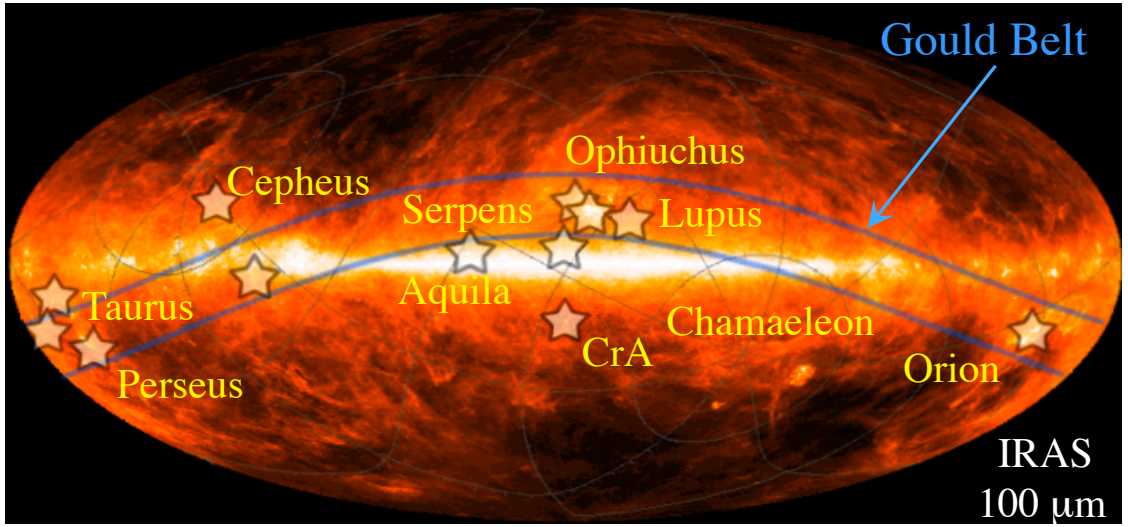
## A&A Special Issue

- 153 papers submitted by 31 March deadline
- 15 May acceptance deadline
- astro/ph posting of accepted papers commenced on 10 May

# The *Herschel* Gould Belt Survey

**http://gouldbelt-herschel.cea.fr/**

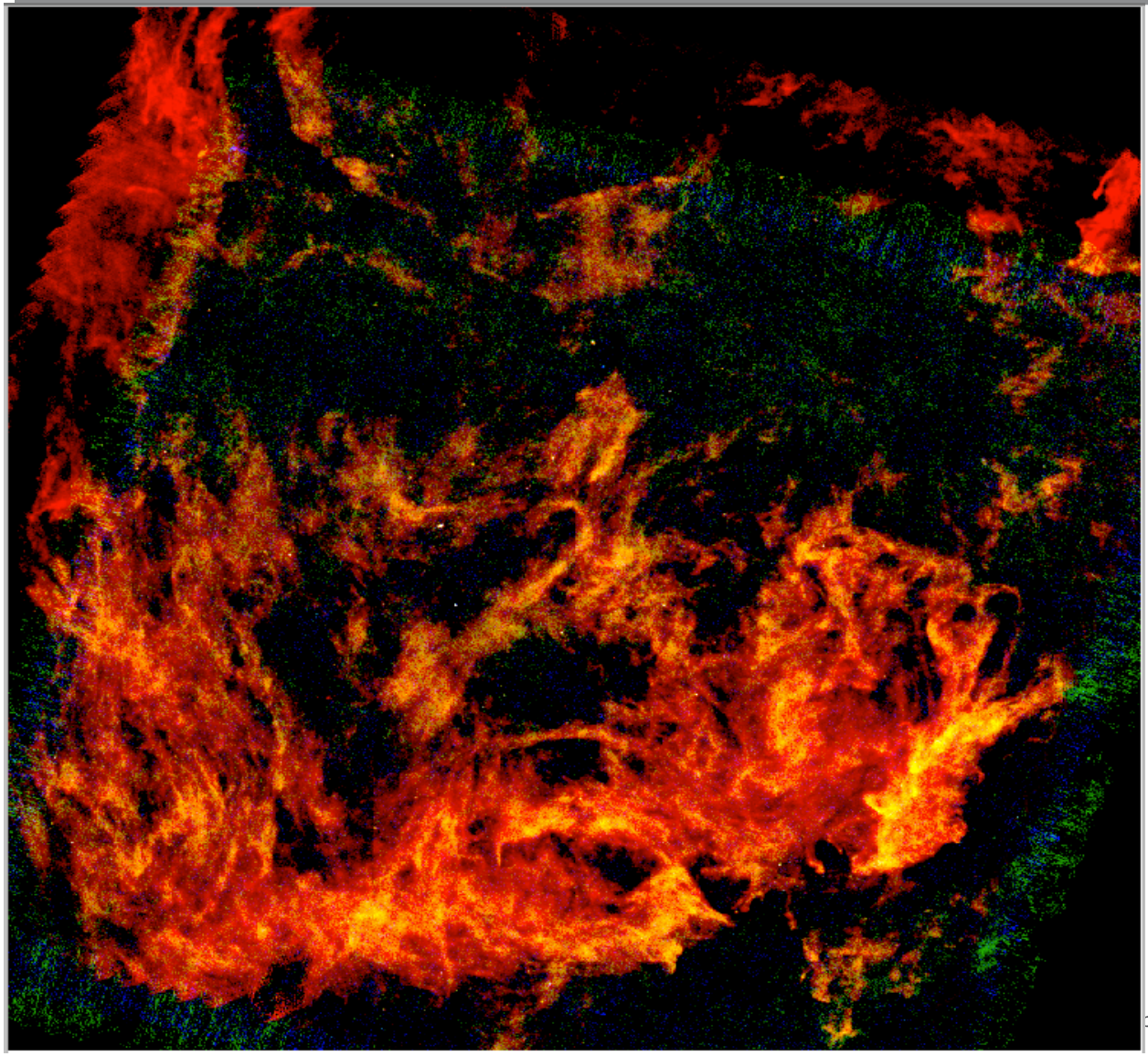
SPIRE/PACS 70-500 μm imaging of the bulk of nearby (d < 0.5 kpc) molecular clouds (~ 160 deg$^2$), mostly located in Gould's Belt.




## Motivation: Key issues on the early stages of star formation

- What determines the distribution of stellar masses = the IMF ?
- What generates prestellar cores and what governs their evolution to protostars and proto-brown dwarfs ?

# "First images" from the Gould Belt Survey



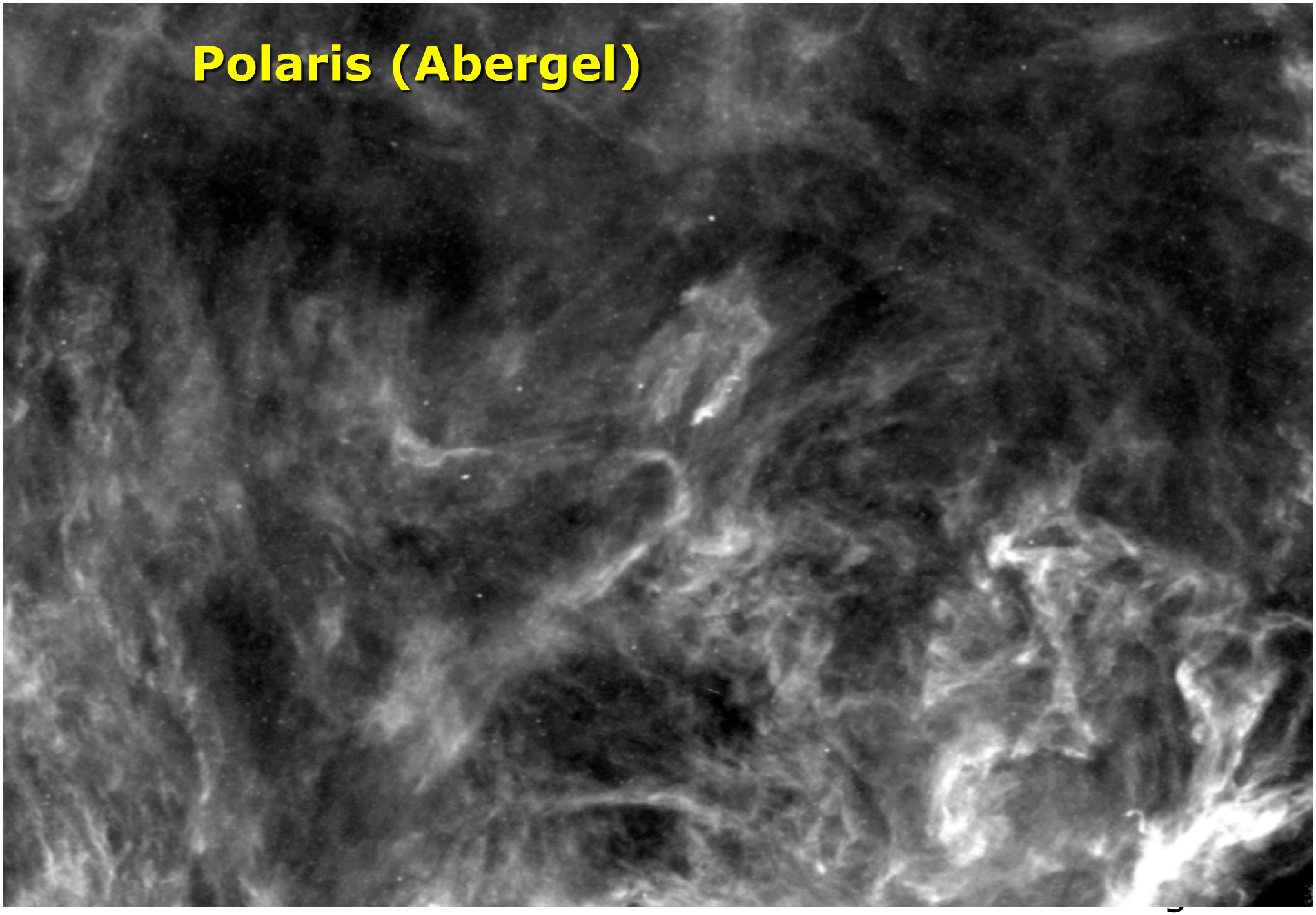
**1) Polaris translucent cloud (d ~ 150 pc)**

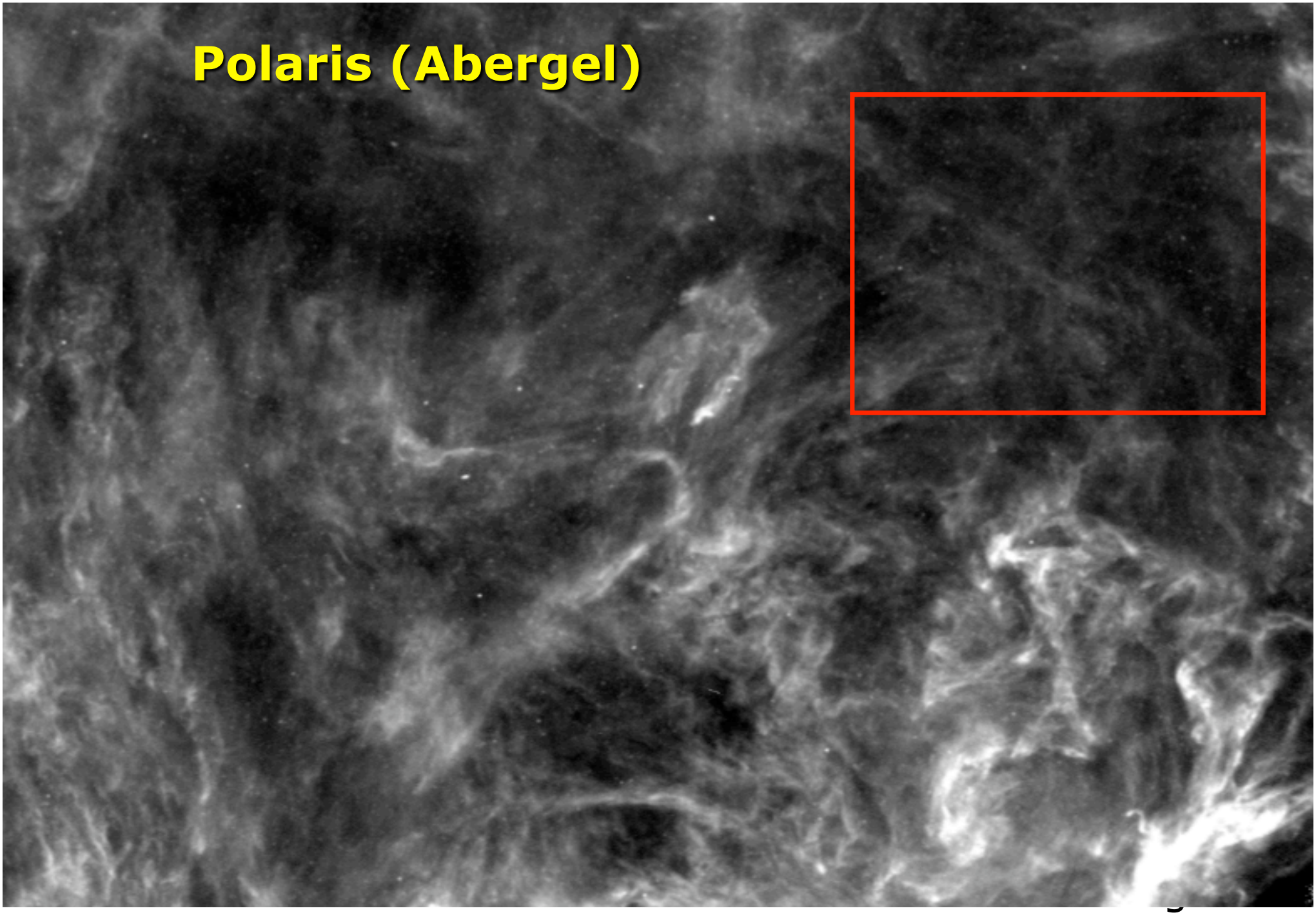
**Red : SPIRE 500 μm**
**Green : SPIRE 250 μm**
**Blue : PACS 160 μm**

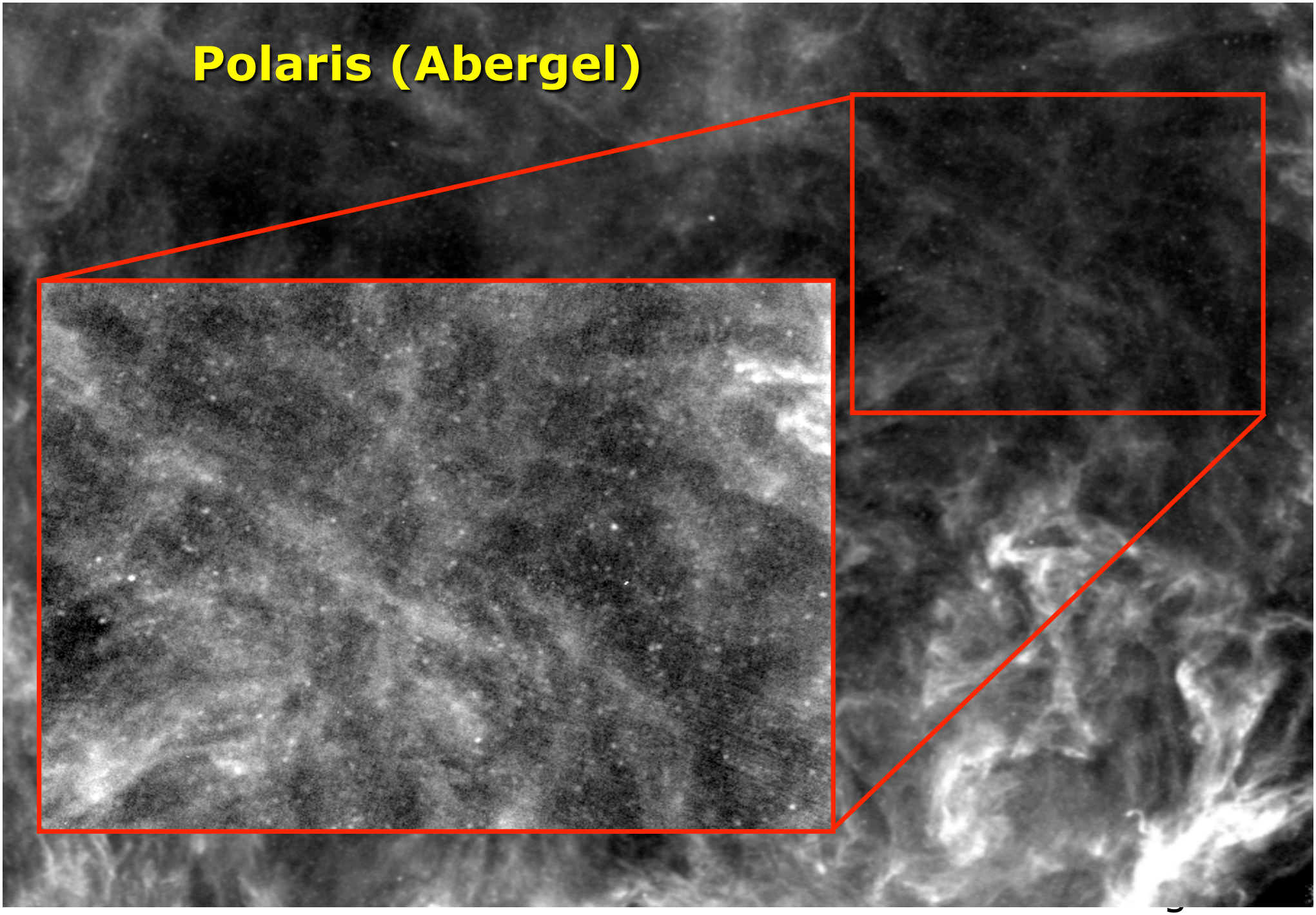
**~ 7 deg$^2$ field**

Ward-Thompson et al. 2010
Miville-Deschênes et al. 2010
A&A special issue

HERSCHEL SPACE OBSERVATORY


Polaris (Abergel)


Polaris (Abergel)


Polaris (Abergel)

# "First images" from the Gould Belt Survey

**2) Aquila Rift star-forming molecular cloud (d ~ 260 pc)**

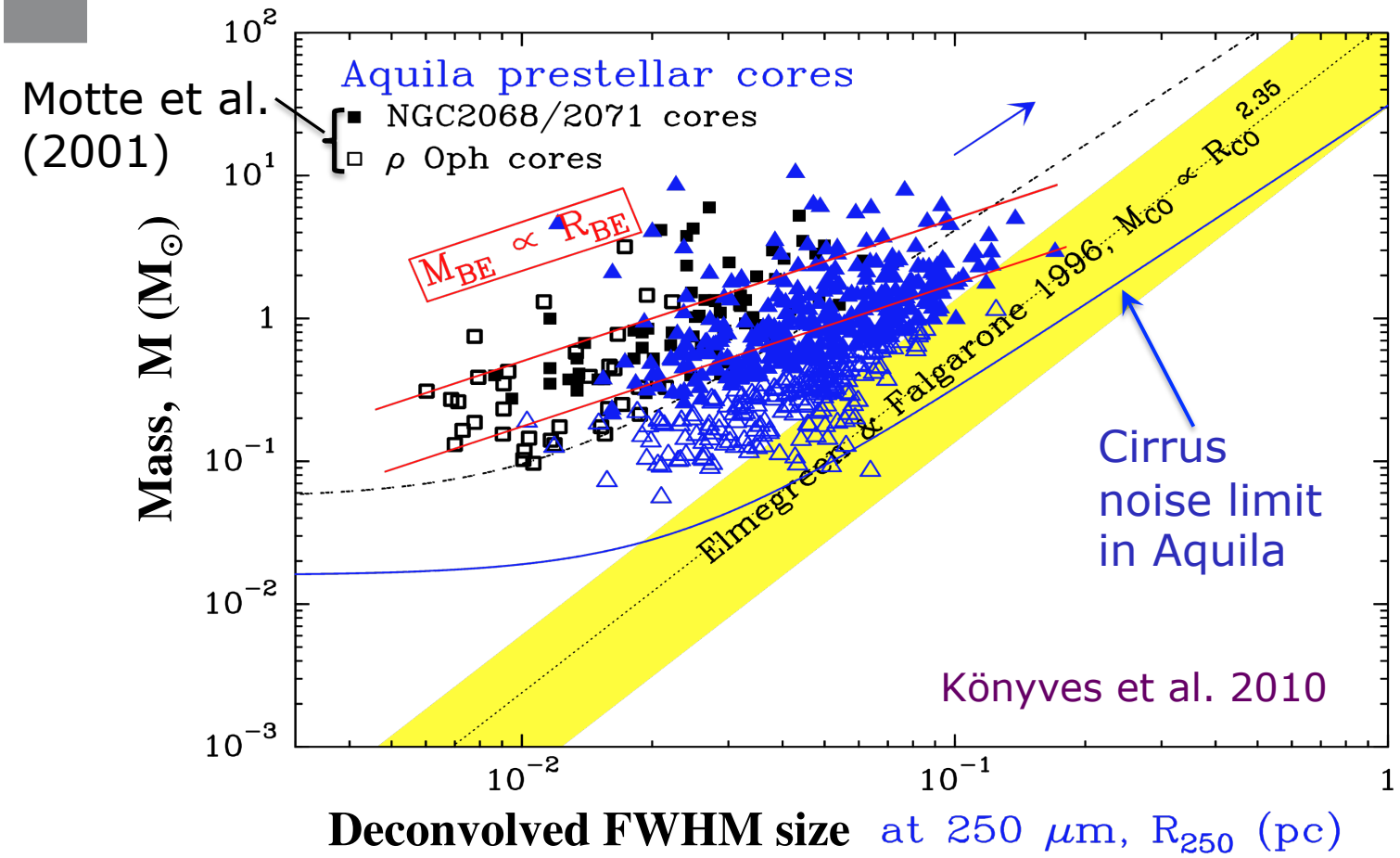
**Red : SPIRE 500 μm**
**Green : SPIRE 160 μm**
**Blue : PACS 70 μm**

