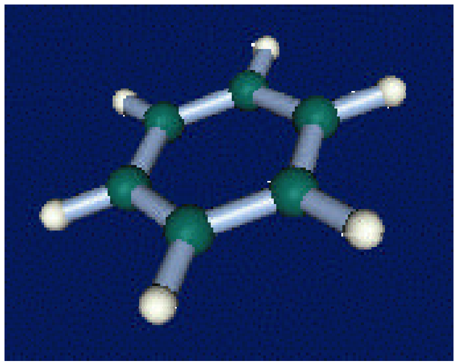
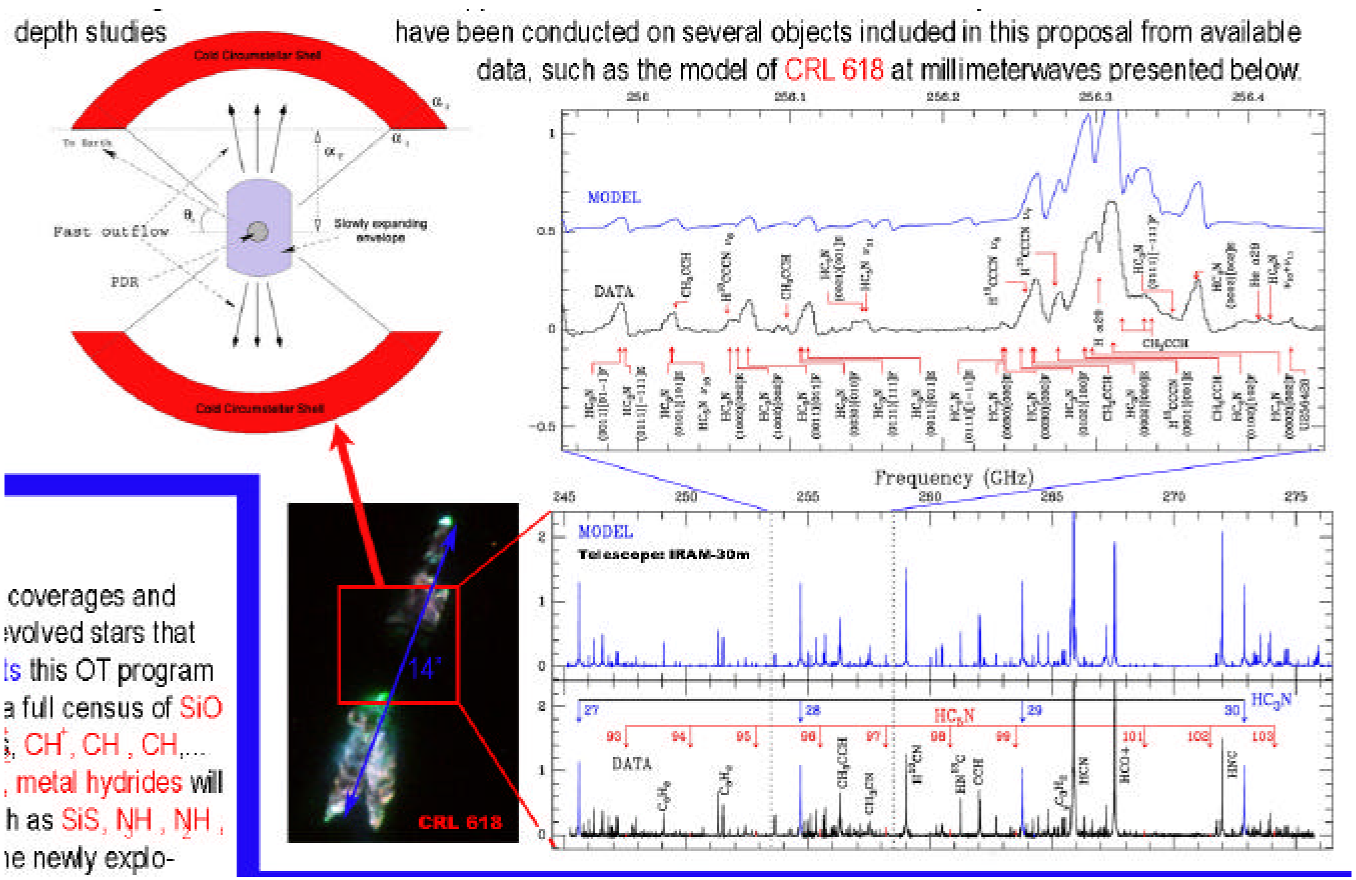
OT-KP: LINE SURVEYS IN EVOLVED STARS

- The AGB to PN transition provides some of the more efficient laboratories in space. In particular there is formation of carbon clusters, PAH´s, etc…
- Line surveys provide the most complete chemical and physical picture of the objects.
- By a proper selection of O-rich and C-rich sources in different stages of evolution, a chemical picture of the AGB to PN evolution can be obtained.
- Spectacular progress in recent years in lab. work and theoretical calculations allows a nearly complete analysis of surveys that typically contain thousands of lines.





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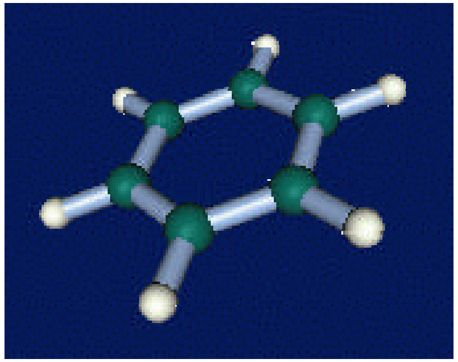
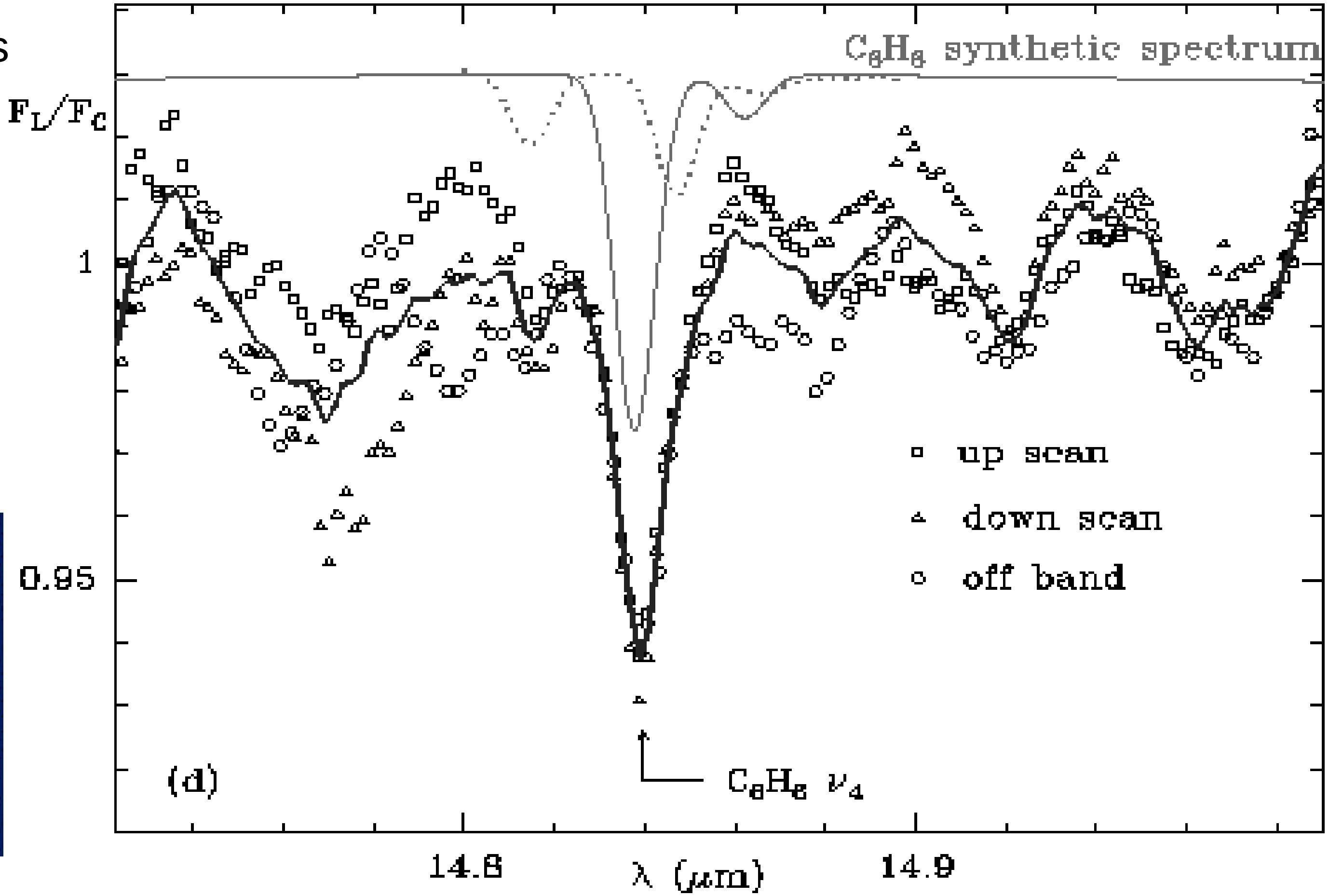




"MAPSO" MAPping Sgr B2 and Orion star forming regions

(A **Herschel** OPEN TIME KEY PROGRAM. POSTER 57)

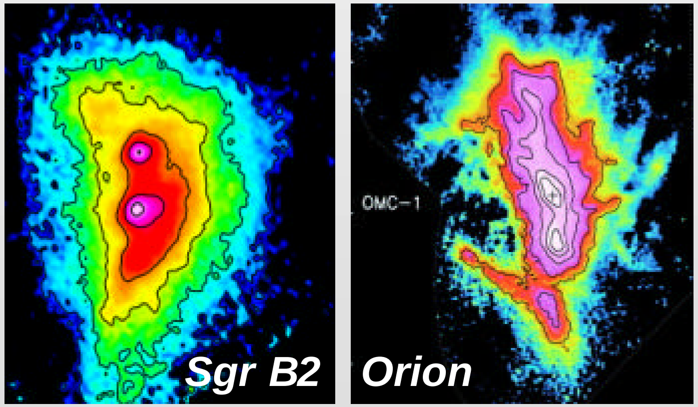
Coordinator: J. CERNICHARO (DAMIR, CSIC, Madrid) on behalf of the **MAPSO team**.

*"**Widespread** gas & dust sets the initial conditions for star formation"*

***OBJETIVE:* large scale** *molecular content + gas properties of the 2 most important SFRs :*

COHERENT + HOMOGENEOUS MOLECULAR/DUST DATABASE

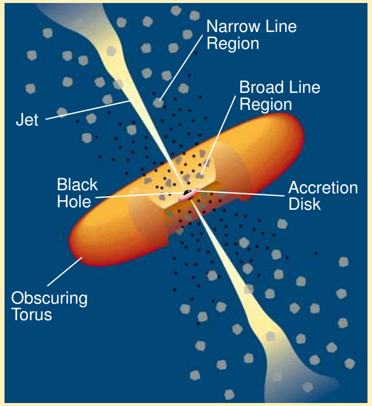
7'x7' **8'x20'**



MAPSO SUBSECTIONS:

- * *Large scale* ***HIFI*** *water maps (several lines). Chemistry of Oxygen*
- * ***HIFI*** *and* ***PACS*** *[CII] and [OI] maps.*
- * *Maps of the ionized component ([OIII], [NIII] and [NII])*
- * ***HIFI*** *maps of selected key species (OH, CH^+, HD , $H3O^+$, $H2D^+$, …+ byproducts = high excitation lines of CO, HCN, HCO^+, CN, NH_3, SO_2,…)*
- * *Polarization measurements with* ***HIFI****. (OH)*
- * ***PACS*** *full coverage line surveys.*
- * ***SPIRE*** *SEDs and low resolution maps.*

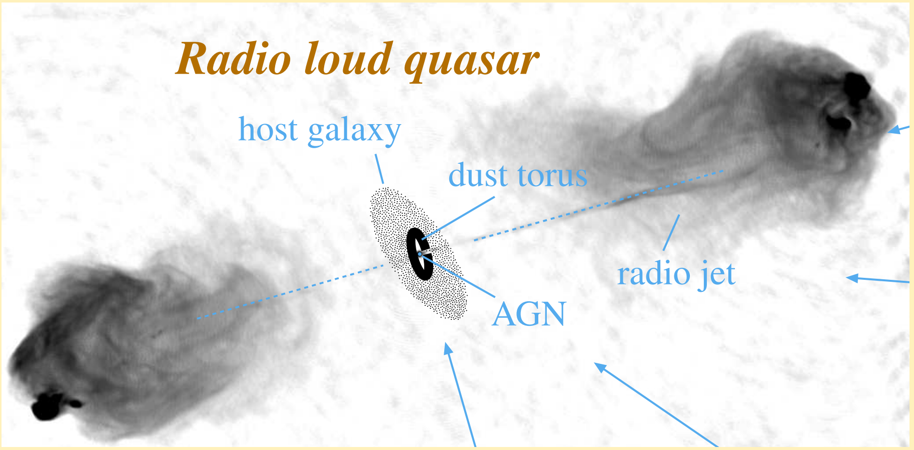
Herschel time ~ 350-400 hours

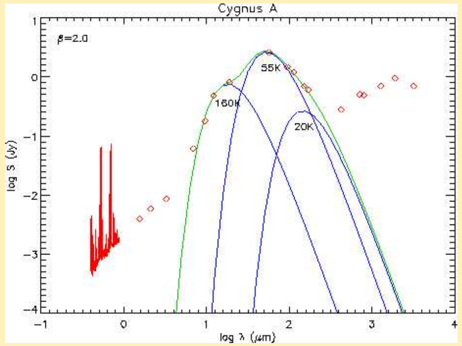


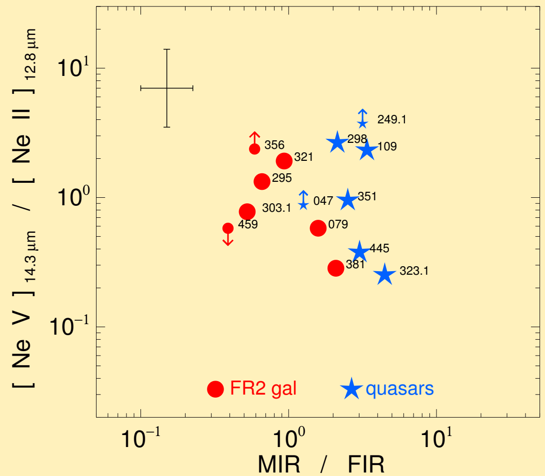
A Herschel Open Time Key Project

Dust and gas in the hosts of the most powerful radio sources during the peak of cosmic activity