**~ 3.3 deg x 3.3 deg field**

Könyves et al. 2010
Bontemps et al. 2010
André et al. 2010
A&A special issue

HERSCHEL SPACE OBSERVATORY

# Most of the Aquila starless cores are bound




➢ **Likely prestellar in nature**

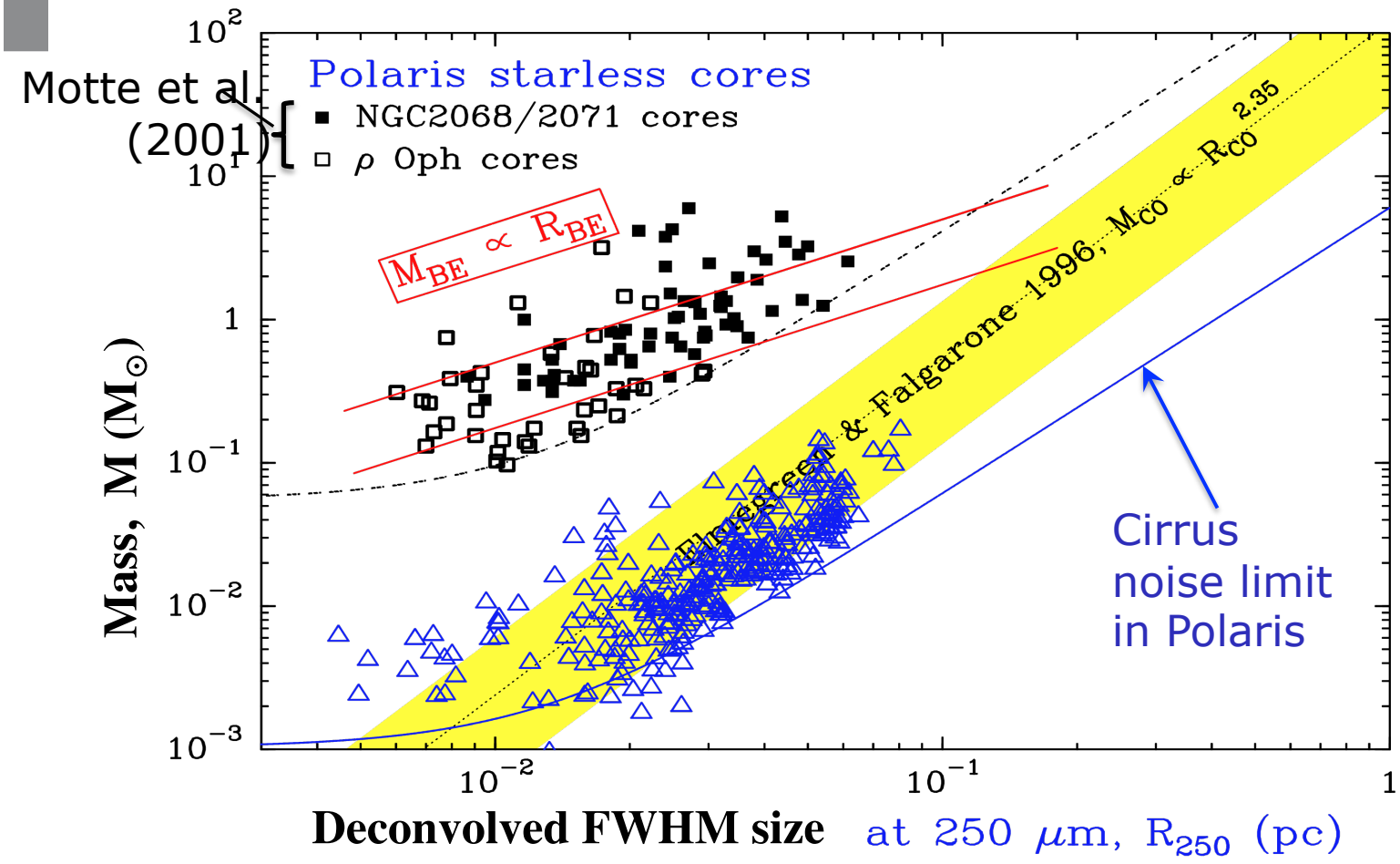
➢ **Location in mass vs. size diagram,** consistent with BE spheroids

➢ High degree of concentration: $N_{H2,\,peak}/\langle N_{H2}\rangle \sim 4$ on average

➢ Median column density contrast over the background ~ 1.5

HERSCHEL SPACE OBSERVATORY

# Most Polaris starless cores are unbound




- **not (yet ?) prestellar**

André et al. 2010
Ward-Thompson et al. 2010

- **Location in mass vs. size diagram:** 2 orders of magnitude below the density of self-gravitating Bonnor-Ebert isothermal spheres

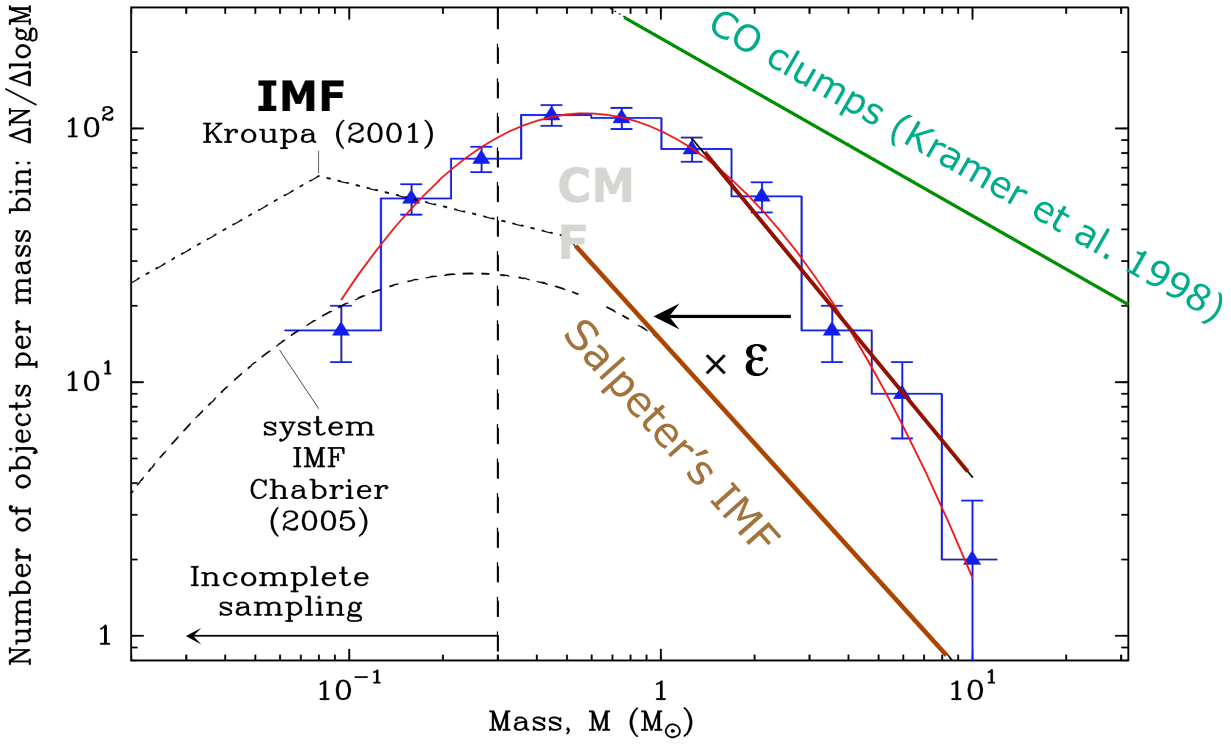
# Confirming link prestellar CMF & IMF

Könyves et al. 2010
André et al. 2010
A&A special issue

**341-541 prestellar cores in Aquila - factor ~ 2-9 better statistics than earlier studies:**

e.g. Motte, André, Neri 1998; Johnstone et al. 2000; Beuther & Schilke 2004; Stanke et al. 2006; Enoch et al. 2006; Alves et al. 2007; Nutter & Ward-Thompson 07

**Prestellar Core Mass Function (CMF) in Aquila Complex**




- **Good (~ one-to-one) correspondence between core mass and system mass: $M_* = \varepsilon M_{core}$ with $\varepsilon \sim 0.2$-$0.4$ in Aquila**
- **The IMF is at least partly determined by pre-collapse cloud fragmentation** (cf. models by Padoan & Nordlund 2002, Hennebelle & Chabrier 2008)

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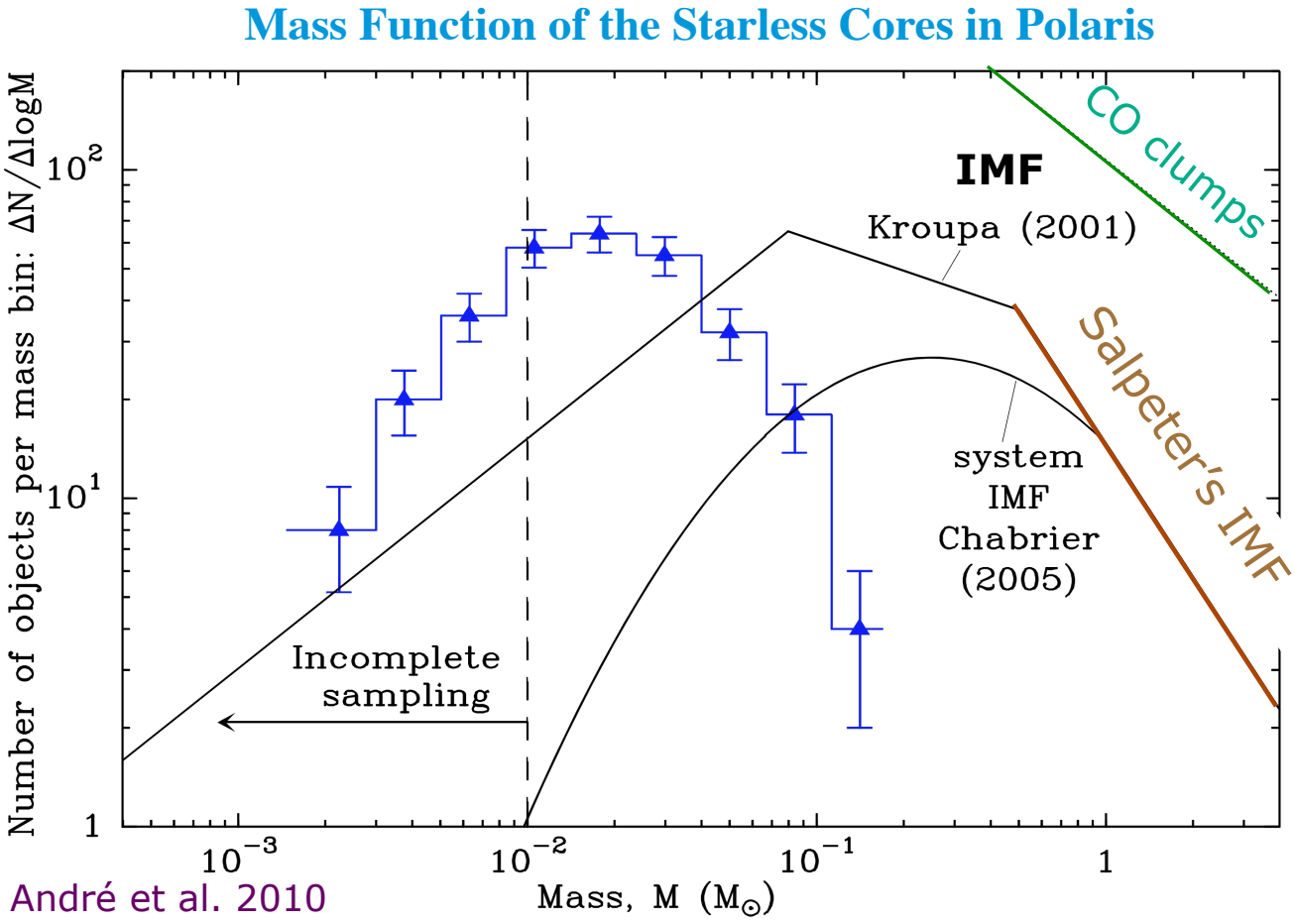
# The Polaris starless cores are not massive enough to form stars



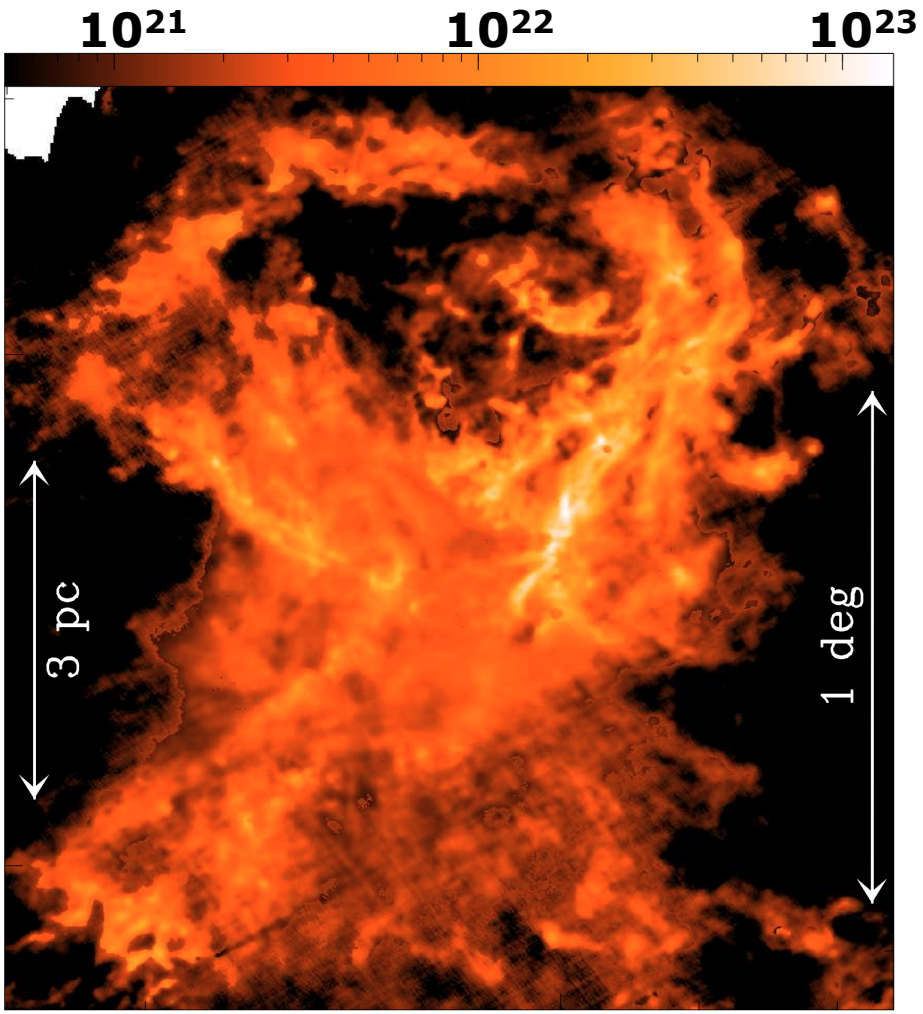

André et al. 2010

**The mass function of Polaris starless cores peaks at ~ 0.02 $M_\odot$, i.e., ~ one order of magnitude below the peak of the stellar IMF**