Martin Haas, Peter Barthel, Belinda Wilkes, + 25 Co-Is







- 30 - 40 extended radio galaxies and quasars @ $1.5 < z < 4$
- Spitzer IRAC / IRS 16 / MIPS 24 data available
- PACS + SPIRE 70 - 490 μm SEDs: AGN + starbursts
- PACS line spectra: AGN ↔ starbursts

→ **Unification** in the **Quasar Era: "Uni-Qu-E"**

OTKP: Herschel survey of Local Galaxies Activity

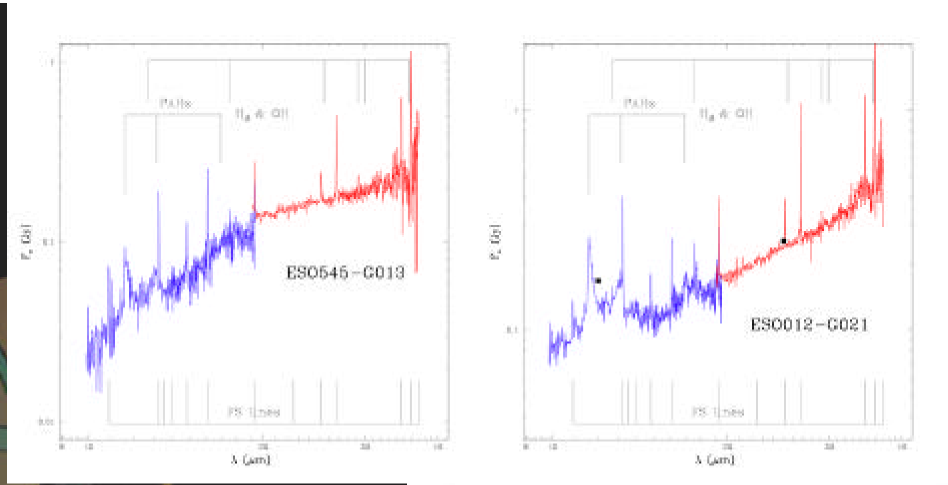
HerLoGAL

Poster 25

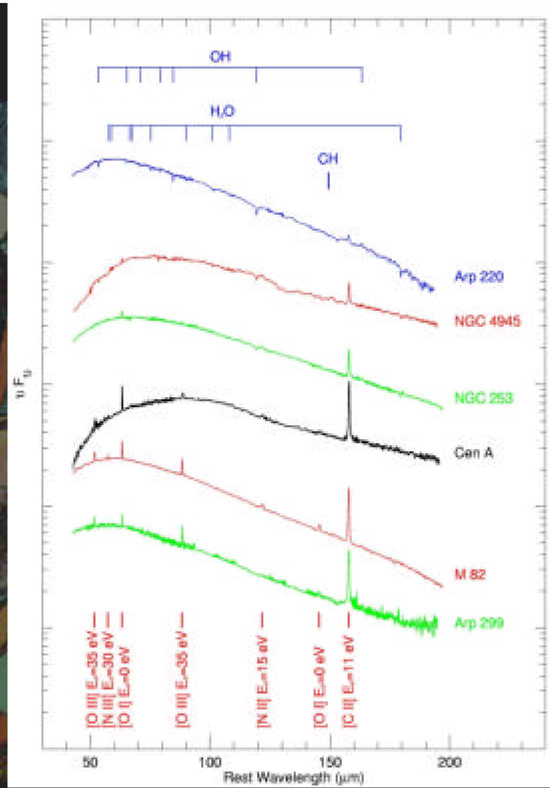
PI: Luigi Spinoglio (IFSI-INAF Roma)

Preliminary list of coinvestigators:
Leslie Hunt, Mat Page, Matt Malkan, Eduardo Gonzalez- Alfonso, Vassilis Charmandaris, Ismael Perez Fournon, Dave Clements, Roberto Maiolino, Paul van der Werf, Matt Jarvis, Henrik Spoon, Suzanne Madden, Kate Isaak, Howard Smith, Masa Imanishi, Fabio La Franca , Carlotta Gruppioni.

Large sample: 12um sample + Hard-X (Piccinotti):
two complementary *all-sky* and *flux-limited samples with* orthogonal selection biases



mid-IR + FIR spectra + imaging characterize:
- AGN
- starburst
in the Local Universe



53+6=59 Seyfert 1s, 63 Seyfert 2s, 34 starbursts, 33 LINERs
Estimated time : 300 hours

CORE TOMOGRAPHY USING HERSCHEL & GROUND-BASED DATA

Paul Goldsmith, William D. Langer, Di Li, Thangasamy Velusamy, Ken Marsh, Darren Dowell, Ted Bergin, Darek Lis, Lee Mundy, Giles Novak, and Jennifer Wiseman

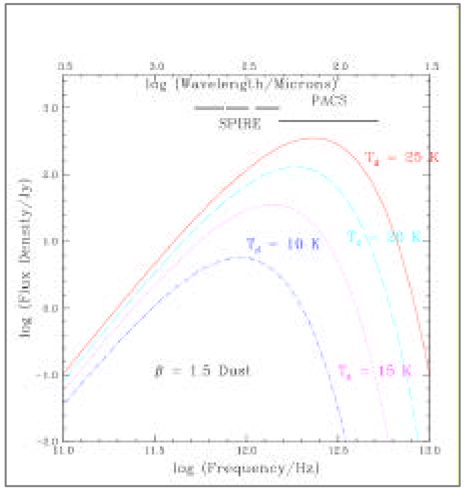
Herschel PACS & SPIRE cover key wavelength range but high resolution ground based maps (CSO SHARC2) important for accurate dust column density retrieval

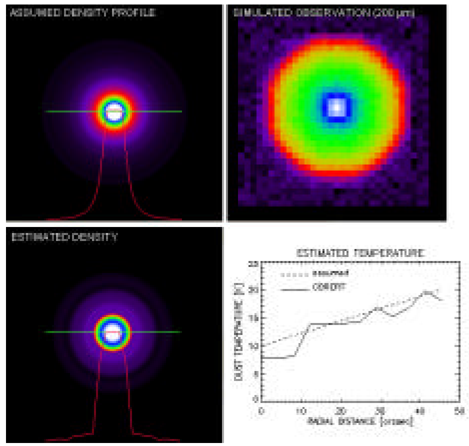
Use JPL COREFIT program to combine multiple wavelength images and obtain n(r) and T(r) with superresolution achieving 3" angular resolution

Will yield improved determination of core masses & Core Mass Function (CMF)

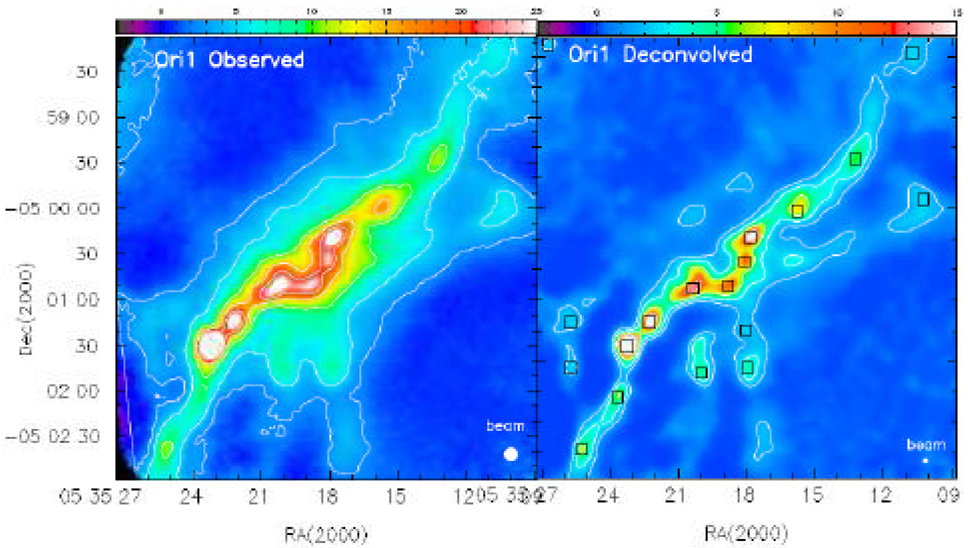
We will add key spectroscopic tracers to determine core kinematics and energy balance

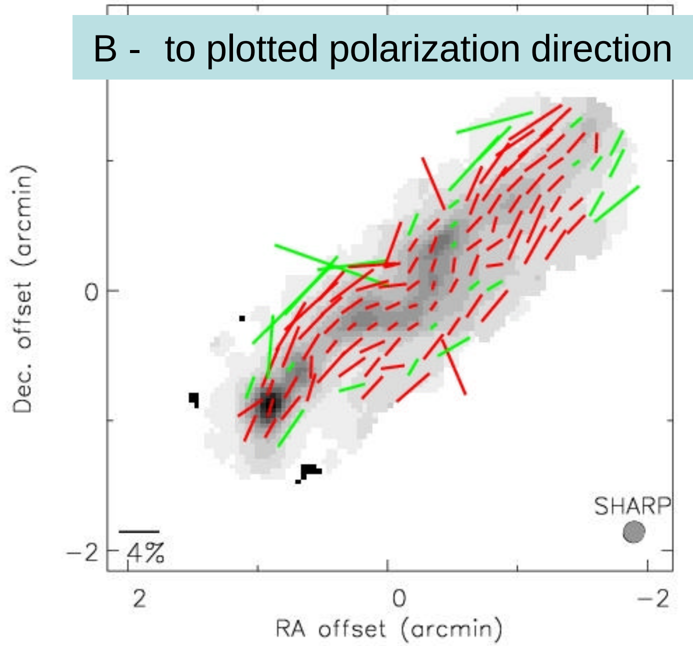
B-field polarization using SHARP on CSO will be used to assess importance of magnetic field for support, and connection to core's environment





CORE TOMOGRAPHY USING HERSCHEL & GROUND-BASED DATA





Super resolution requires high signal to noise ratio. Improvement in angular resolution from 9” to 3” offers dramatic improvement in isolating cores and accuracy of mass determination (Li et al. ApJ 655, 2007)

Measurement of magnetic field direction in OMC3 cores using SHARP with SHARC2 on CSO by Dowell, Novak et al. 2007. Necessary for full understanding of core evolution

Properties of proto Brown Dwarfs

D. Barrado y Navascués, C. Eiroa, M. Morales Calderón, A. Bayo,
O. Morata , I. de Gregorio

Aim:

to detect and study of proto-BDs
(Class 0 and Class I phase)

Sample:

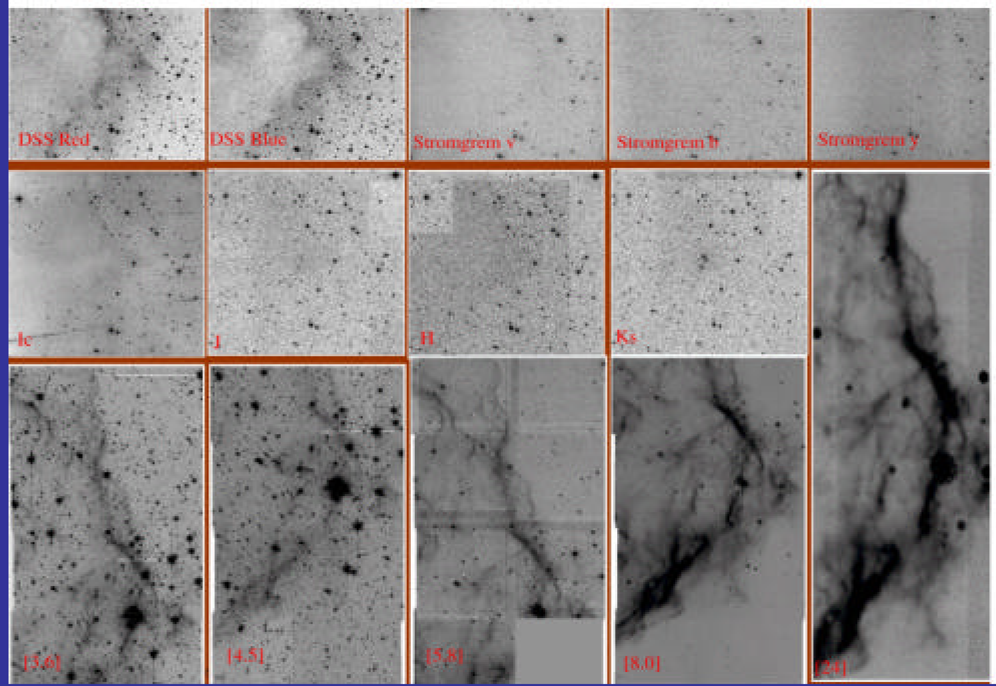
Several embedded stellar associations
selected from the Spitzer archive.

Multiwavelength approach:

Complete SED mandatory to compute:
- disk/envelope mass
- to constrain the final mass
  of the proto-BD.

Herschel data:

- Essential to derive their properties
- FIR/smm fluxes:
  70, 100 and 170 μm (PACS)
  250, 360 and 520 μm (Spire).



A sequence of optical (Digital Sky Survey Red and Blue, Strongrem vby and Cousin I), near infrared (J, H and Ks) and mid-infrared (3.6, 4.5, 5.8, 8.0 and 24 micron) for one of our Star Forming Regions. These data have been used toextract the stellar and substellar populations for each SFR based on color-color and color-magnitude diagrams, to classify them in Class 0/I, Class II and Class III objects, and to built Spectral Energy Distributions.

Evolution of Protoplanetary and Planetary Disks

C. Eiroa, A. Heras, D. Barrado, A. Bayo, C. del Burgo, I. de Gregorio,
M. Fridlund, R. Liseau, R. Llorente, J. Maldonado, B. Montesinos,
A.Mora, M. Morales, G. Olofsson, E. Solano, G. White

i) From Primordial to Debris Disks

Objective:

- Dust /gas evolution for a sample of PMS and Vega type stars.