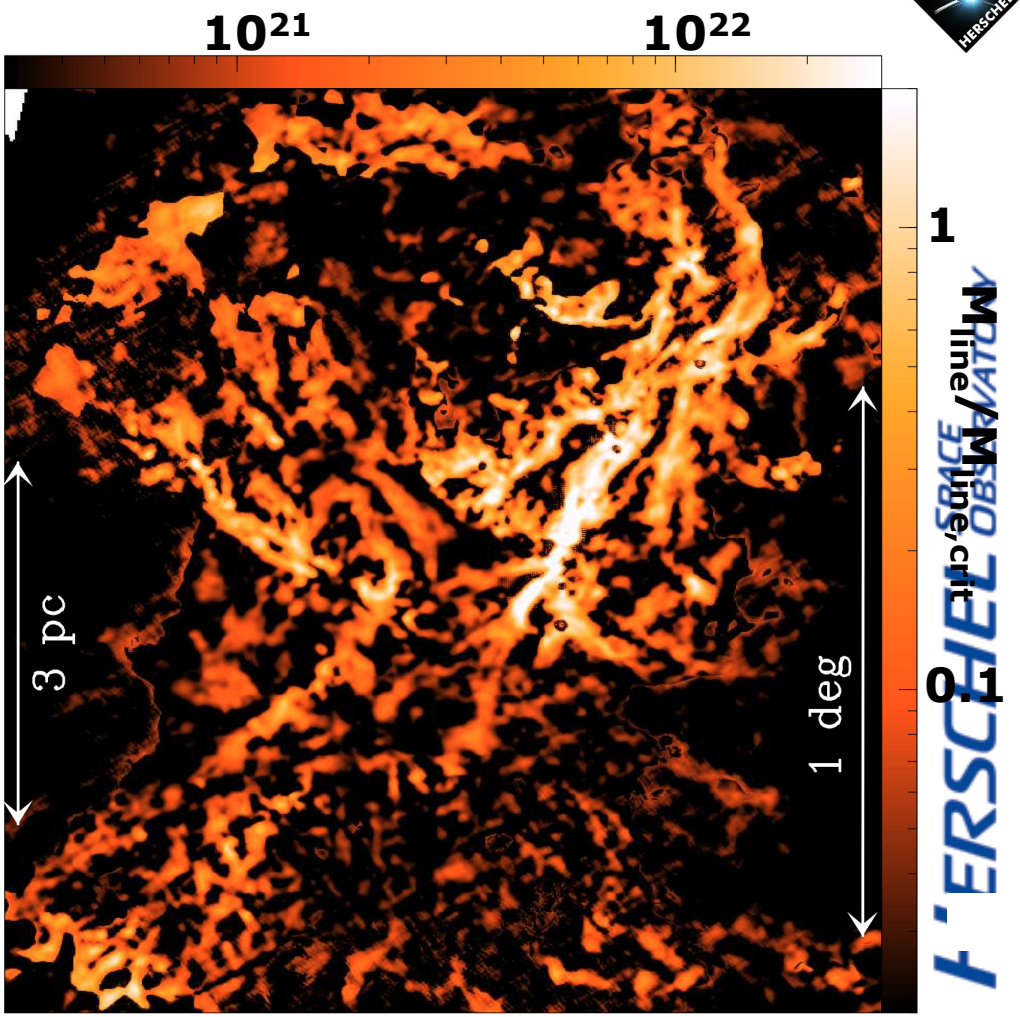
HERSCHEL SPACE OBSERVATORY

# Prestellar cores form out of a filamentary background

**Herschel (SPIRE+PACS)**
**Column density map ($H_2$/cm$^2$)**

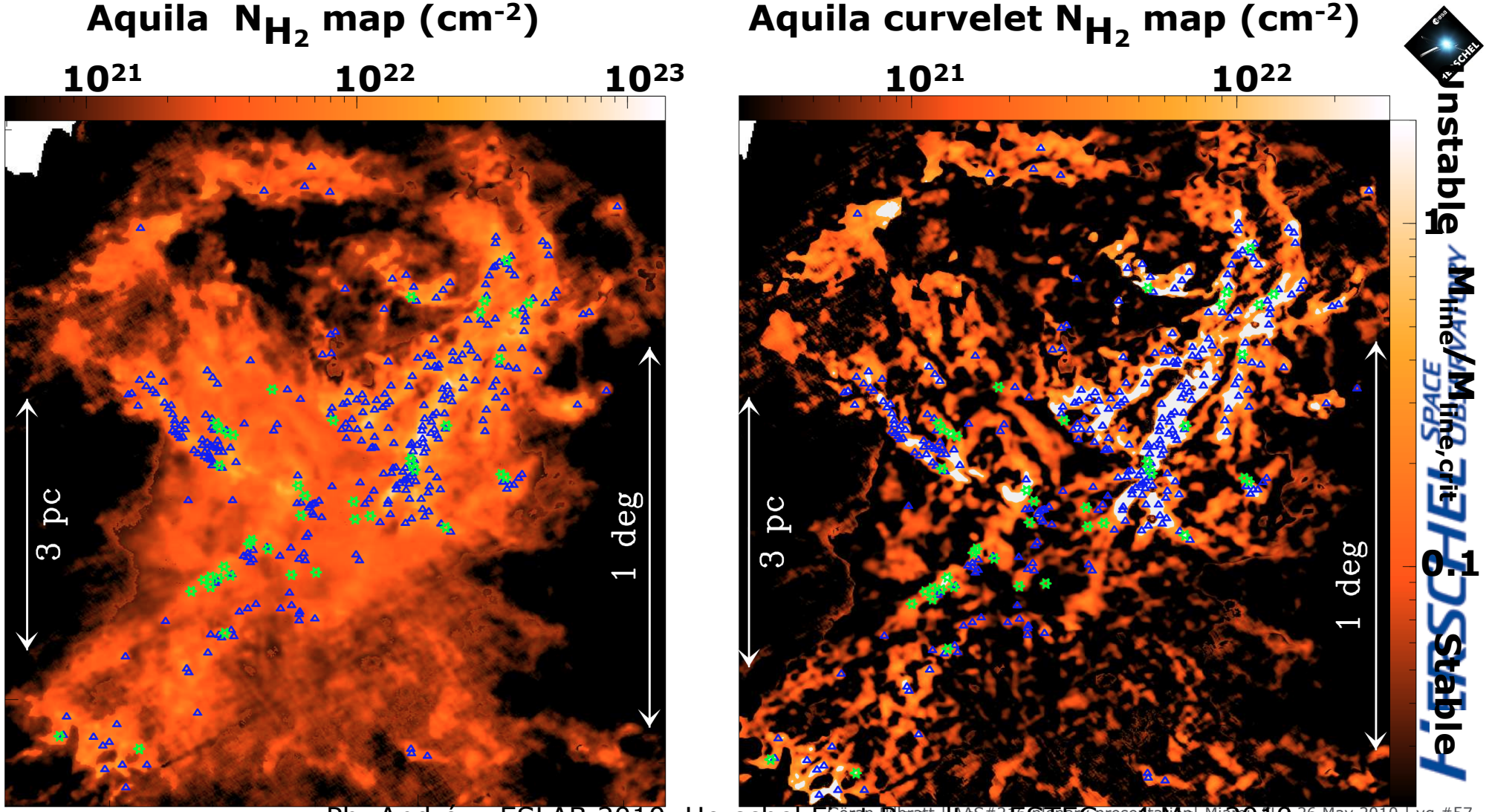



**Curvelet component of column density map ($H_2$/cm$^2$)**

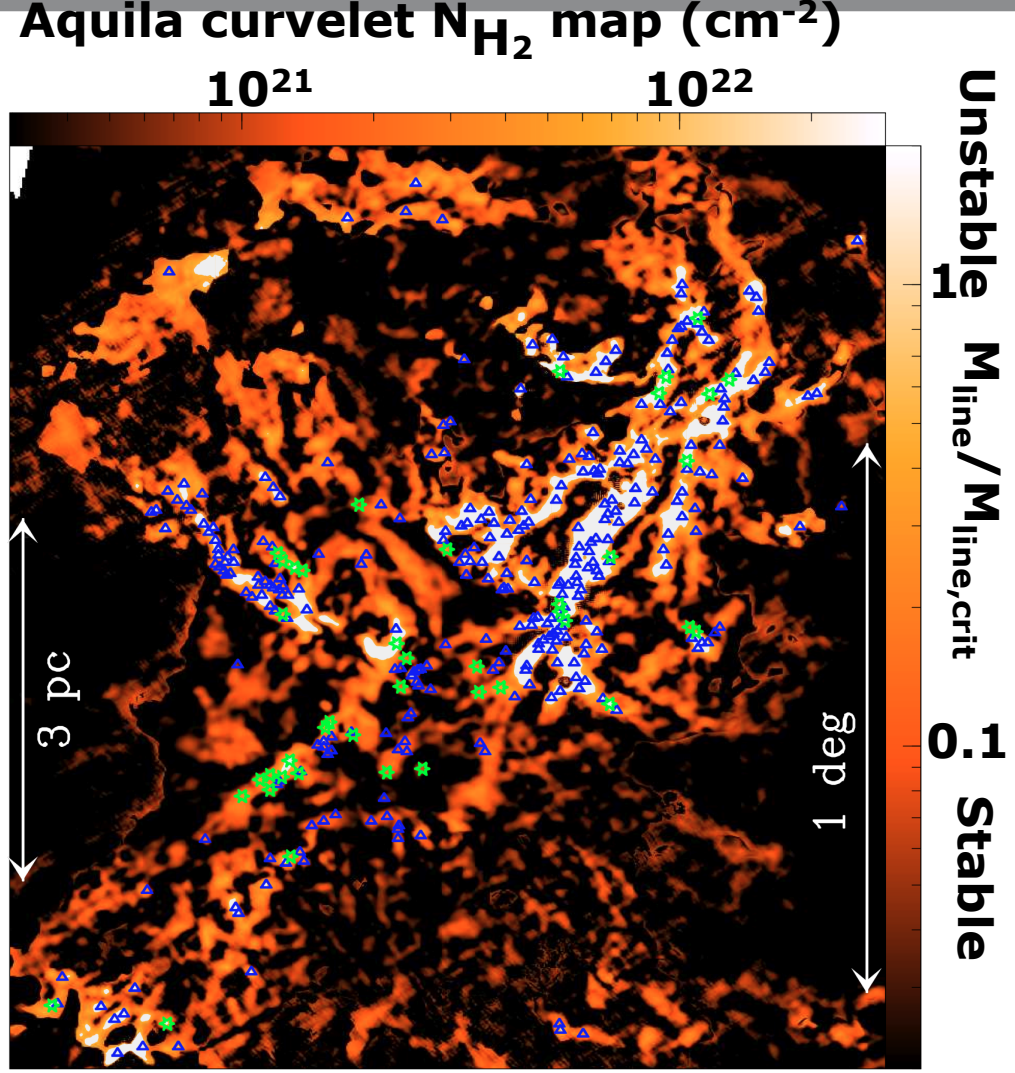


# Prestellar cores form out of a filamentary background

⋆: Class 0 protostars  △: Prestellar cores - 80% found at $A_v$(back) >7



# Only the densest filaments are gravitationally unstable and contain prestellar cores (▵)




André et al. 2010, A&A special issue

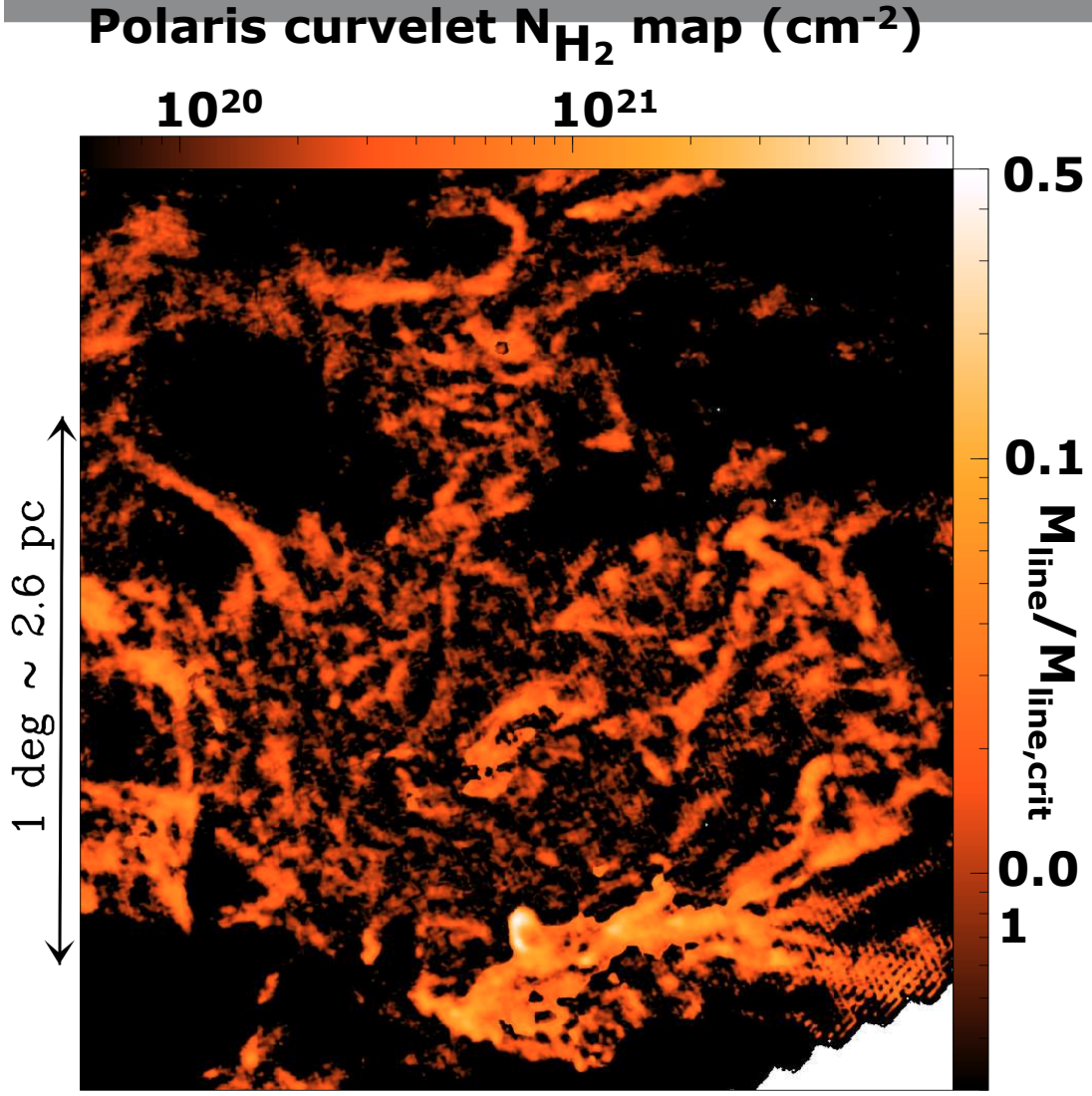
- The gravitational instability of filaments is controlled by the value of their mass per unit length $M_{line}$ (cf. Ostriker 1964, Inutsuka & Miyama 1997):
  - unstable if $M_{line} > M_{line,\,crit}$
  - stable if $M_{line} < M_{line,\,crit}$
  - $M_{line,\,crit} = c_s^2/G \sim 15\ M_\odot/pc$ for T = 10K
- Simple estimate:

  $M_{line} \propto N_{H2}$ x Width

  Unstable filaments highlighted in white in the $N_{H2}$ map

HERSCHEL SPACE OBSERVATORY

# Polaris (d ~ 150 pc): Structure of the cold ISM prior to any star formation




André et al. 2010, A&A special issue

## No prestellar cores (yet ?) in Polaris

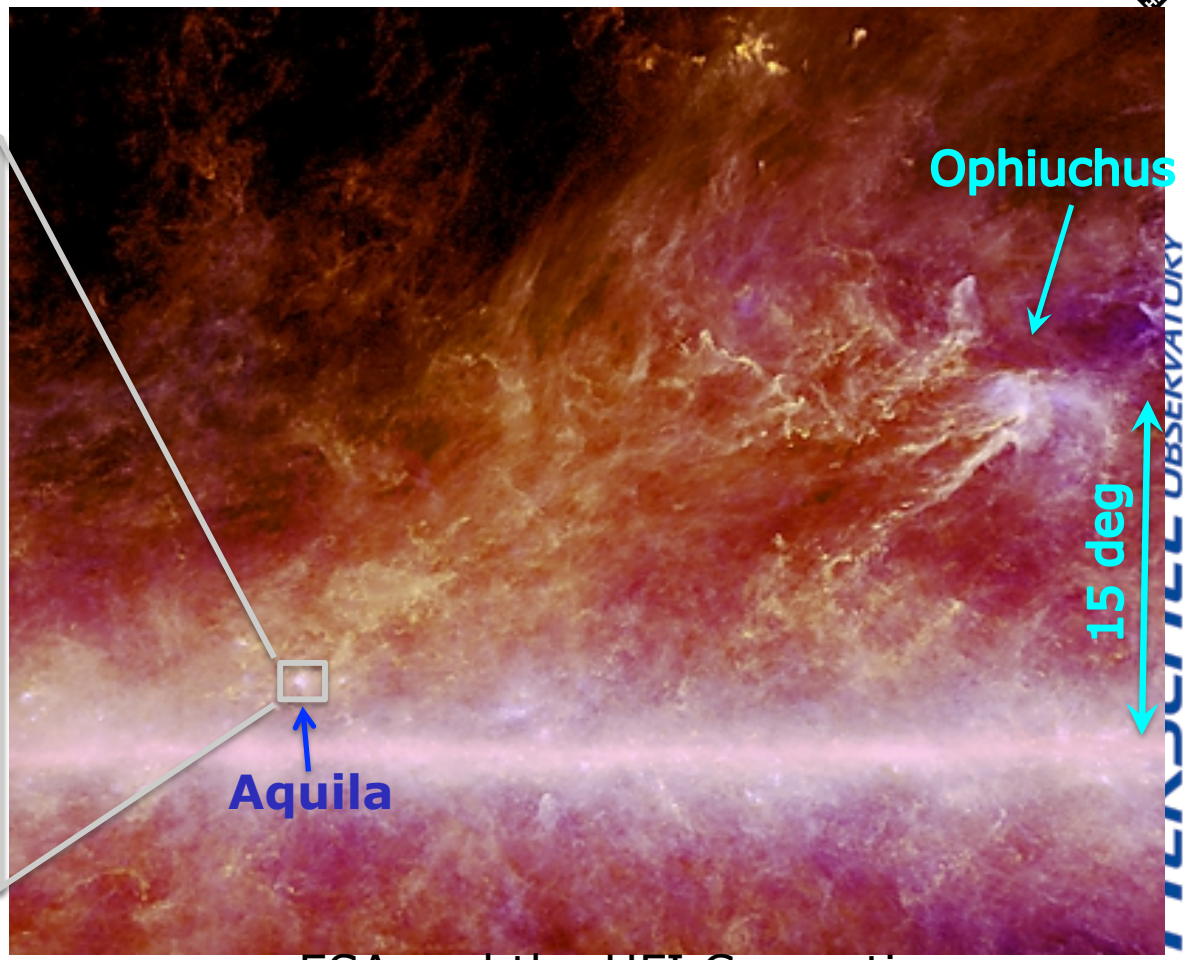
- Filaments are already widespread prior to star formation:
- The maximum value of $M_{line}/M_{line,\,crit}$ observed in the Polaris filaments is ~ 0.5
- The Polaris filaments are gravitationally stable and unable to form prestellar cores and protostars at present