Herschel Observations:

✓ **DUST:**
- **PACS 70, 100, 170 μm + SPIRE 250, 360, 520 μm**

✓ **GAS:**
- **HIFI: [CI] l l 370,610 μm**
  [CII] l 158 μm
- **PACS [OI] l l 63,146 μm**

ii) Edgeworth-Kuiper belt Structures

Objective :

- Detection of EK-belt structures around nearby main-sequence FGK stars

Herschel Observations:

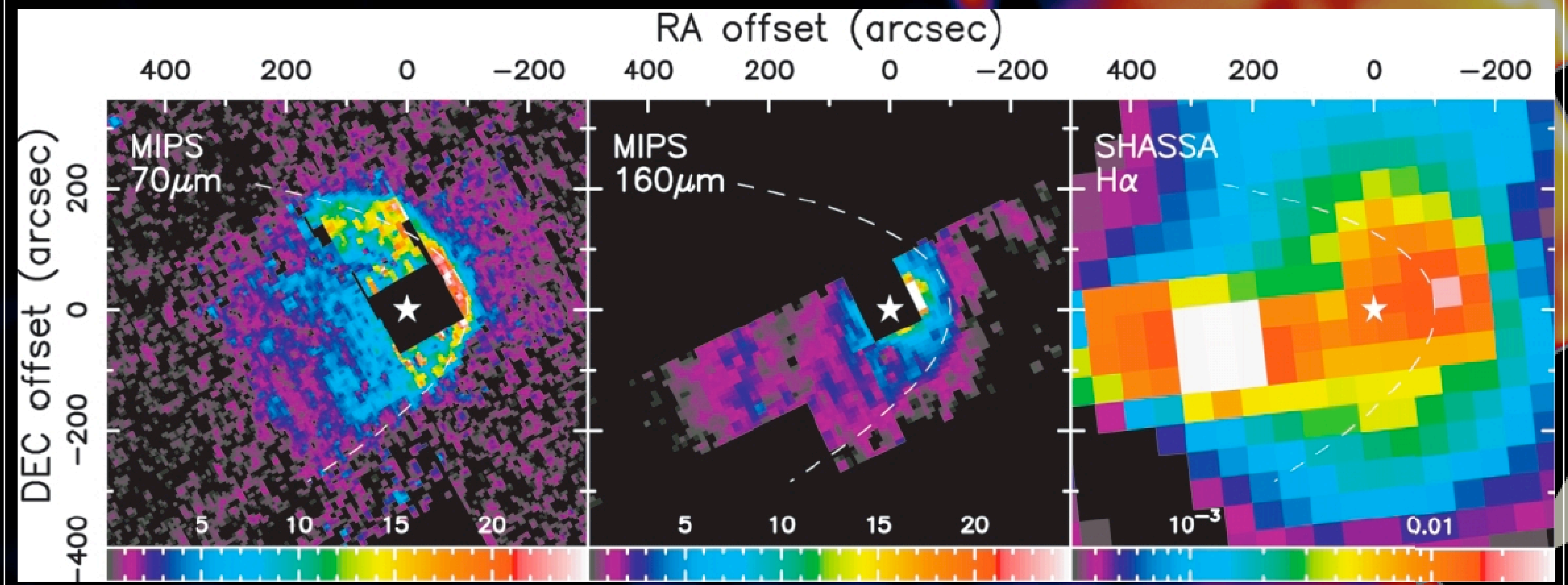
- **PACS 70, 100, 170 μm +**
- **SPIRE 250, 360, 520 μm**

Herschel Probing of the Circumstellar - Interstellar Interface

Toshiya Ueta
(University of Denver)

Discoveries of Far-IR Bow-Shock Emission at the Stellar Wind - ISM Interface

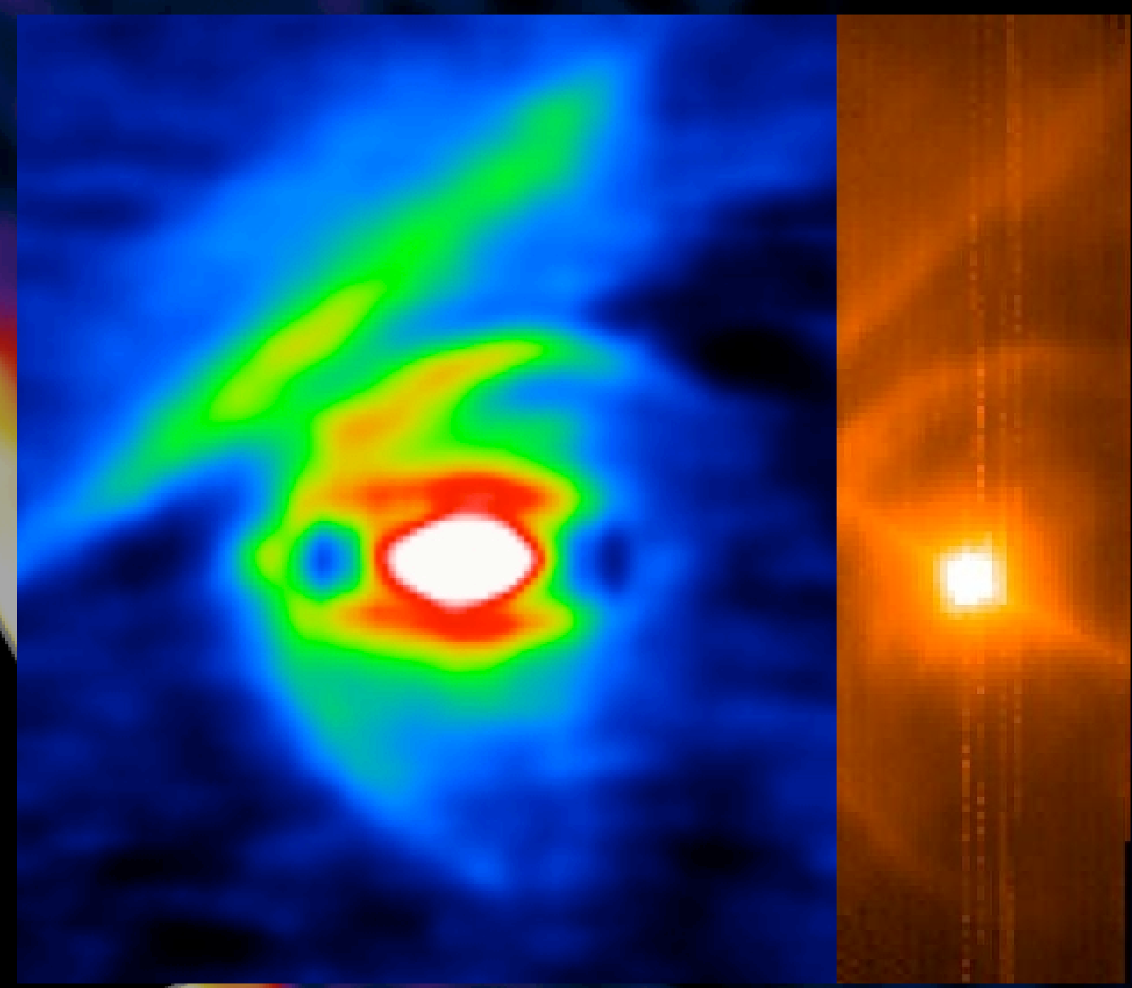
Spitzer-MIRIAD Discovery around an Asymptotic Giant Branch Star, R Hya



Ueta et al. (2006, ApJ, 648, L39)

Far-IR Bow Shock Emission is also detected from Massive Runaway O and B Stars (France et al. 2007, ApJ, 655, 920)

IRAS HiRes & AKARI Scan Maps of a Red Super Giant, α Ori (Betelgeuse)



[Left] IRAS HiRes 60μm Map (Noriega-Crespo et al. 1997, AJ, 114, 837)

[Right] AKARI WS/90μm Map (Ueta et al. 2007, in preparation)

How Do Stellar Ejecta/CSEs Really Dissipate into the ISM?