# Filaments permeate the ISM on all scales

## Herschel
**SPIRE 500 μm**
**+**
**PACS 160/70 μm**

ESA and the Gould Belt KP

## Planck
**HFI 540/350 μm + IRAS 100 μm**

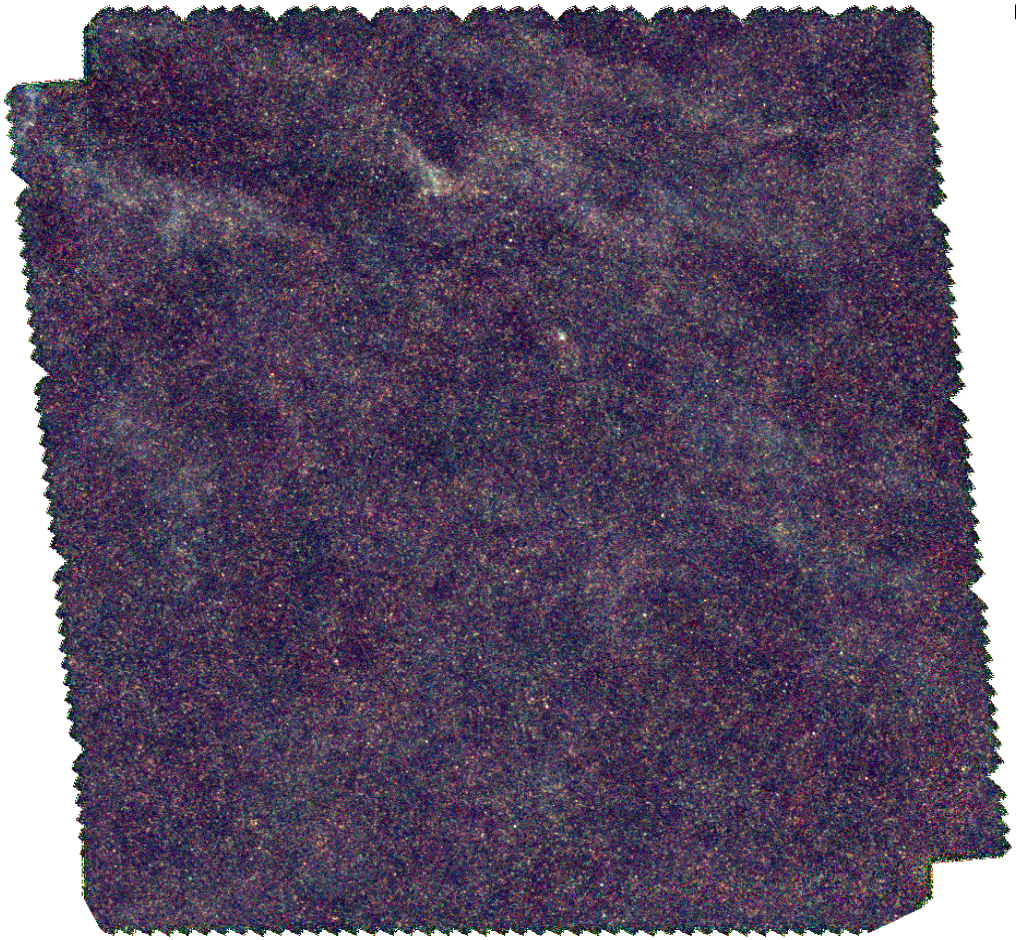



ESA and the HFI Consortium

# The Herschel ATLAS

## Astrophysical Terahertz Large Area Survey

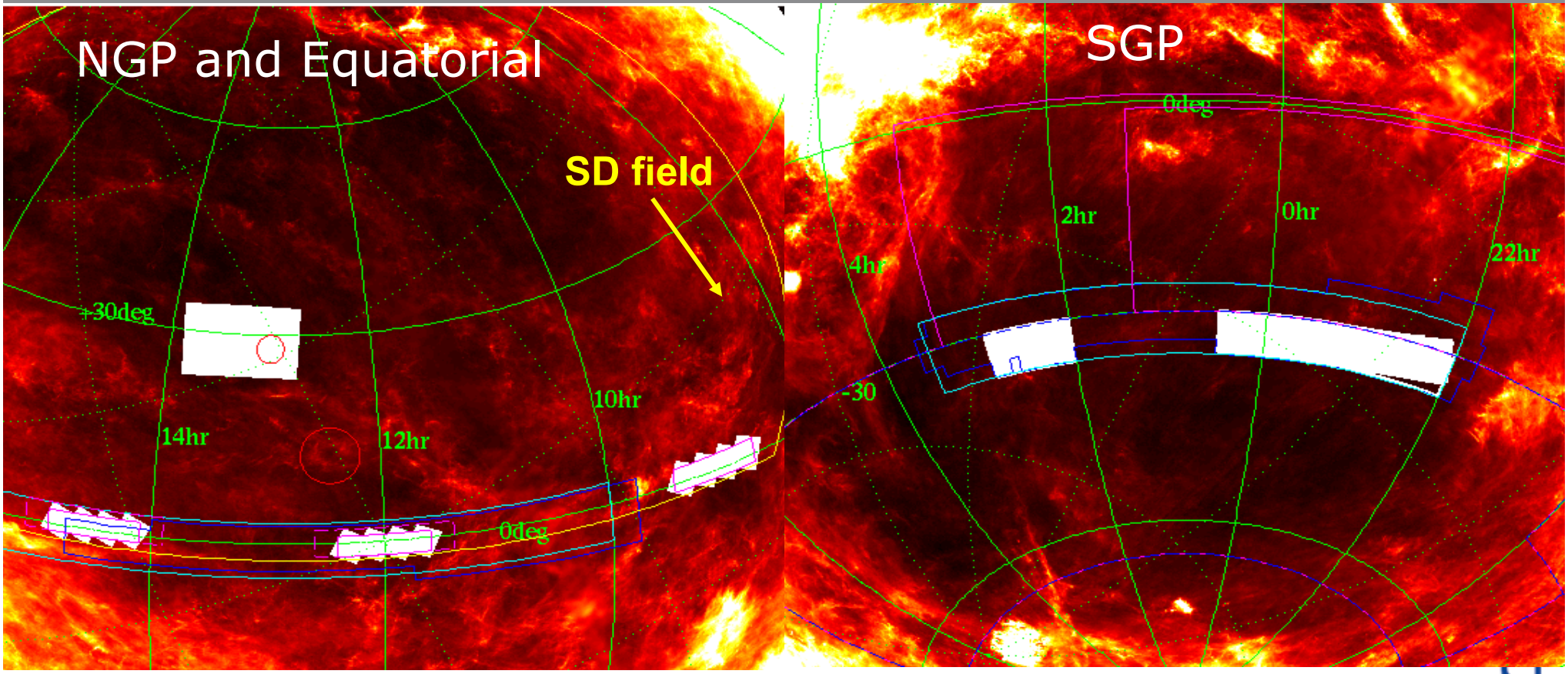
- The widest area survey with Herschel (~ 550 sq deg)
- Consortium of 150+ astronomers worldwide led by Nottingham and Cardiff (Dunne, Eales)
- Covering 5 bands with PACS and SPIRE (110 – 500 microns) in fast parallel mode
- 5 sigma sensitivities of 132, 126, 33, 36 and 45 mJy / beam from 110-500μm
- Detect ~$10^5$ sources to z~3



3-col SPIRE H-ATLAS SDP field

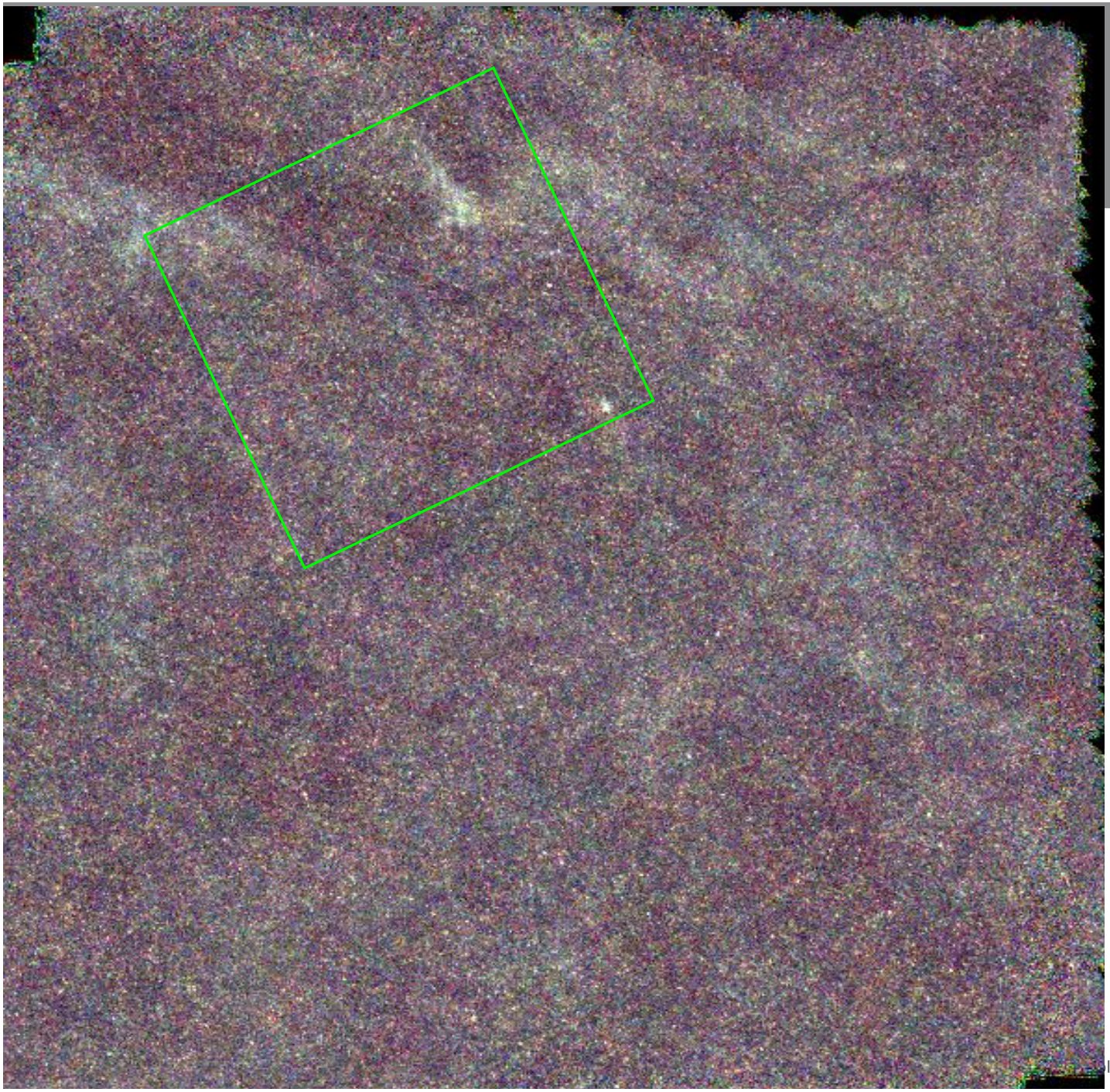
HERSCHEL SPACE OBSERVATORY

# The Herschel ATLAS - fields




Fields chosen to allow maximum overlap with existing and planned surveys
GALEX, 2dF, SDSS, GAMA, UKIDSS, KIDS, VIKING, PanSTARRS, DES, SPT, SASSy

and to be accessible to new facilities which will be valuable for follow-up
ALMA, SKA and prototypes, SCUBA2, LOFAR, e-MERLIN