We naively believe that Stellar Ejecta in the Circumstellar Envelopes dissipate into the ISM, and the processing of such matter is done in the ISM. But, is it really true?

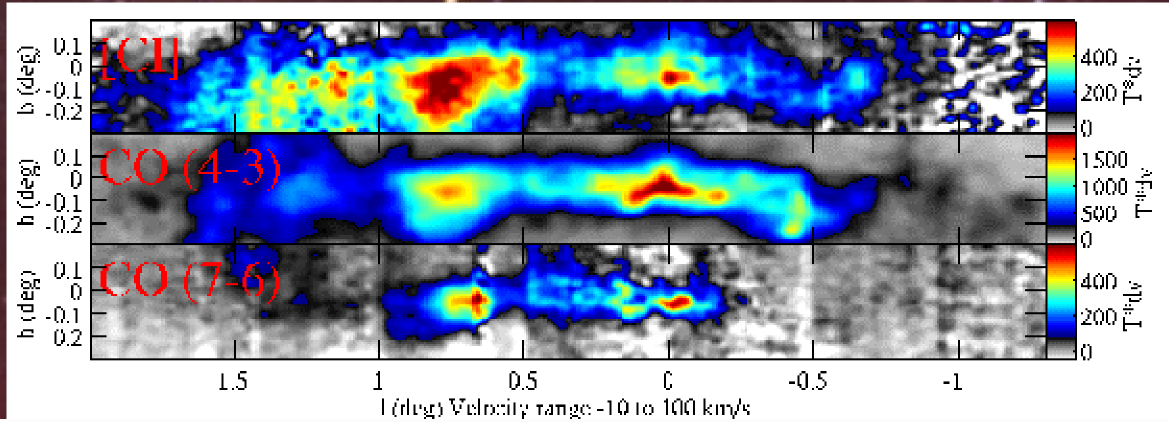
The stellar wind - ISM bow shock surfaces have been found not only around RSGs of high mass-loss rates, but also around AGB stars of lower mass-loss rates.

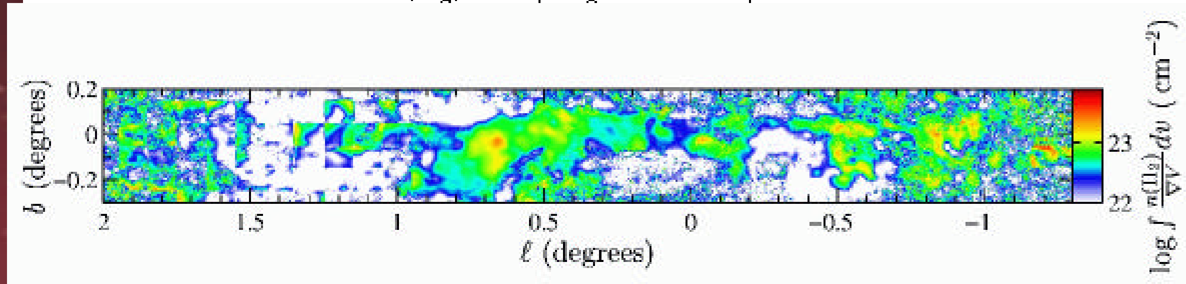
At this juncture, it is not clear if such shocks are common around mass losing stars. Nevertheless, this phenomenon has been seen around many types of stars. If it is significant, the CSE dust grains/molecules are largely destroyed when they dissipate into the ISM, impacting the nature of the ISM at large.

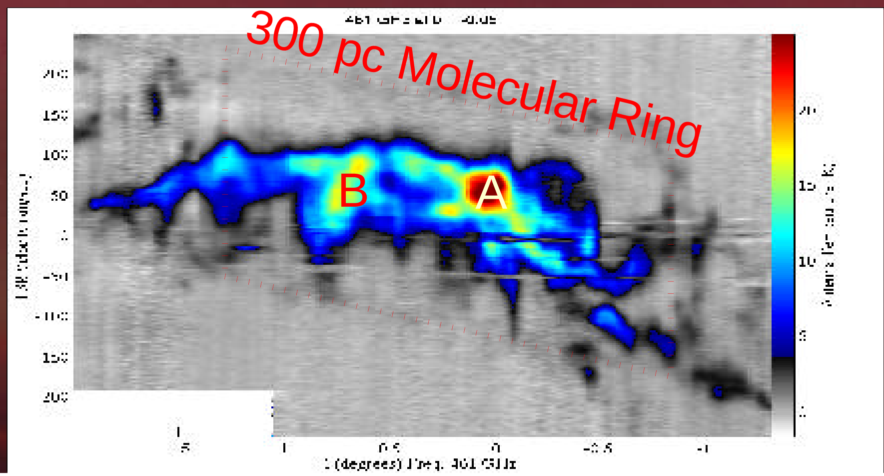
Suite of Herschel instruments allows detailed probing of Spatially Resolved Shock Physics in this uncharted territory for the first time, augmenting existing Circumstellar/ISM GTs.

Galactic Center Region
Chris.Martin@oberlin.edu

- Have ~3 sq deg. around Galactic Center with AST/RO
  - CI ($^3P_1$-$^3P_0$) – 492 GHz
  - CO (4-3) – 461 GHz
  - CO (7-6) – 806 GHz
- Herschel Open Time
  - Higher frequency lines not usable from ground
  - Gas Dynamics
  - Physical Properties of gas near GC
- Looking for collaborators





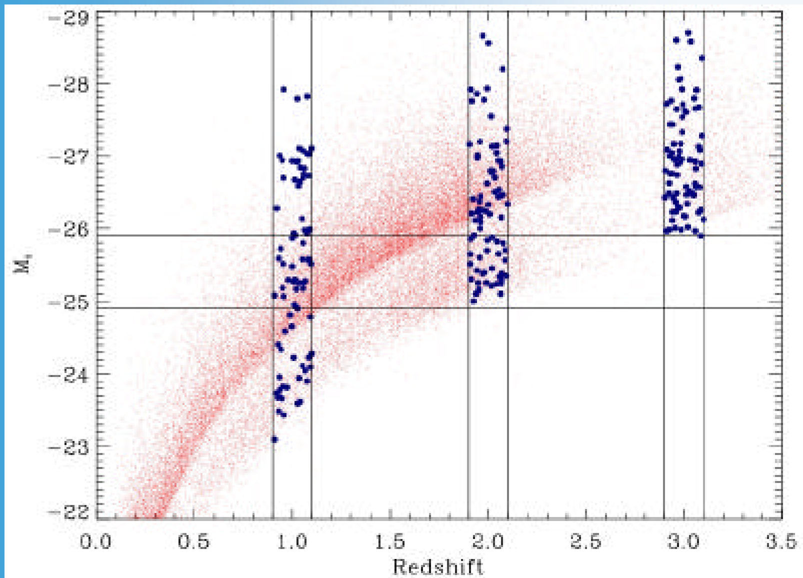


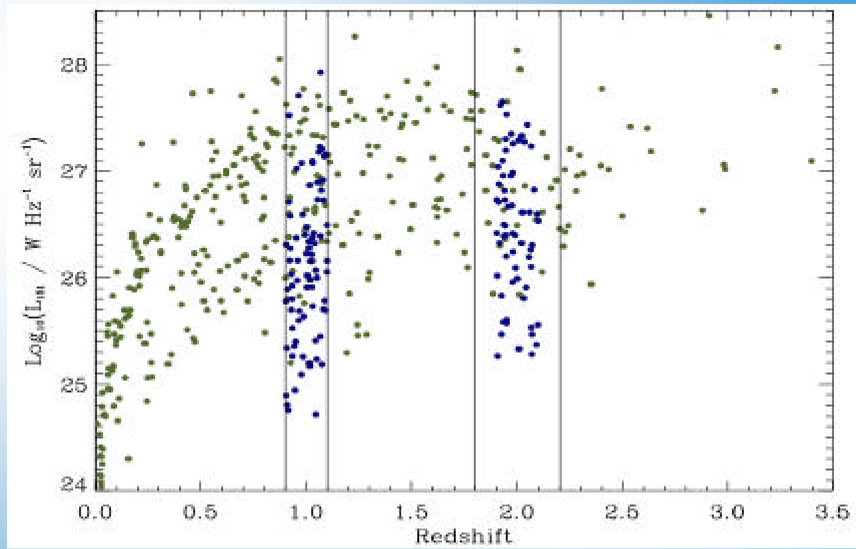
The Spitzer-Herschel Active Galaxy Survey

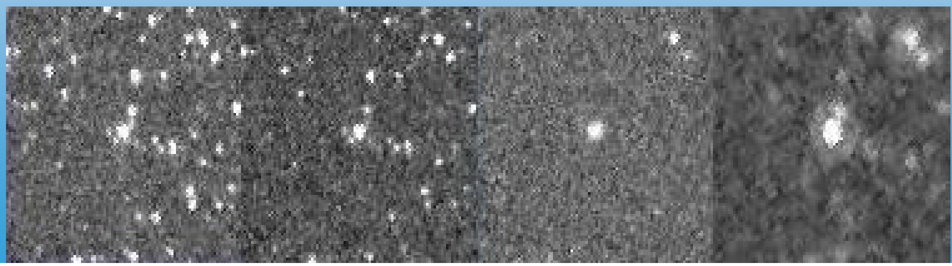
Matt Jarvis

Centre for Astrophysics Research, University of Hertfordshire

Jason Stevens, Ross McLure, Mat Page, Alain Omont, Ismael Perez-Fournon, Gordon Richards, Mark Lacy, Chris Simpson, Dave Clements, Stephen Serjeant, Jim Dunlop, Alejo Martinez-Sansigre, Bernhard Schultz, Dimitra Rigopoulou, Duncan Farrah, Paul O'Brien, Chris Willott, Maarten Baes, Gianfranco de Zotti, Alastair Edge, Eva Schinnerer, Evanthia Hatziminaoglou, Paola Andreani, Rob Ivison, Luigo Spinoglio, Roberto Maiolino, Ian Robson, Steve Rawlings, Charmandaris Vassilis, Paul van der Werf, Ian Waddington, Aprajita Verma, Tim Waskett, Richard McMahon, Robert Priddey, Eduardo Gonzalez-Solares







A Herschel follow-up to the SCUBA-2 cosmology legacy survey

- SCUBA-2 will perform two confusion limited surveys at 450/850 microns

- Herschel is needed to determine SED, temperatures, bolometric luminosities, star formations rates and photometric redshifts for these sources

- Selection at 450/850 traces dusty galaxies in an unbiased way out to high-z

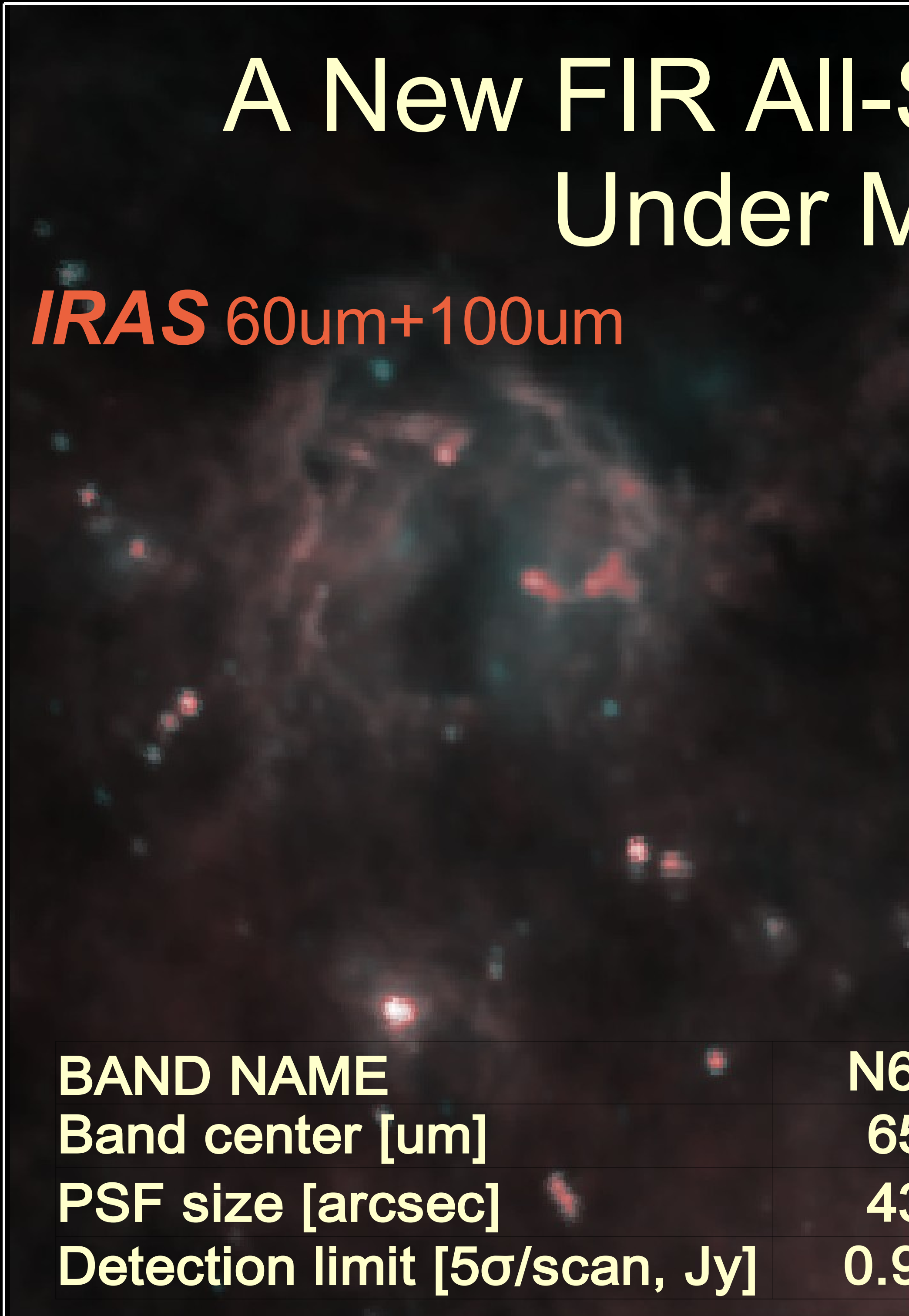
- Knowledge of source position / greater angular resolution at 450 microns will allow extraction of Herschel counterparts below the confusion limit