## Herschel ATLAS Science Demonstration Field

4 x 4 degrees

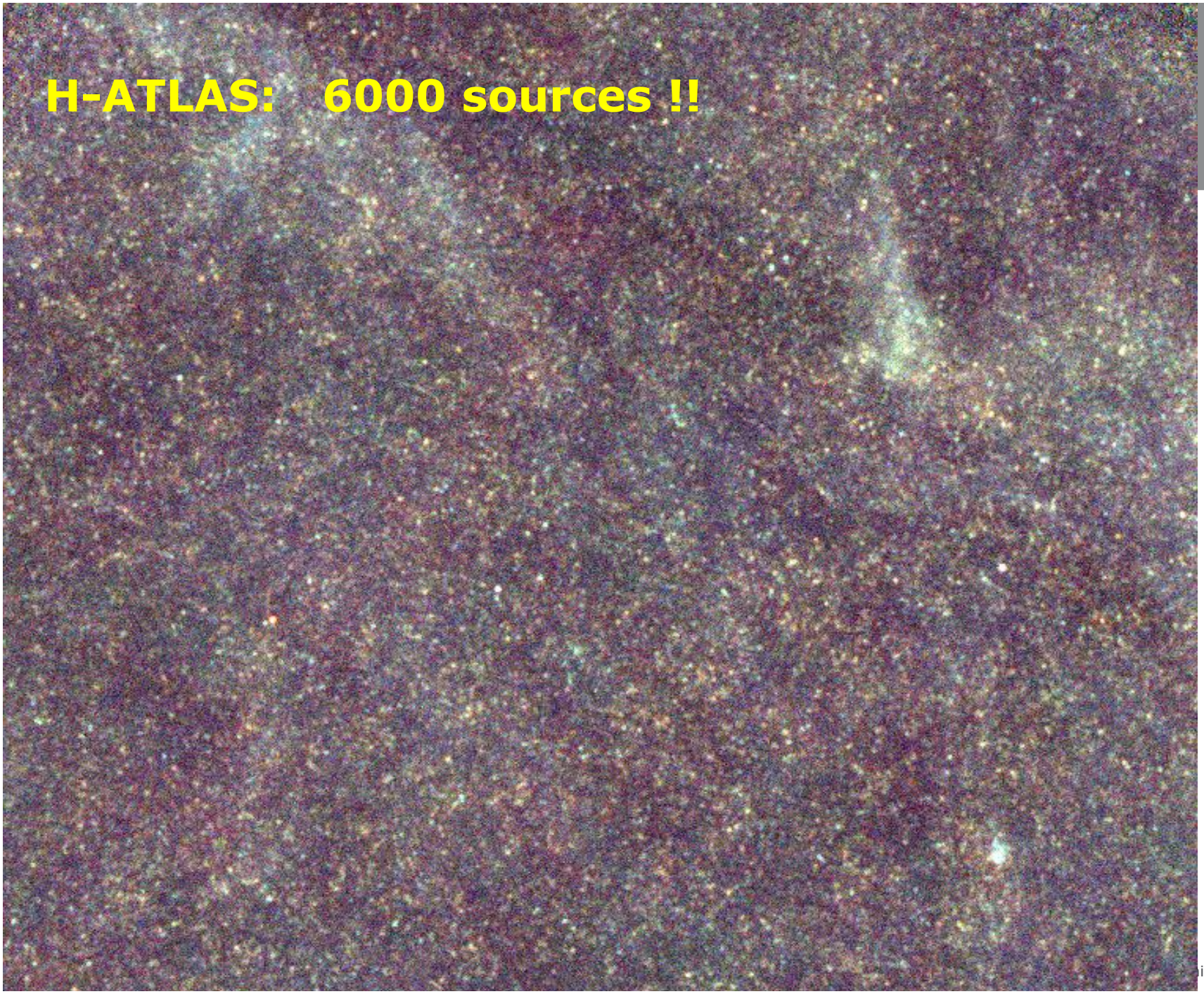
3% of final area

Unbiased survey of dust in the local and distant Universe

Samples peak of SED across z=0-2; good measure of $L_{IR}$ and dust mass

HERSCHEL SPACE OBSERVATORY

# H-ATLAS: 6000 sources !!

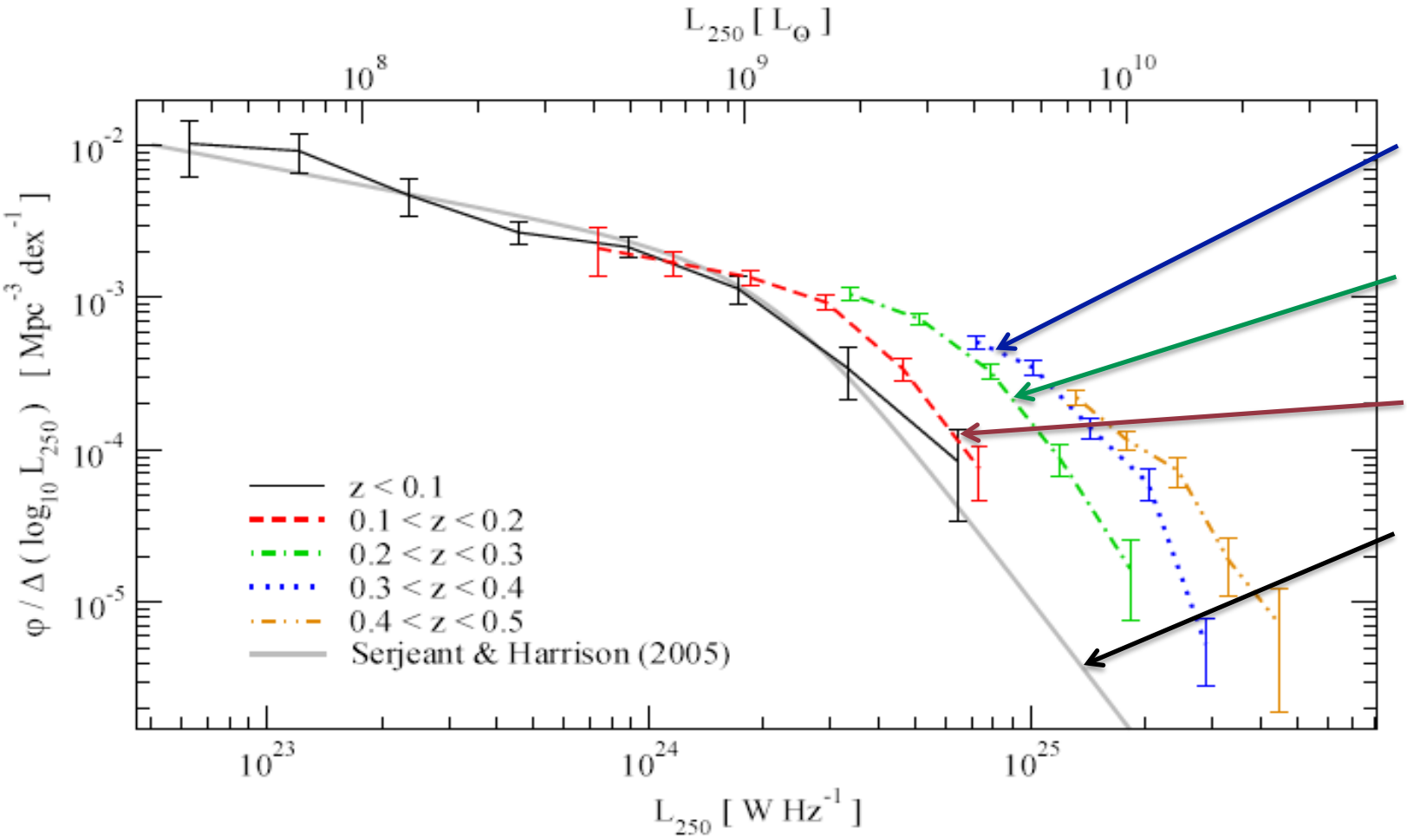


esa

HERSCHEL SPACE OBSERVATORY

# Evolution of the 250 um Luminosity Function

Dye et al, A&A special issue



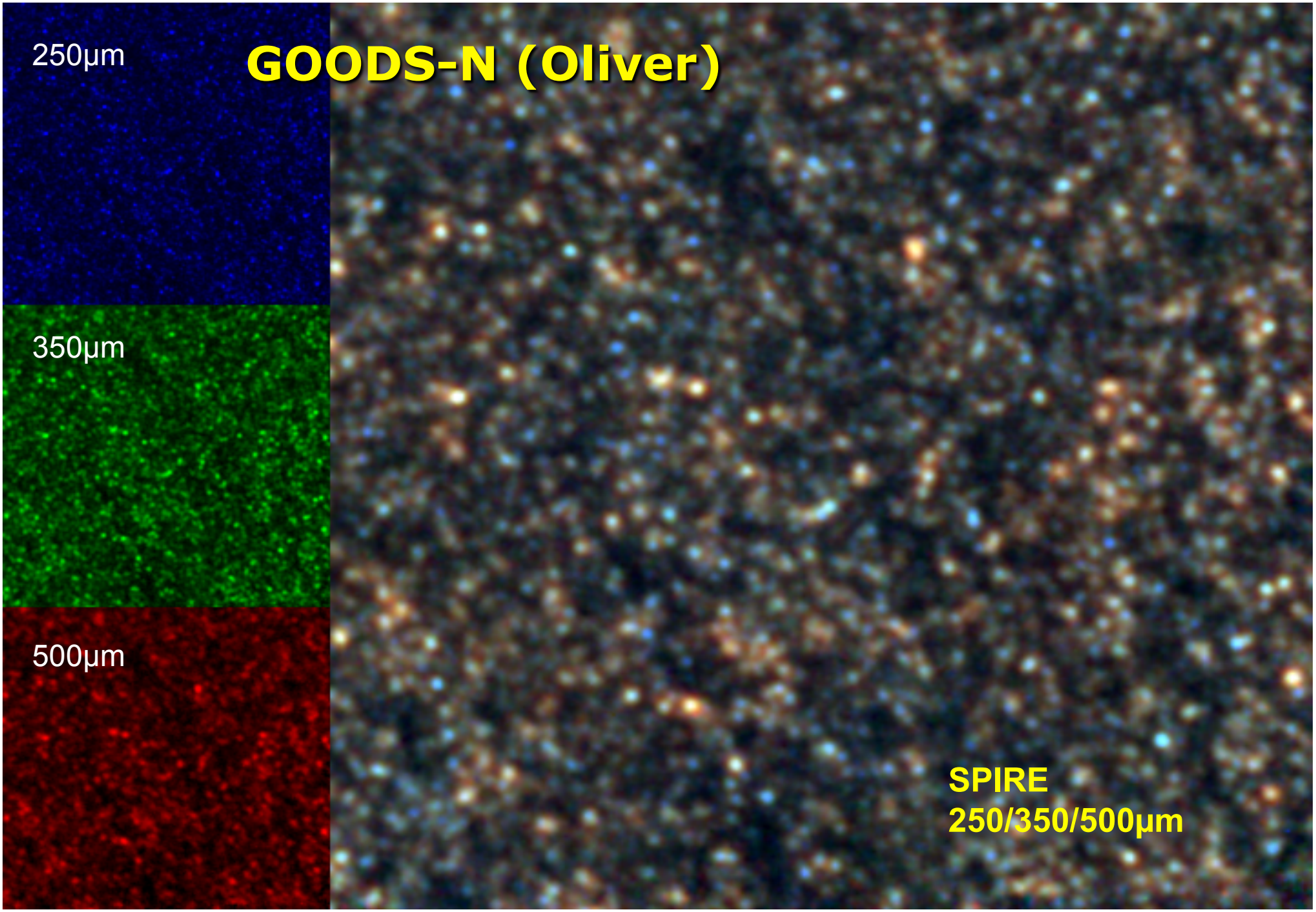

3 billion years ago

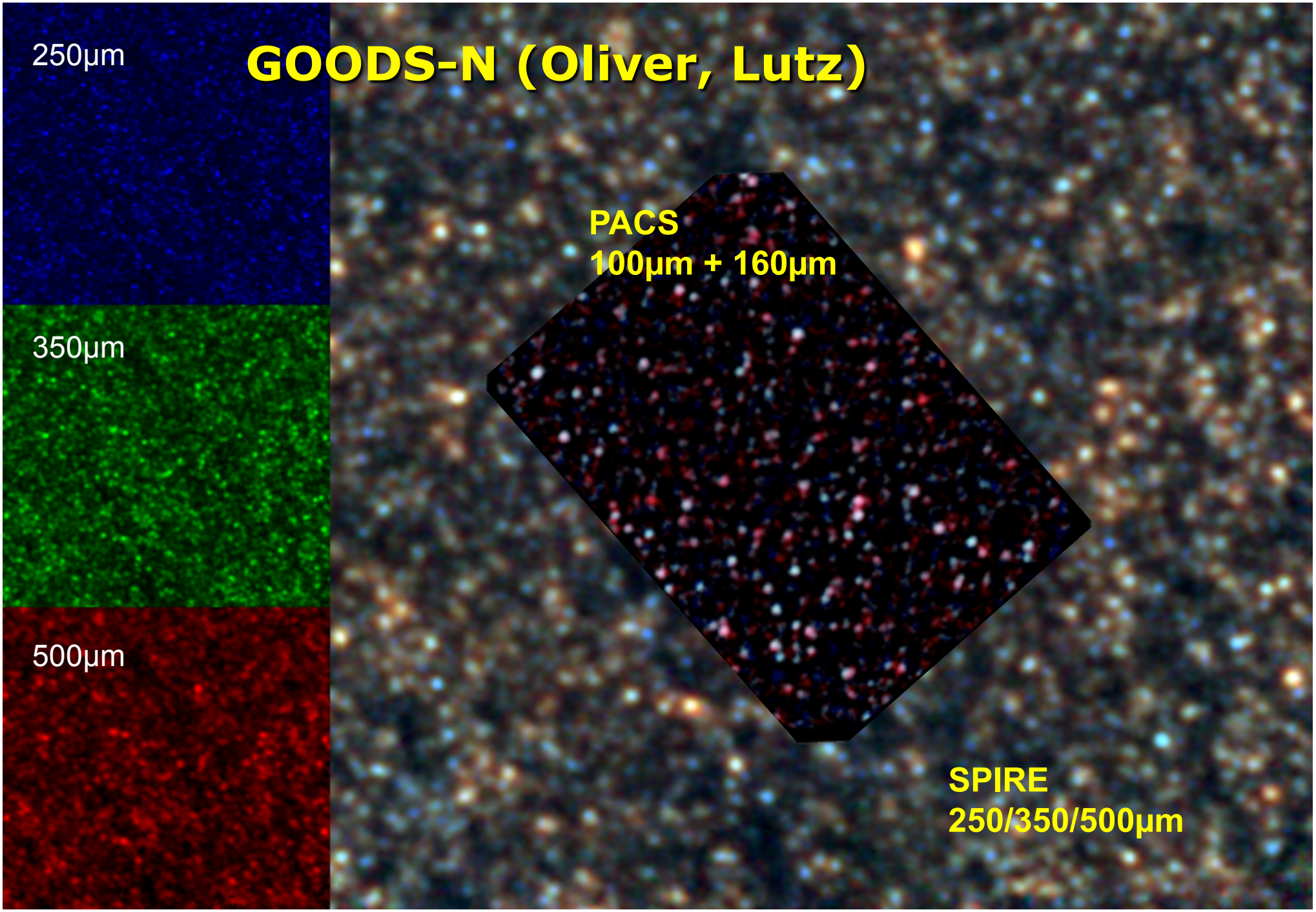
2 billion years ago

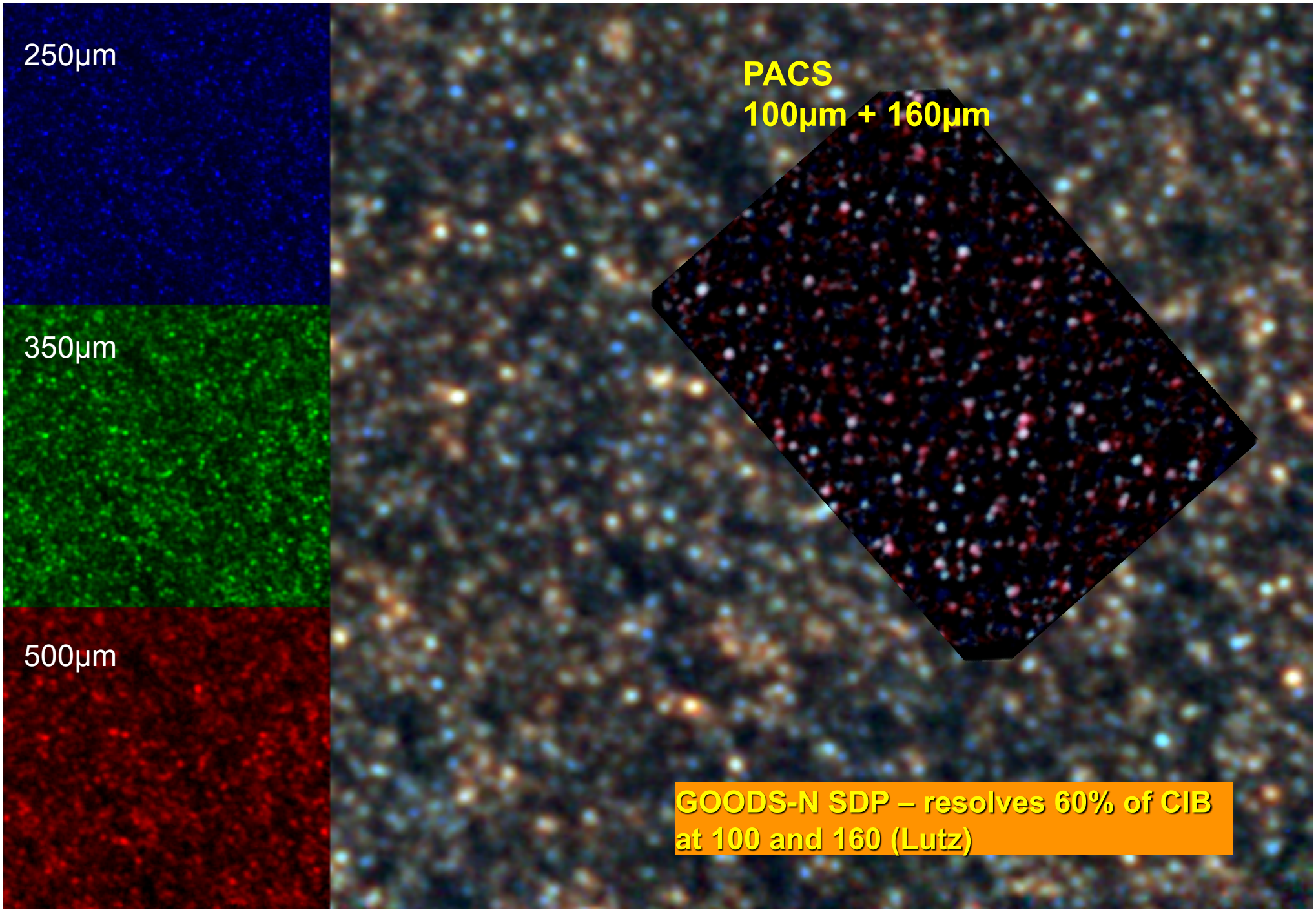
1 billion years ago

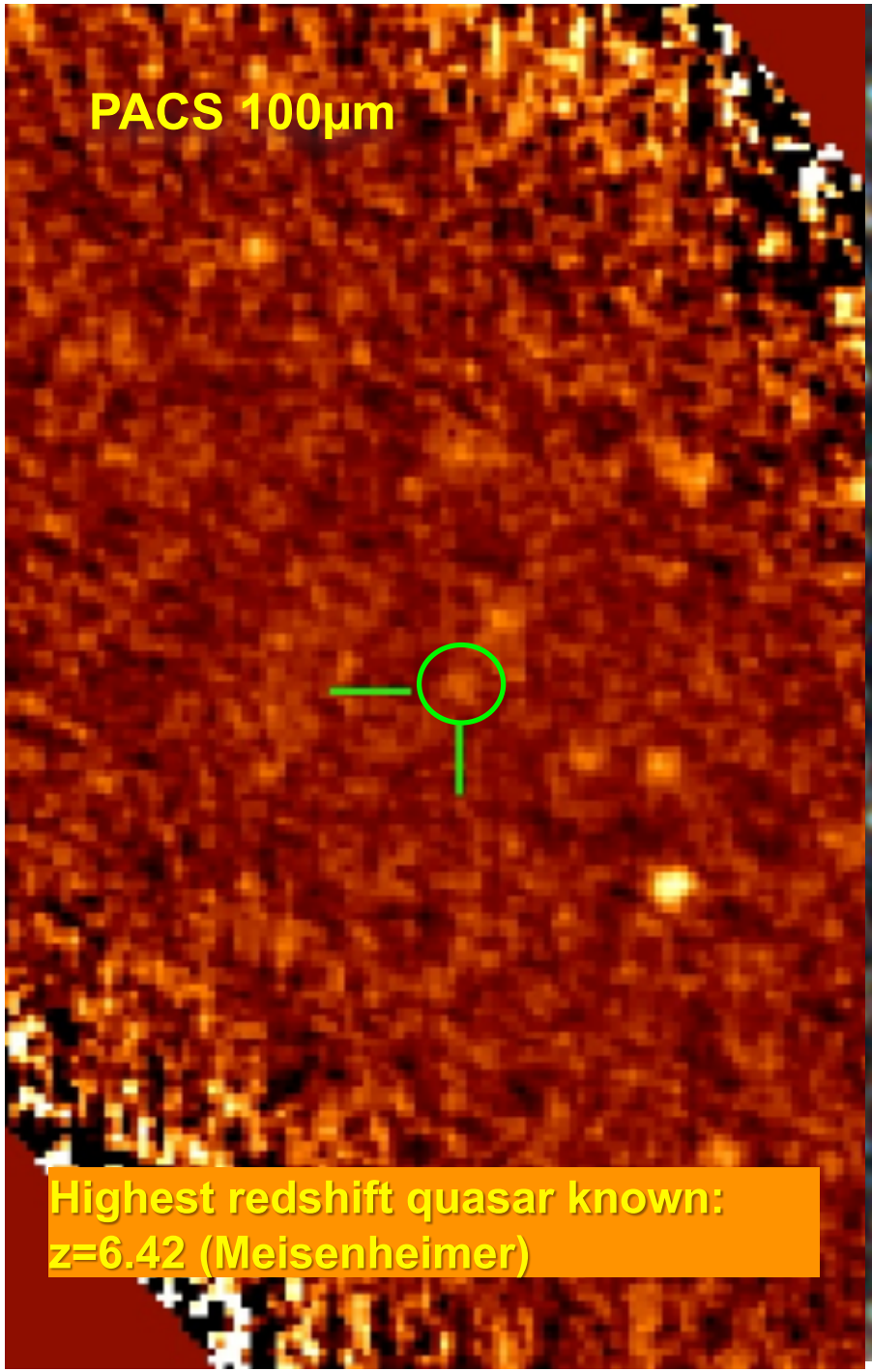
Now

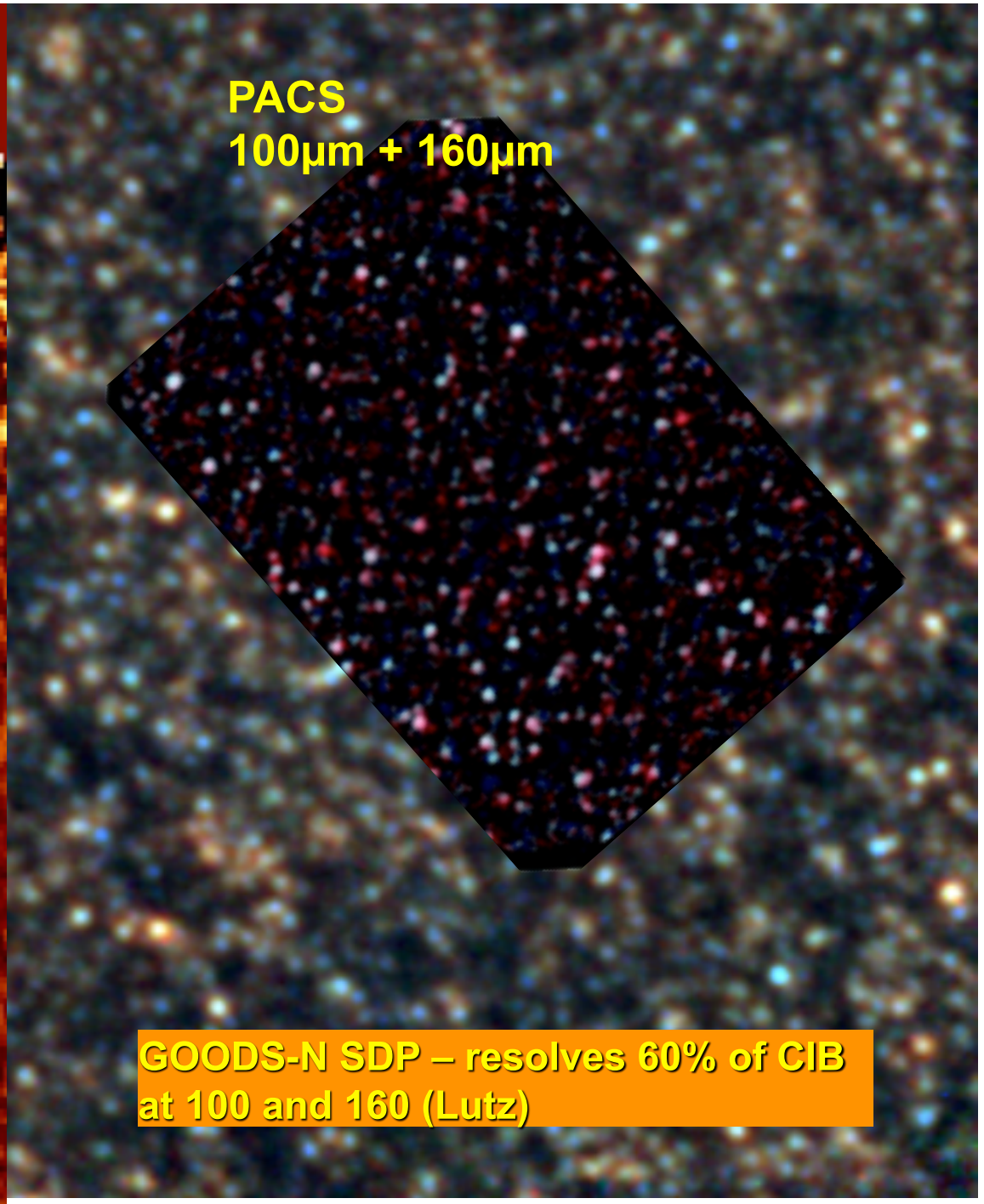
HERSCHEL SPACE OBSERVATORY


250μm
GOODS-N (Oliver)
350μm
500μm
SPIRE
250/350/500μm

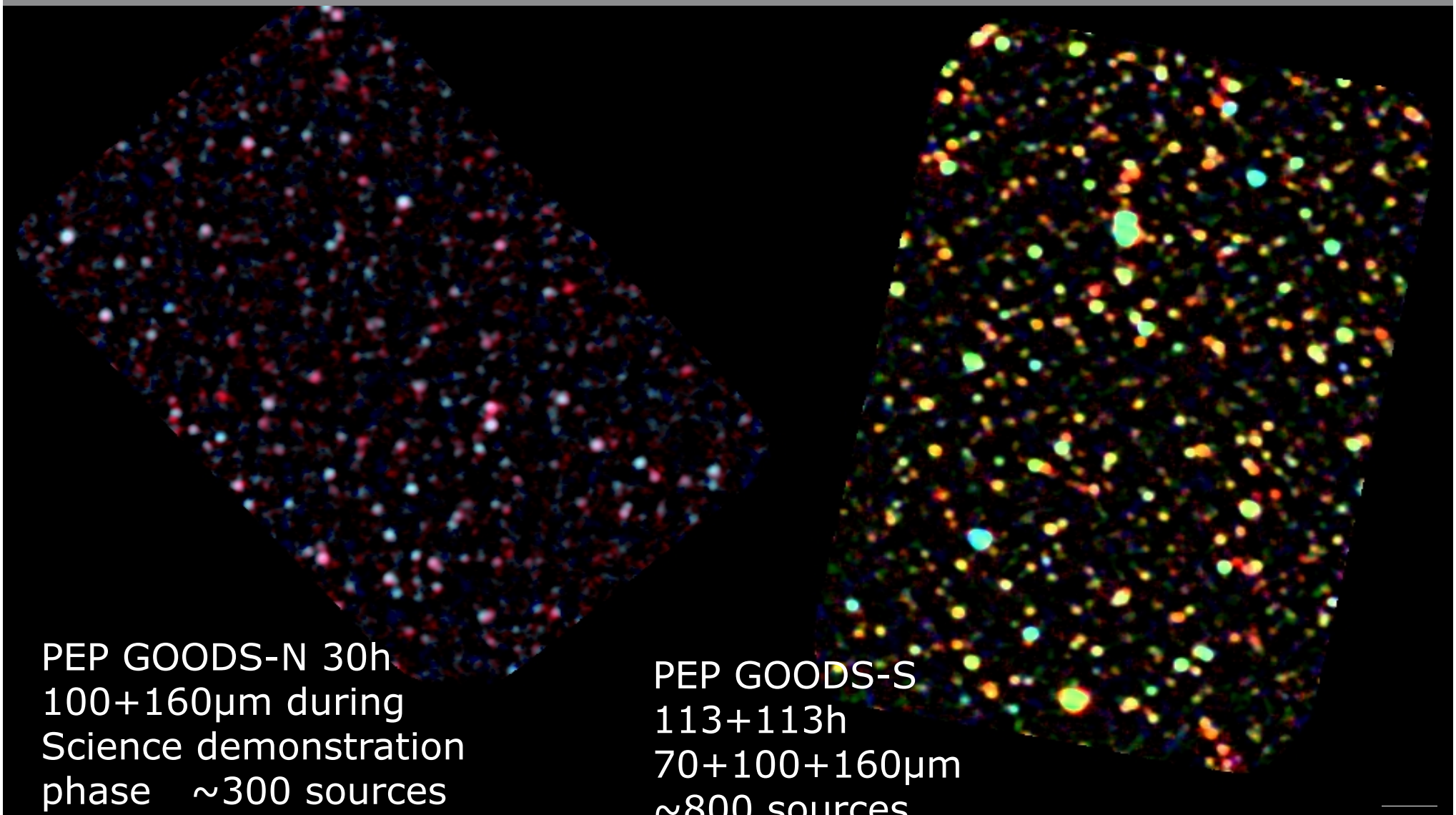

250μm
GOODS-N (Oliver, Lutz)
350μm
PACS
100μm + 160μm
500μm
SPIRE
250/350/500μm


250μm
350μm
500μm
PACS
100μm + 160μm
GOODS-N SDP – resolves 60% of CIB
at 100 and 160 (Lutz)


PACS 100μm
Highest redshift quasar known:
z=6.42 (Meisenheimer)


PACS
100μm + 160μm
GOODS-N SDP – resolves 60% of CIB
at 100 and 160 (Lutz)

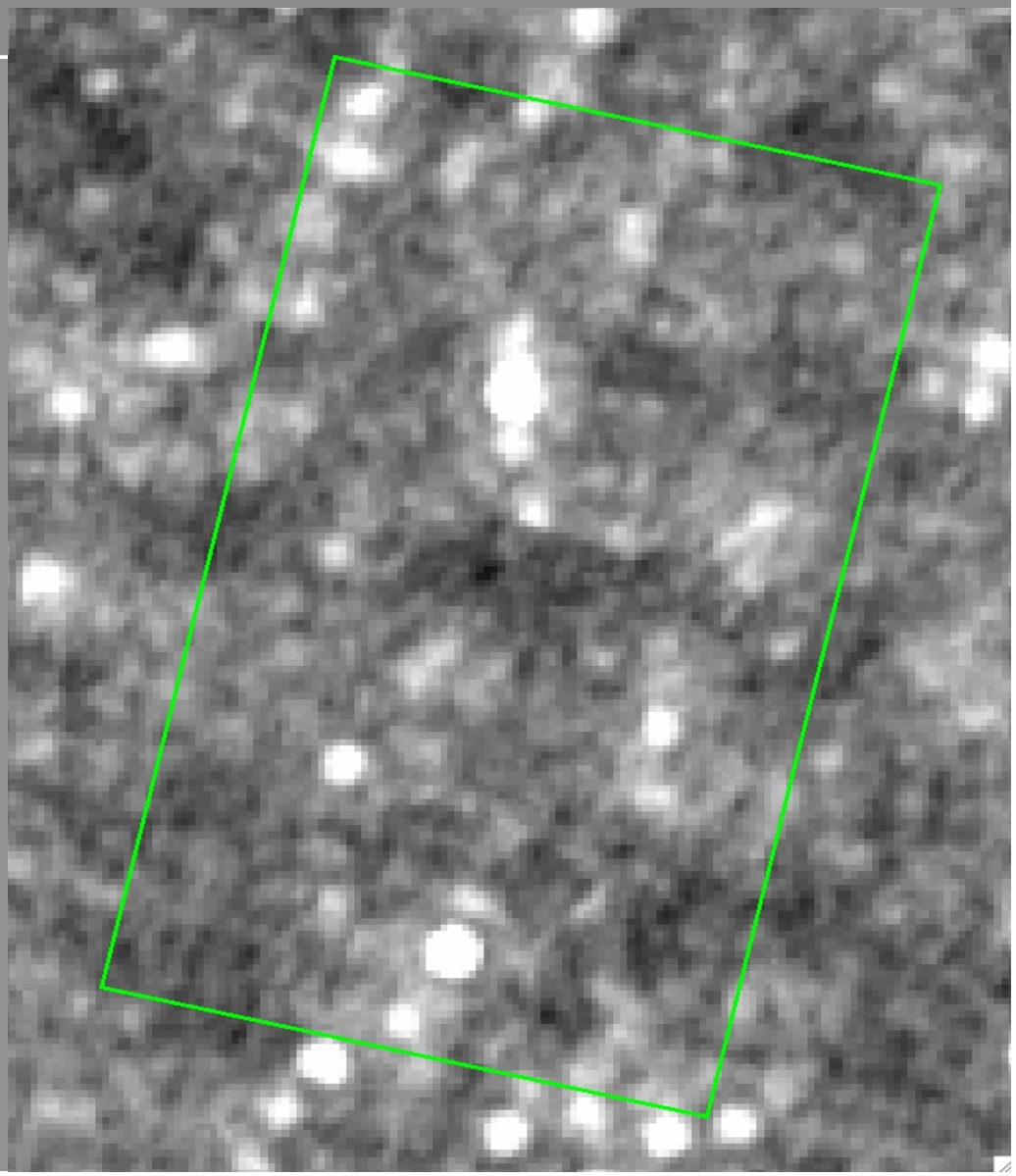
# The deepest Herschel-PACS blank fields taken to date



PEP GOODS-N 30h
100+160μm during
Science demonstration
phase ~300 sources

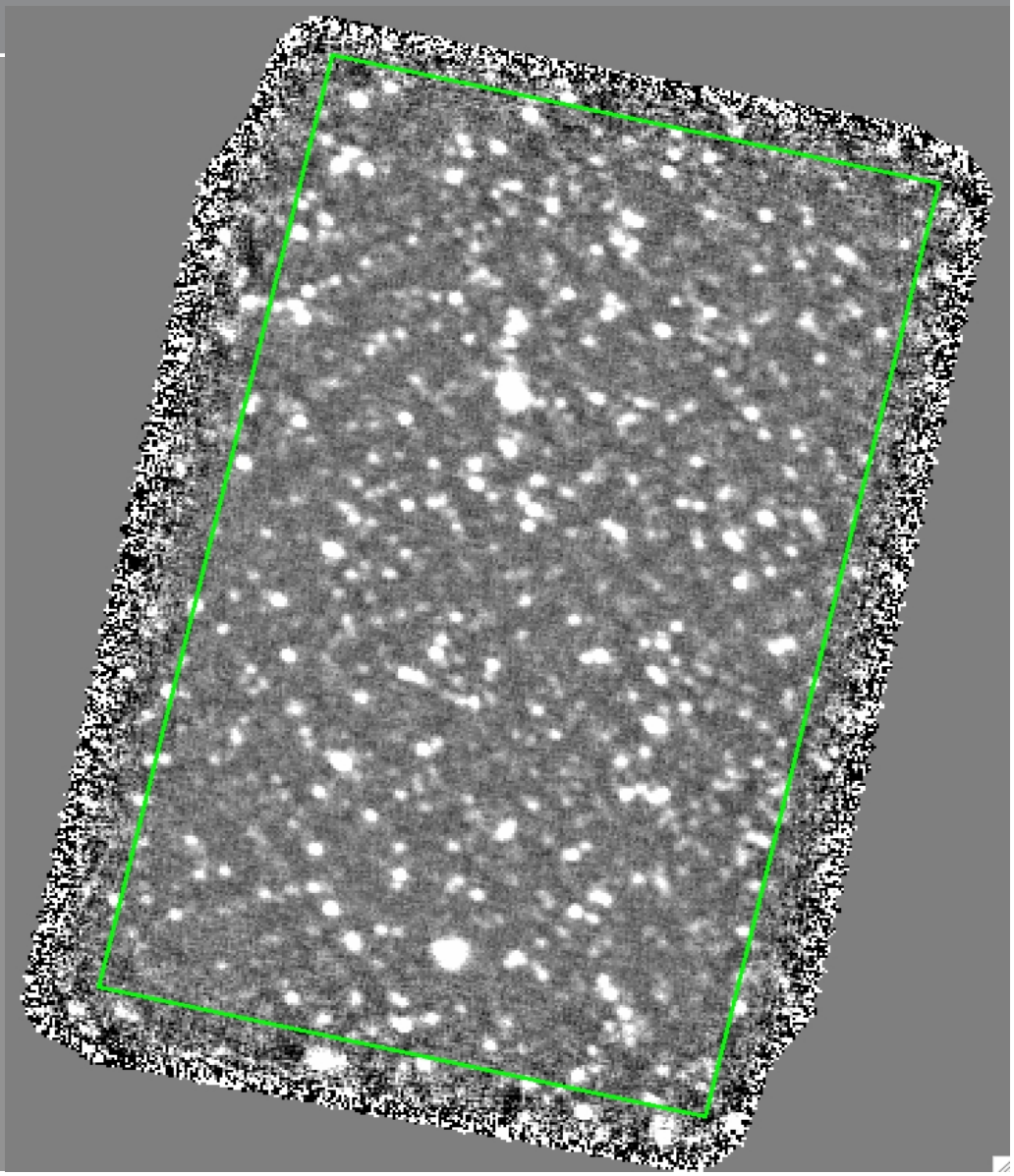
PEP GOODS-S
113+113h
70+100+160μm
~800 sources

# From MIPS to PACS



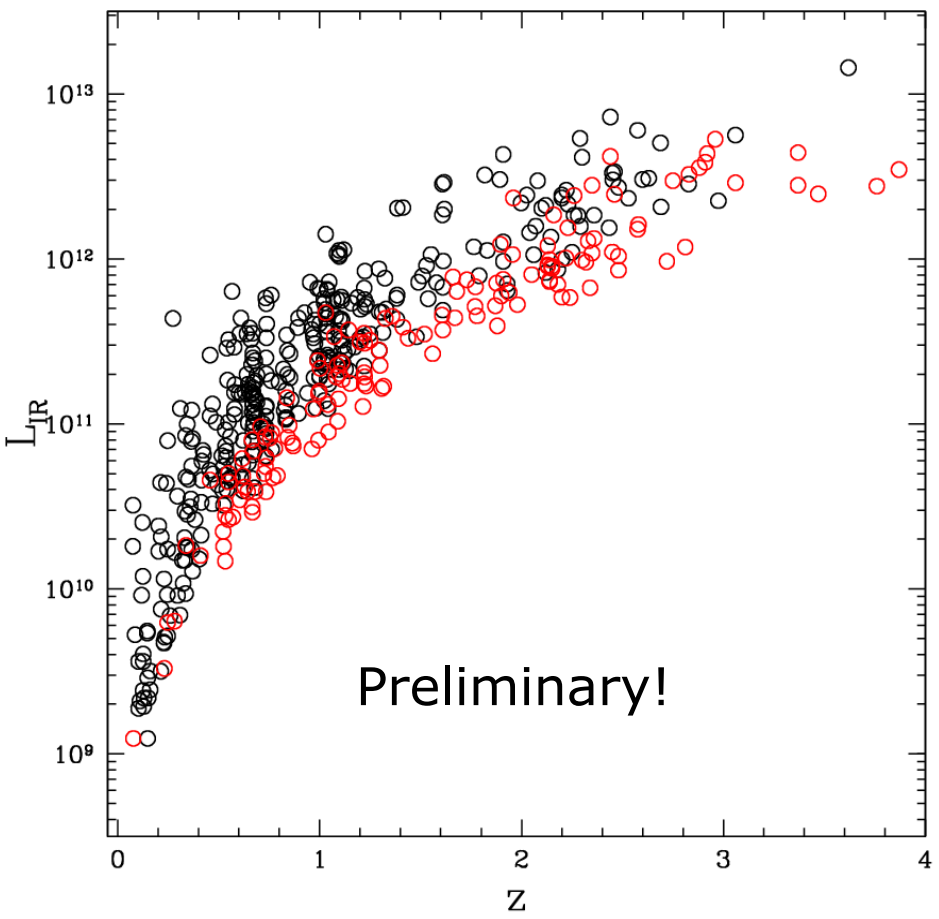
GOODS-S MIPS 160μm
FIDEL team

# From MIPS to PACS

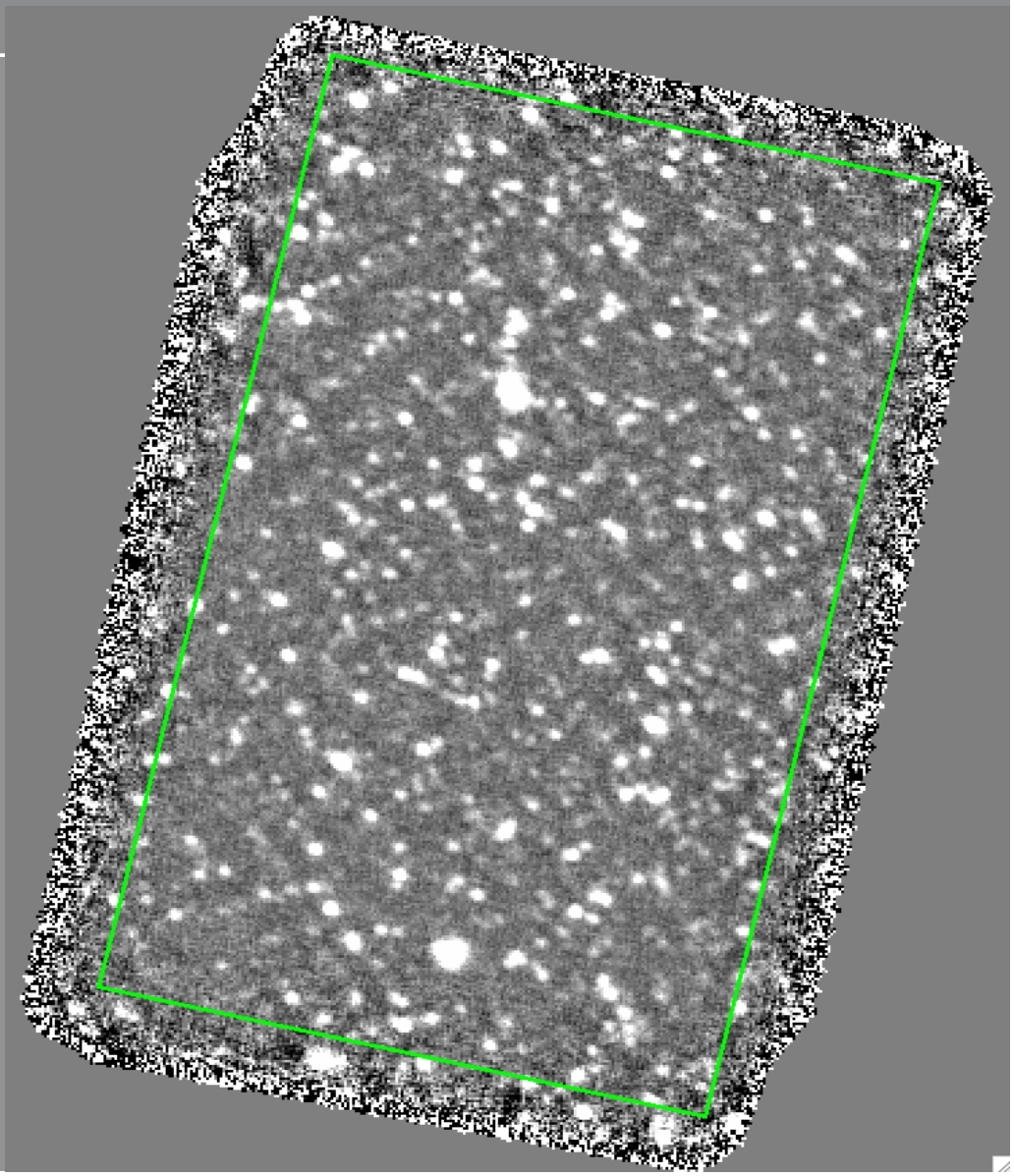


GOODS-S PACS 160μm
PEP team

# From MIPS to PACS




GOODS-S PACS 160μm
PEP team

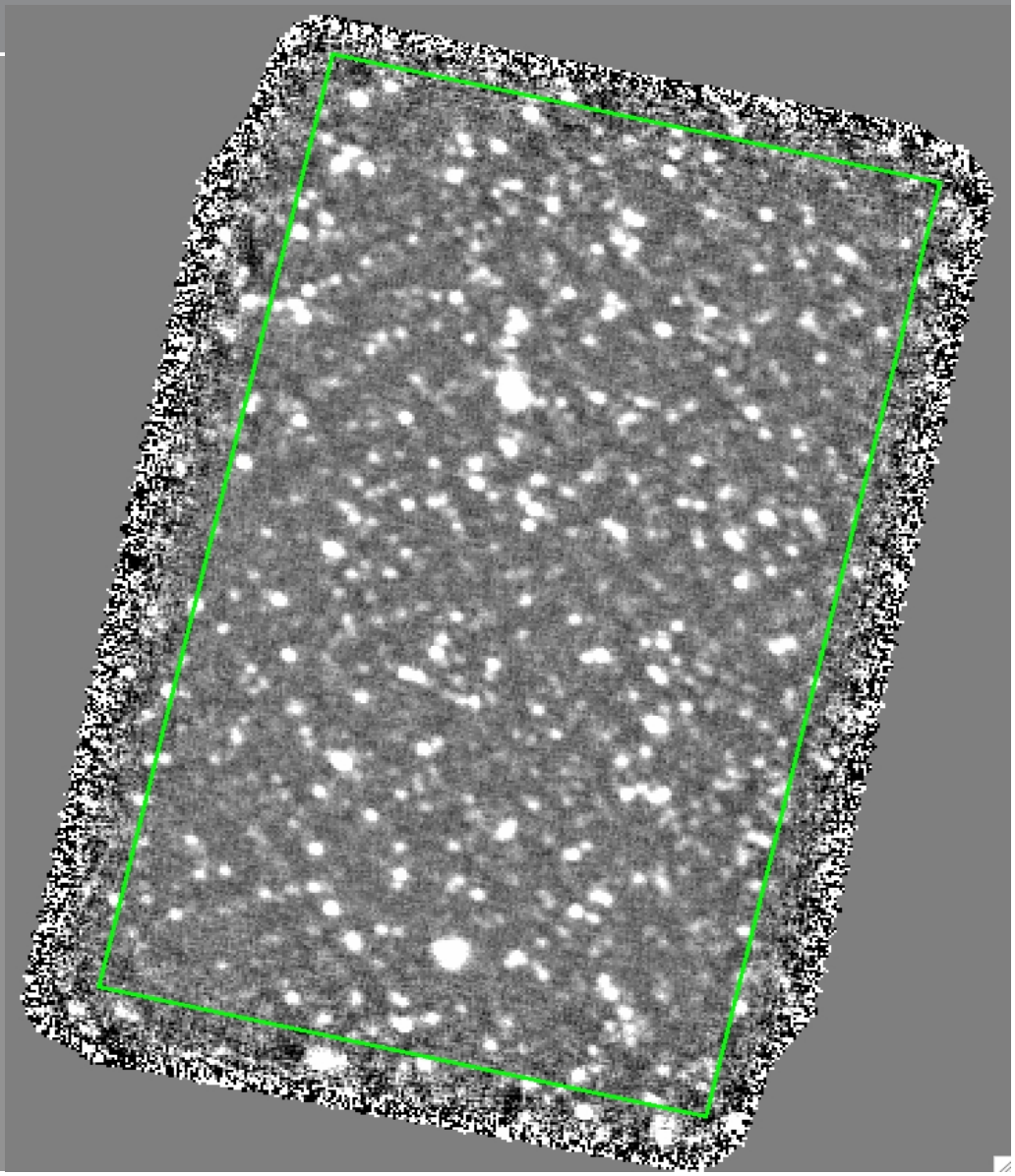


# From MIPS to PACS

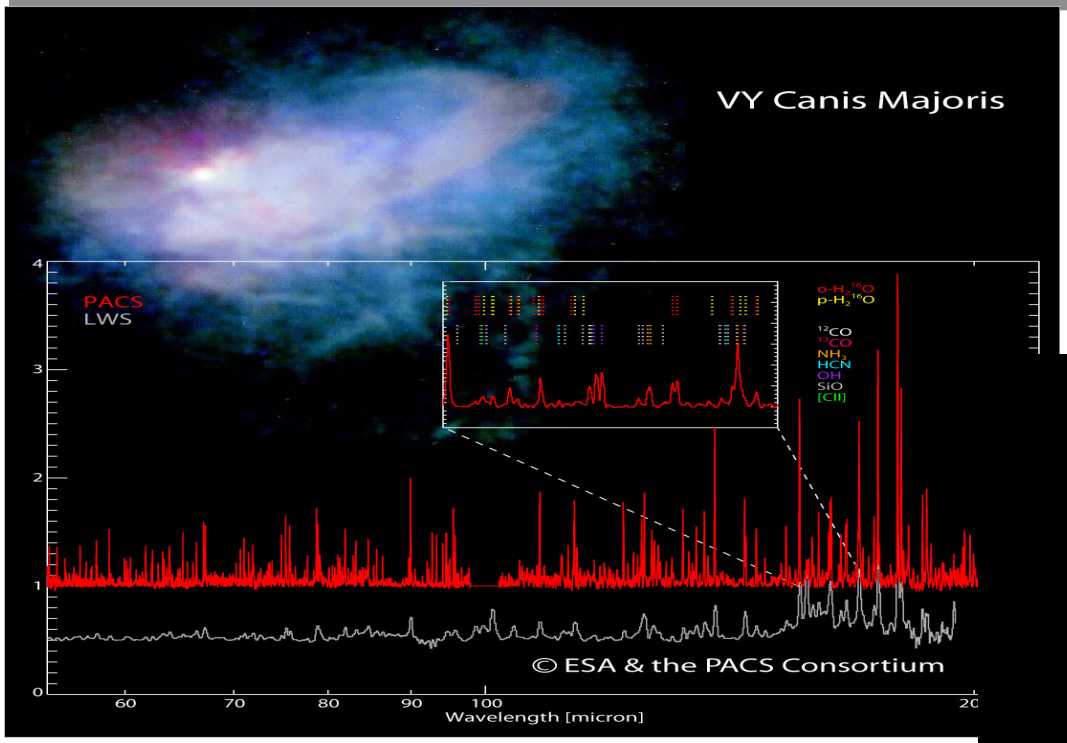
## Resolving the CIRB

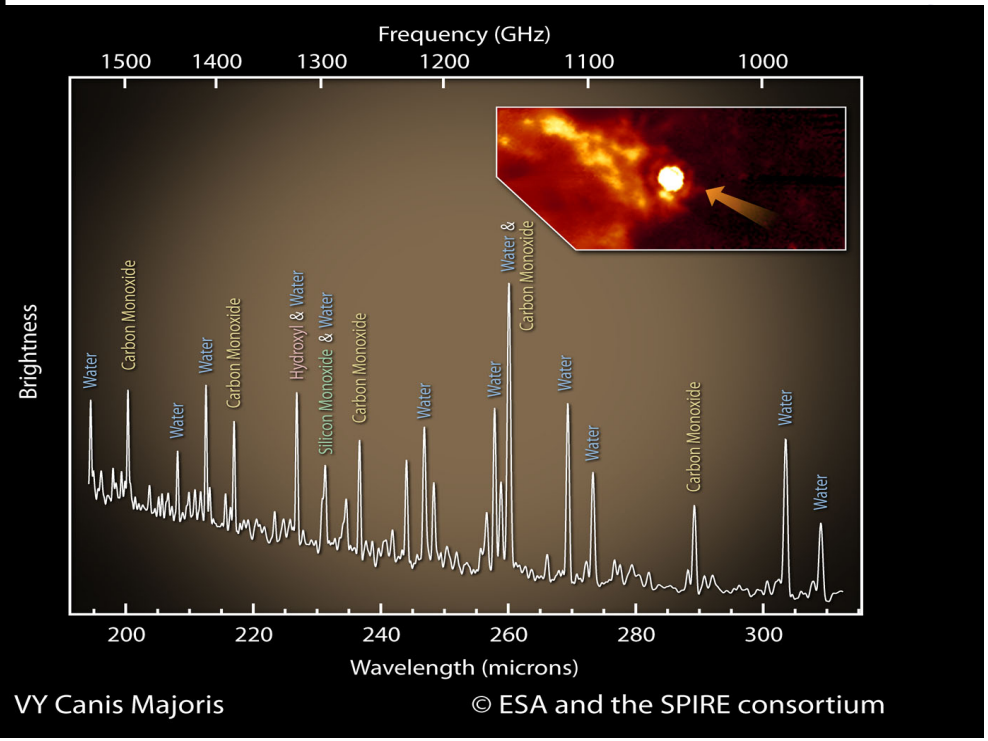
PEP:
- 100 & 160 μm: 45% & 52%
- Stacking of 24 μm sources
  50% & 75%

HerMES:
- Confusion limited counts
  250, 350, & 500 μm:
  15%, 10%, 6%
- P(D)
  250, 350, & 500 μm:
  65%, 60%, & 45%



# VY Cma – evolved star



# VY Cma – evolved star

## Main results on VY CMa so far:

- 400 out of 930 lines are water lines; ortho-to-para ratio is 1.3/1
- Other species detected: $^{18}H_2O$, $^{12}CO$, $^{13}CO$, $C^{17}O$, $C^{18}O$, $NH_3$, OH, SiO, HCN, CN, CS, SO, SiS, $H_3O^+$?
- High HCN and SiO abundances point to non-TE processes, with inner-wind pulsation-driven shocks as a possible explanation.

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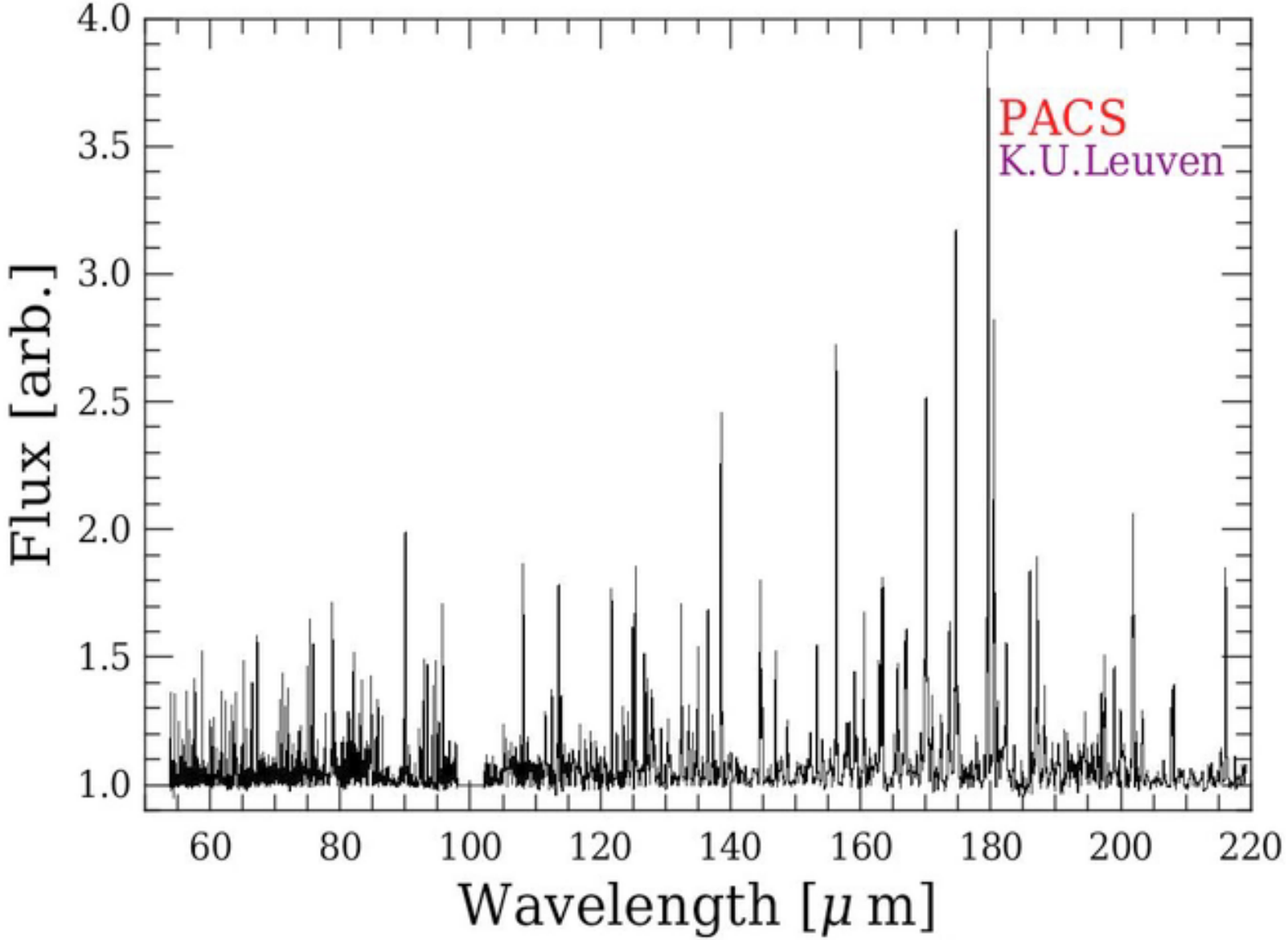
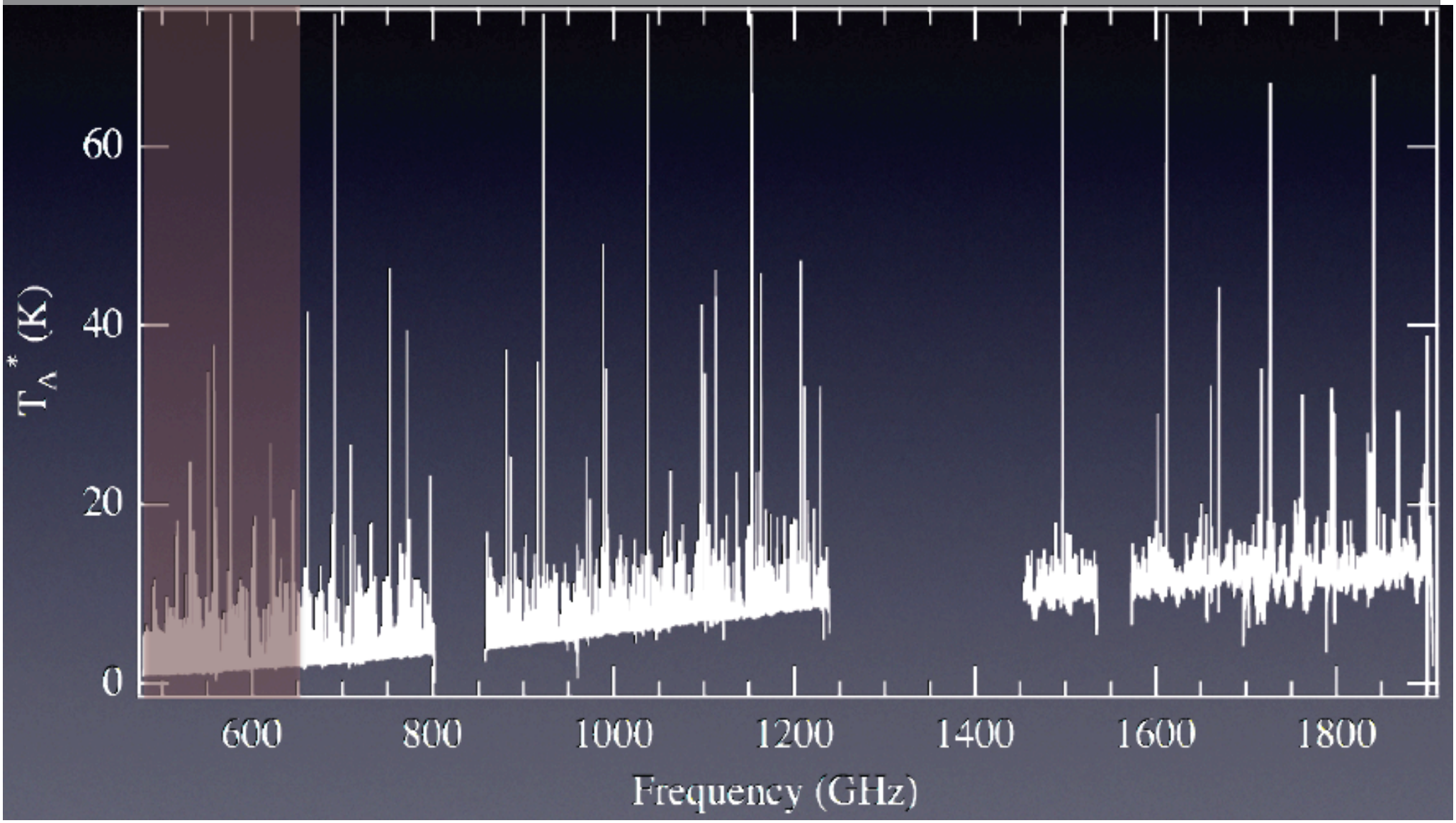
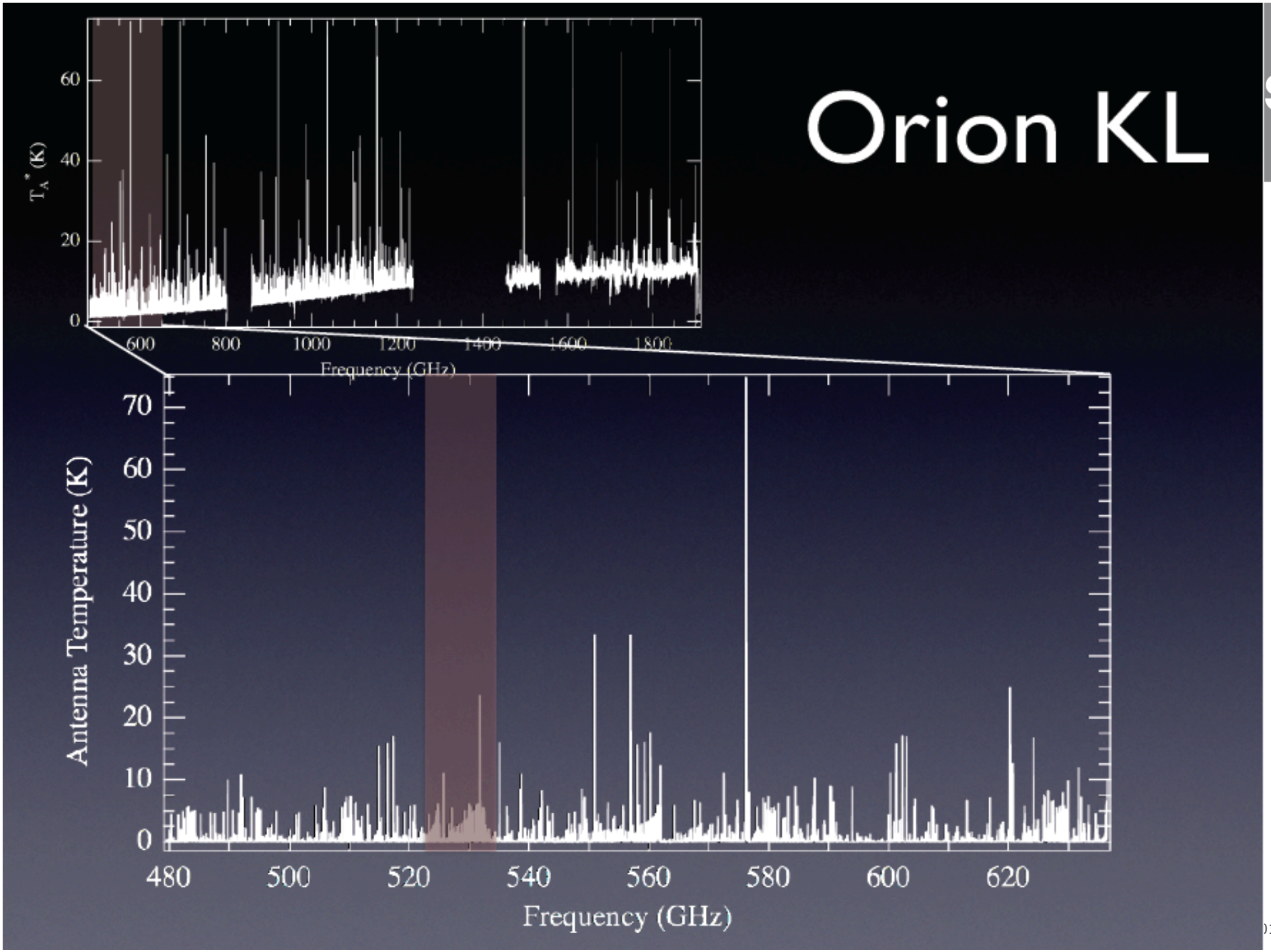

VY CMa
PACS
K.U.Leuven
Flux [arb.]
Wavelength [μ m]
4.0
3.5
3.0
2.5
2.0
1.5
1.0
60
80
100
120
140
160
180
200
220

# HIFI – Orion KL

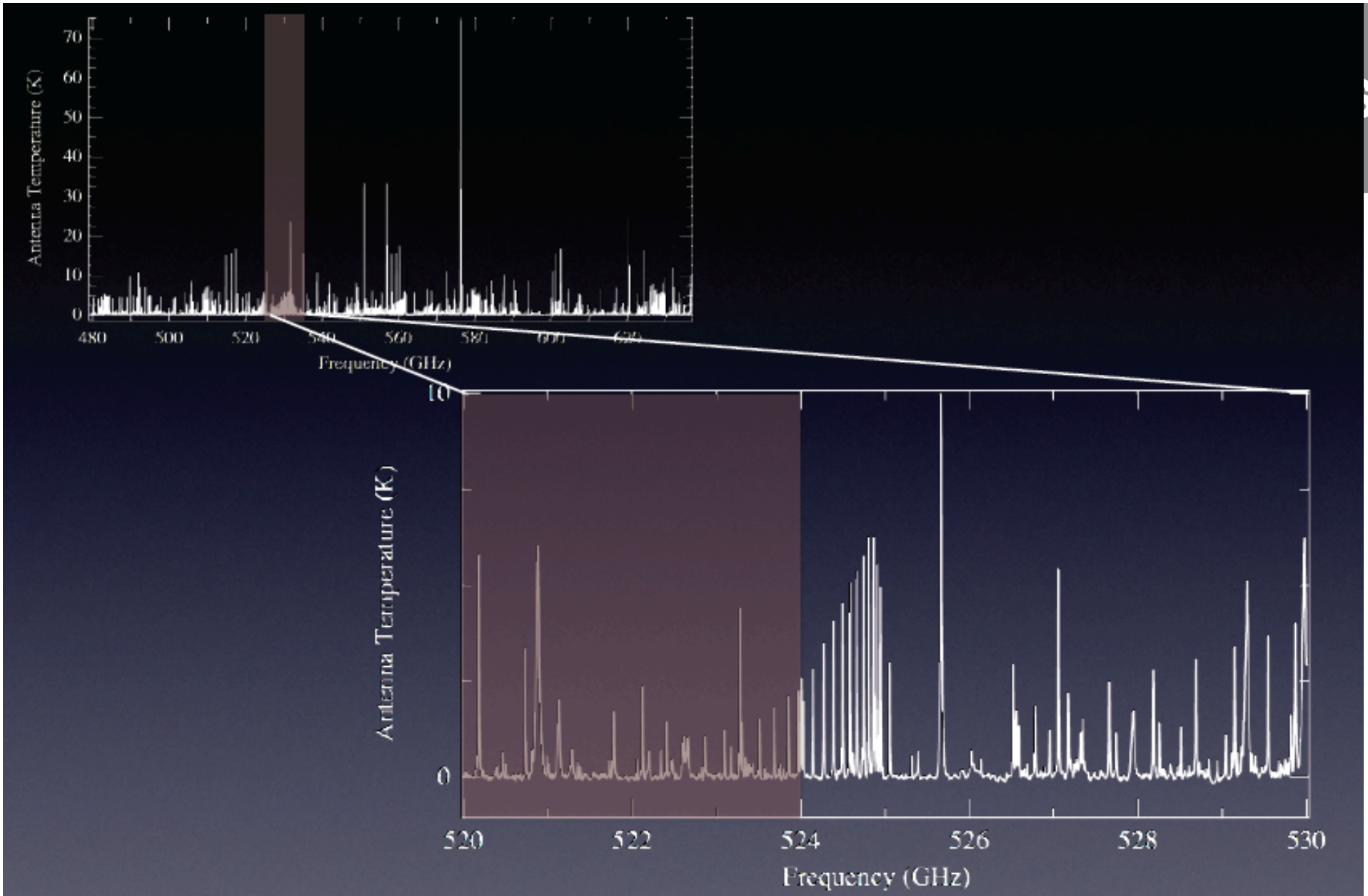


# Orion KL




sa

HERSCHEL SPACE OBSERVATORY




# Orion KL - Band 1

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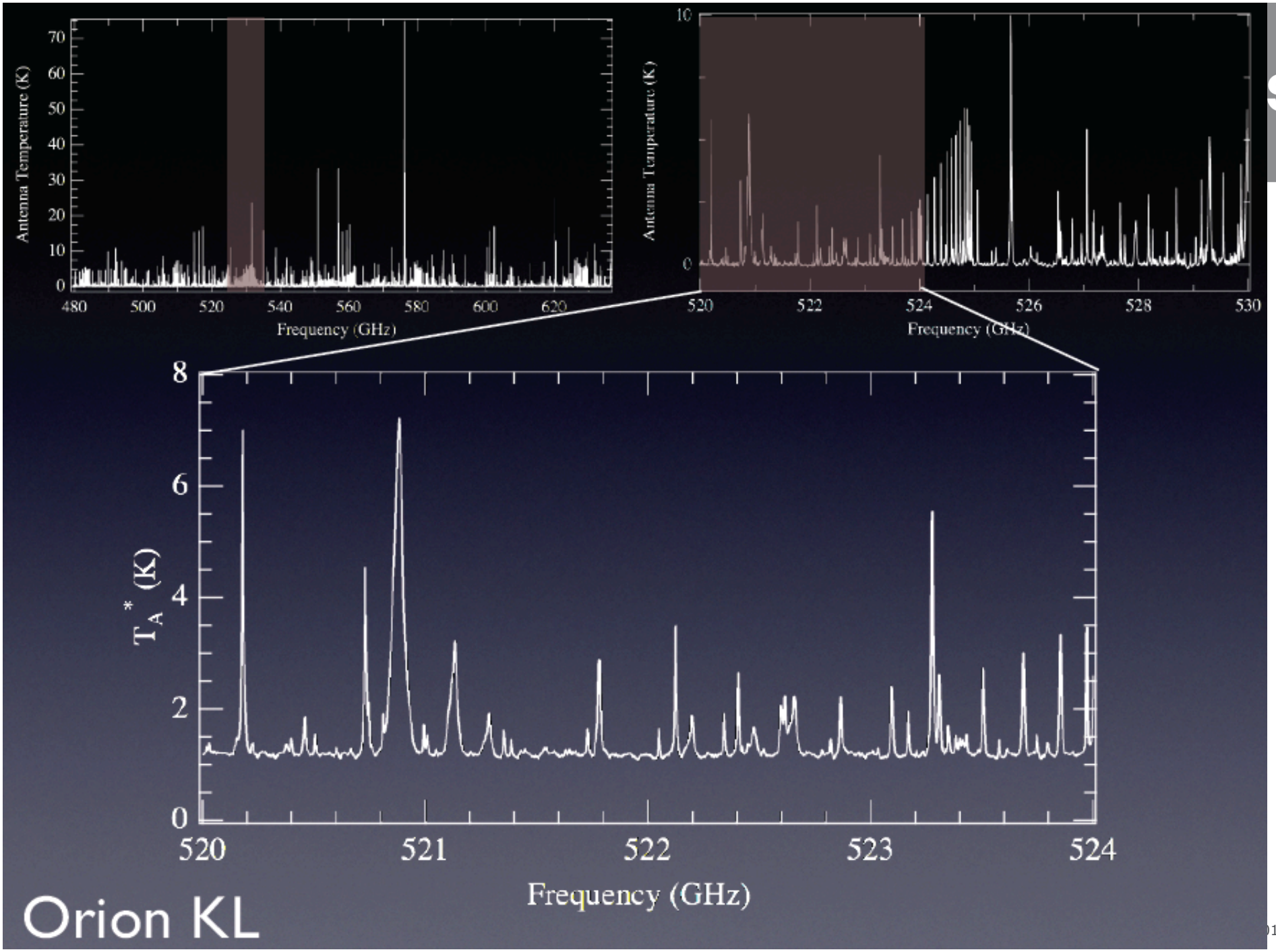



sa

HERSCHEL SPACE OBSERVATORY

# HIFI Orion KL Spectral Survey

## Orion KL Spectrum:

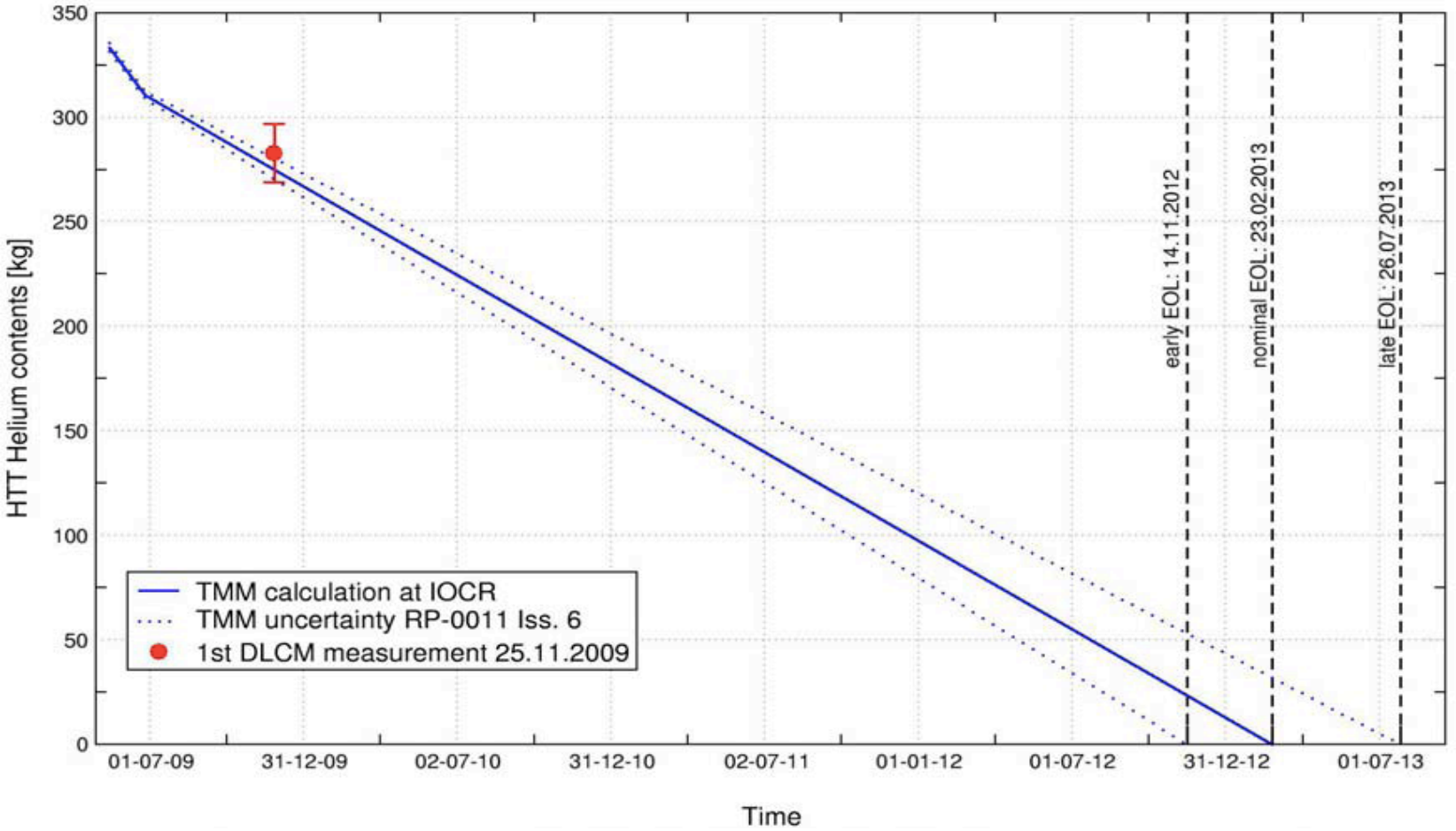
- Most complete spectrum of molecular gas at high spectral resolution ever obtained
- ***~100,000 lines***

HERSCHEL SPACE OBSERVATORY

# Seeing what nobody has seen before ...

# Mission (cryostat) lifetime

## Large uncertainties remain, but confidence in ≥ 3.5 years




HERSCHEL SPACE OBSERVATORY

# Current AO – GT1 & OT1


- **GT1 process**
  - 31 March 2010 – 14 May2010
  - About 550 hours
- **OT1 process**
  - Offer 1 year of observations (6592 hours)
  - **Released: 20 May 2010 (large and 'normal' proposals)**
  - All information, documents, and tools on HSC website
  - **Submission deadline: 22 July 2010 at 12:00 (noon) UT**
  - Scientific (HOTAC) and technical (HSC) evaluation
  - HOTAC meetings: 11-15 October 2010
  - Announcement of successful proposals: 1 November 2010
  - Final AOR updating by successful proposers in November 2010
- **GT2 & OT2**
  - About a year later – exact dates (TBD)

HERSCHEL SPACE OBSERVATORY

# AO content

## AO documention:

- Herschel Key Programme Announcement of Opportunity
- Executive Summary
- Policies and Procedures
- Herschel Observers' Manual
- HIFI Observers' Manual
- PACS Observers' Manual
- SPIRE Observers' Manual
- SPIRE/PACS Parallel Mode Observers' Manual

## AO tools:

- HerschelFORM PDFLaTeX package
- Reserved Observations Search Tool & duplications policy
- HSpot Observing Planning Tool

## Plus:

- ESLAB presentations on HSC website & A&A papers on astro/ph!

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Herschel Science Centre

http://herschel.esac.esa.int/

herschel science centre

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22-May-2010 19:19:34

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- Science Instruments
- Community Information
- Conferences/Workshops
- Press Releases
- e-News
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**Herschel Announcement of Opportunity (OT1)**
- Introduction
- 'How-to' step-by-step
- Documentation
- Tools
- AO Latest News

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- Observing Log
- Observing Schedule
- AOTs Release Status
- Key Programmes
- GT1 Programmes

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## HERSCHEL

### Exploring the formation of galaxies and stars
### Découvrir la formation des galaxies et des étoiles

373 T 04 : 08 : 46
Days Hours Minutes Seconds

*Elapsed time since launch on 14 May 2009 at 13:12 (UTC).*

Welcome to the **Herschel Astronomers' website** provided by the Herschel Science Centre (HSC) primarily for the scientific community. For additional ESA and external Herschel related websites see link buttons above and "Useful links".

**Herschel was launched on 14 May 2009!** It is the fourth `cornerstone' mission in the ESA science programme. With a 3.5 m Cassegrain telescope it will become the largest space telescope ever launched. It will perform photometry and spectroscopy in approximately the 55-672 μm range, bridging the gap between earlier infrared space missions and groundbased facilities.

Herschel is designed to observe the `cool universe'; it has the potential of elucidating structure formation in the universe, resolving the far infrared cosmic background, revealing cosmologically evolving AGN/starburst symbiosis and galaxy evolution at the epochs when most stars in the universe were formed, unveiling the physics and chemistry of the interstellar medium and its molecular clouds, the wombs of the stars, and unravelling the mechanisms governing the formation of and evolution of stars and their planetary systems, including our own solar system putting it into context. In short, Herschel will open a new window to study how the universe has evolved to become the universe we see today, and how our star the sun, our planet the earth, and we ourselves fit in. For abstracts of accepted Herschel observing programmes see "Key Programmes".

Herschel is operated as an observatory facility. It is available to the worldwide scientific community, roughly two thirds of the observing time is 'open time' allocated through a standard competitive proposal procedure.

### News and highlights:

- The first in-flight Open Time (OT1) Announcement of Opportunity (AO) process has started. The OT1 call has been released on 20 May 2010. It offers 6592 hours of Herschel observing time with proposal submission deadline on 22 July 2010 at 12:00h UT. See the menu on the left.
- **Herschel First Results Symposium.** The Herschel First Results Symposium (aka ESLAB 2010) was held on 4-7 May 2010 in the ESTEC Conference Centre. Over 400 astronomers attended the meeting which provided a wealth of exciting results.
- **Herschel science demonstration events.** In the week 14-18 December 2009 three major events took place: the SDP data processing workshop, a press event, and the SDP Initial Results workshop.

http://www.sciops.esa.int/index.php

Herschel Science Centre

http://herschel.esac.esa.int/FirstResultsSymposium.shtml

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# Herschel First Results Symposium (aka ESLAB 2010)


## ESTEC, Noordwijk, 4-7 May 2010

### Introduction and background

The first major scientific symposium presenting Herschel scientific results took place on 4-7 May 2010. More than 400 astronomers came to ESTEC, Noordwijk, to share in the excitement.

This meeting was the ESLAB 2010 symposium; ESLAB is an annual meeting organised by the Research and Scientific Support Department (RSSD) which in 2010 was fully dedicated to Herschel and its first science results.

### Workshop Generalities

- Herschel First Results Symposium Programme
- List of participants

### Oral Presentations

The oral presentations given in the meeting are provided here, with the actual speakers listed. A total of 30 plenary session and 69 parallel session talks were given.

#### Bulk downloading

The oral presentation are also available for bulk downloading as follows:

- Plenary session (30 talks, 230Mb)
- Parallel session A (33 talks, 191Mb)
- Parallel session B (35 talks, 272Mb)

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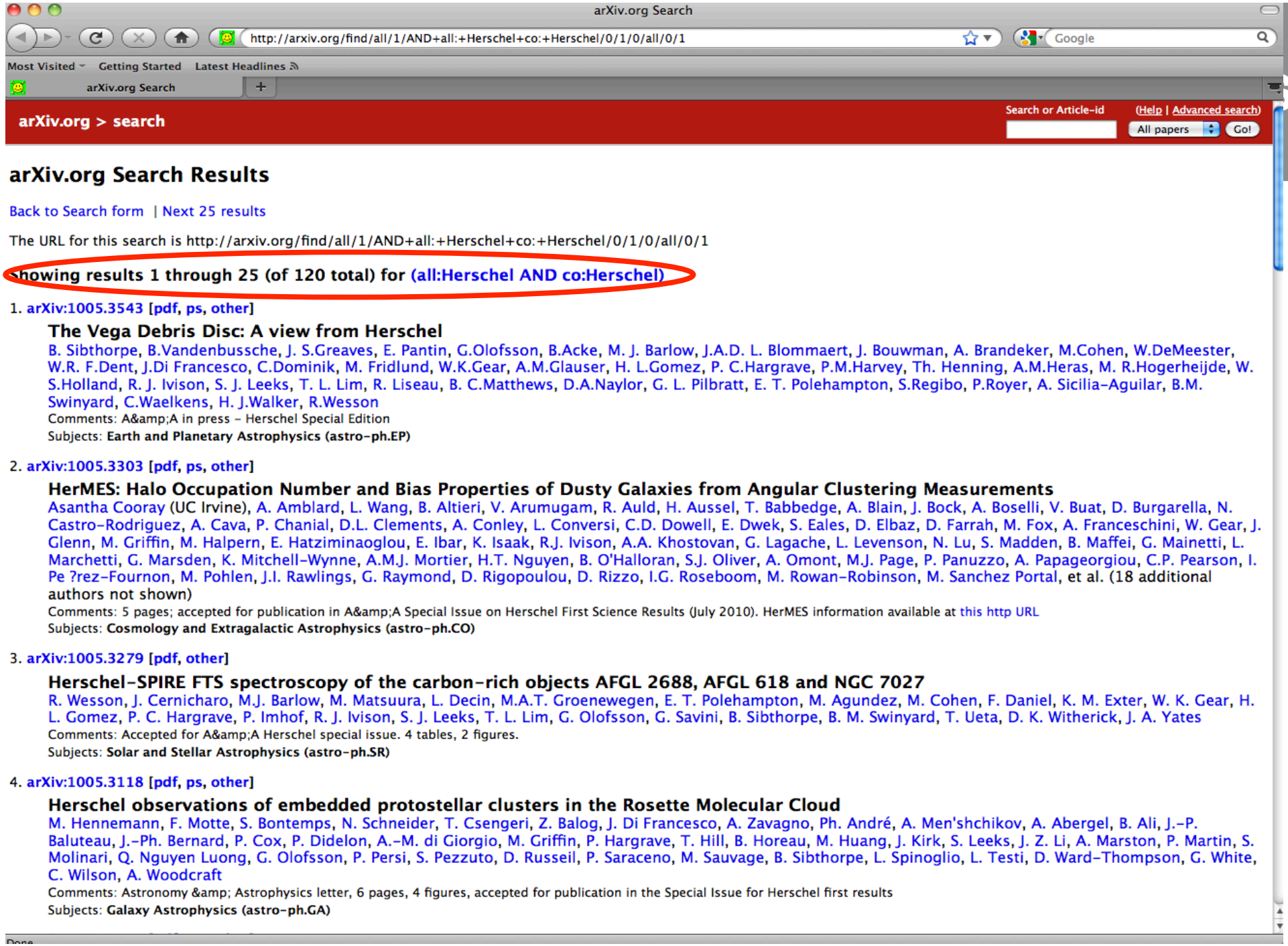
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Showing results 1 through 25 (of 120 total) for (all:Herschel AND co:Herschel)
1. arXiv:1005.3543 [pdf, ps, other]
The Vega Debris Disc: A view from Herschel
B. Sibthorpe, B.Vandenbussche, J. S.Greaves, E. Pantin, G.Olofsson, B.Acke, M. J. Barlow, J.A.D. L. Blommaert, J. Bouwman, A. Brandeker, M.Cohen, W.DeMeester, W.R. F.Dent, J.Di Francesco, C.Dominik, M. Fridlund, W.K.Gear, A.M.Glauser, H. L.Gomez, P. C.Hargrave, P.M.Harvey, Th. Henning, A.M.Heras, M. R.Hogerheijde, W. S.Holland, R. J. Ivison, S. J. Leeks, T. L. Lim, R. Liseau, B. C.Matthews, D.A.Naylor, G. L. Pilbratt, E. T. Polehampton, S.Regibo, P.Royer, A. Sicilia-Aguilar, B.M. Swinyard, C.Waelkens, H. J.Walker, R.Wesson
Comments: A&A in press - Herschel Special Edition
Subjects: Earth and Planetary Astrophysics (astro-ph.EP)
2. arXiv:1005.3303 [pdf, ps, other]
HerMES: Halo Occupation Number and Bias Properties of Dusty Galaxies from Angular Clustering Measurements
Asantha Cooray (UC Irvine), A. Amblard, L. Wang, B. Altieri, V. Arumugam, R. Auld, H. Aussel, T. Babbedge, A. Blain, J. Bock, A. Boselli, V. Buat, D. Burgarella, N. Castro-Rodriguez, A. Cava, P. Chanial, D.L. Clements, A. Conley, L. Conversi, C.D. Dowell, E. Dwek, S. Eales, D. Elbaz, D. Farrah, M. Fox, A. Franceschini, W. Gear, J. Glenn, M. Griffin, M. Halpern, E. Hatziminaoglou, E. Ibar, K. Isaak, R.J. Ivison, A.A. Khostovan, G. Lagache, L. Levenson, N. Lu, S. Madden, B. Maffei, G. Mainetti, L. Marchetti, G. Marsden, K. Mitchell-Wynne, A.M.J. Mortier, H.T. Nguyen, B. O'Halloran, S.J. Oliver, A. Omont, M.J. Page, P. Panuzzo, A. Papageorgiou, C.P. Pearson, I. Pe ?rez-Fournon, M. Pohlen, J.I. Rawlings, G. Raymond, D. Rigopoulou, D. Rizzo, I.G. Roseboom, M. Rowan-Robinson, M. Sanchez Portal, et al. (18 additional authors not shown)
Comments: 5 pages; accepted for publication in A&A Special Issue on Herschel First Science Results (July 2010). HerMES information available at this http URL
Subjects: Cosmology and Extragalactic Astrophysics (astro-ph.CO)
3. arXiv:1005.3279 [pdf, other]
Herschel-SPIRE FTS spectroscopy of the carbon-rich objects AFGL 2688, AFGL 618 and NGC 7027
R. Wesson, J. Cernicharo, M.J. Barlow, M. Matsuura, L. Decin, M.A.T. Groenewegen, E. T. Polehampton, M. Agundez, M. Cohen, F. Daniel, K. M. Exter, W. K. Gear, H. L. Gomez, P. C. Hargrave, P. Imhof, R. J. Ivison, S. J. Leeks, T. L. Lim, G. Olofsson, G. Savini, B. Sibthorpe, B. M. Swinyard, T. Ueta, D. K. Witherick, J. A. Yates
Comments: Accepted for A&A Herschel special issue. 4 tables, 2 figures.
Subjects: Solar and Stellar Astrophysics (astro-ph.SR)
4. arXiv:1005.3118 [pdf, ps, other]
Herschel observations of embedded protostellar clusters in the Rosette Molecular Cloud
M. Hennemann, F. Motte, S. Bontemps, N. Schneider, T. Csengeri, Z. Balog, J. Di Francesco, A. Zavagno, Ph. André, A. Men'shchikov, A. Abergel, B. Ali, J.-P. Baluteau, J.-Ph. Bernard, P. Cox, P. Didelon, A.-M. di Giorgio, M. Griffin, P. Hargrave, T. Hill, B. Horeau, M. Huang, J. Kirk, S. Leeks, J. Z. Li, A. Marston, P. Martin, S. Molinari, Q. Nguyen Luong, G. Olofsson, P. Persi, S. Pezzuto, D. Russeil, P. Saraceno, M. Sauvage, B. Sibthorpe, L. Spinoglio, L. Testi, D. Ward-Thompson, G. White, C. Wilson, A. Woodcraft
Comments: Astronomy & Astrophysics letter, 6 pages, 4 figures, accepted for publication in the Special Issue for Herschel first results
Subjects: Galaxy Astrophysics (astro-ph.GA)
Done

# FIRST proposal workshop May 1982