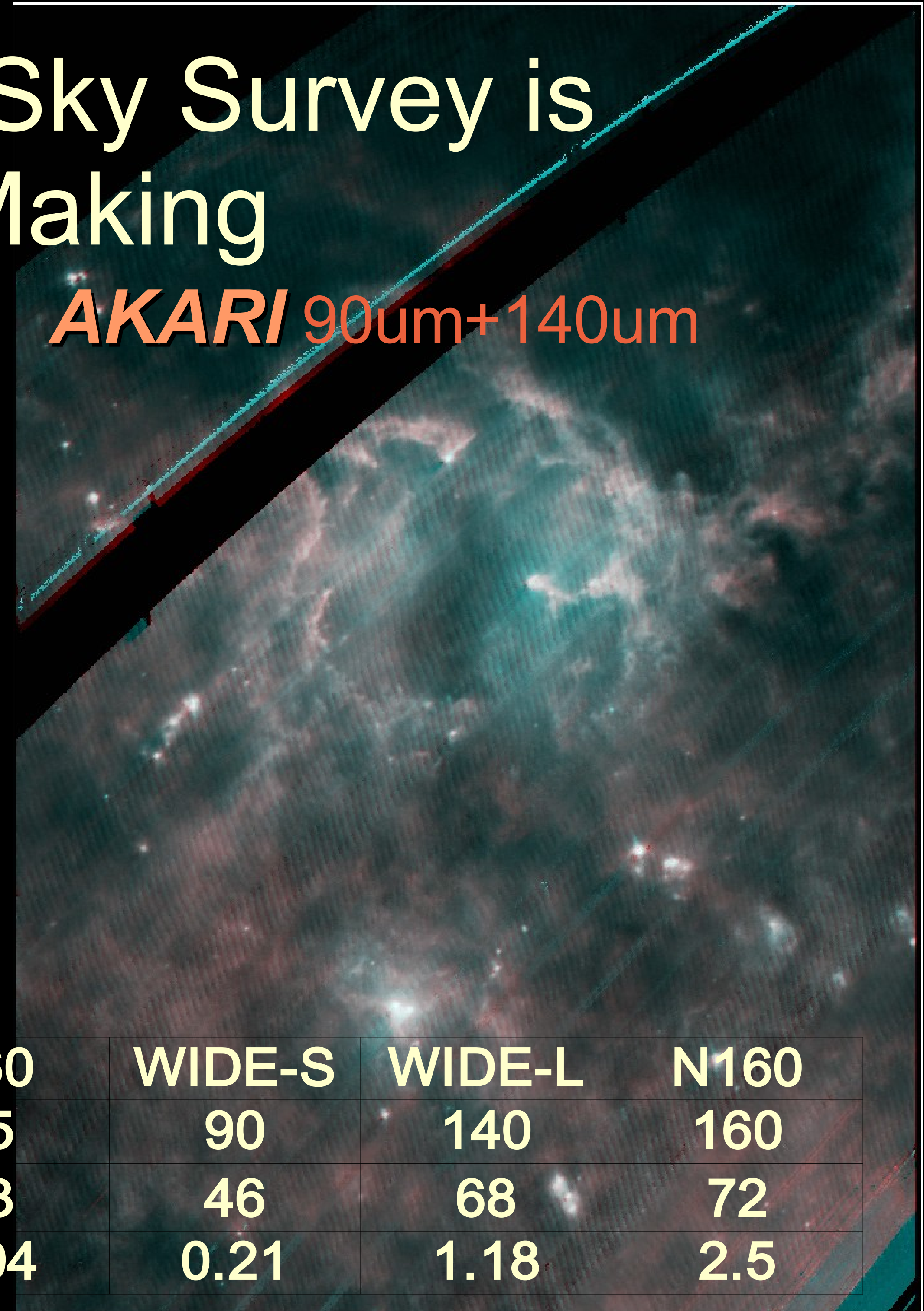
- Full characterisation of luminosity function and evolution, star formation history and large scale structure / clustering and 250 micron source counts

Requirements:

0.6 sq. deg to 1 mJy rms at 250 micron and 110 micron	**T < 900 hrs**
20-50 sq. deg to 3 mJy rms at 250 micron	**T = 200-500 hrs**

A New FIR All-Sky Survey is Under Making





BAND NAME	N60	WIDE-S	WIDE-L	N160
Band center [um]	65	90	140	160
PSF size [arcsec]	43	46	68	72
Detection limit [5σ/scan, Jy]	0.94	0.21	1.18	2.5

First anniversary of AKARI

Launched 2006 Feb. 21 21:28 (UT)

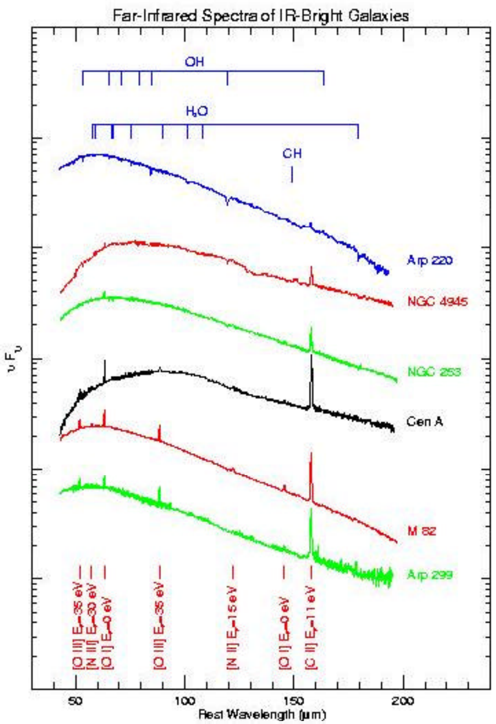
Star Formation Rates from [CII] 158 μm

A. Gil de Paz, P.G. Pérez-González (UCM, Spain), D. Dale (Wyoming), A. Boselli, S. Boissier (LAM), B.F. Madore (Carnegie), J. Gallego, J. Zamorano, A. Castillo-Morales (UCM), S. Charlot (IAP), G. Rieke, K. Gordon (Arizona), M. Mas-Hesse (LAEFF), J. Cepa (IAC) ...

GOAL: Calibrate the [CII] 158 μm line as a measure of the SFR by comparing with other tracers (Hα, UV, IR cont.). Do it against variations in the properties of the ISM; all with spatial resolution.

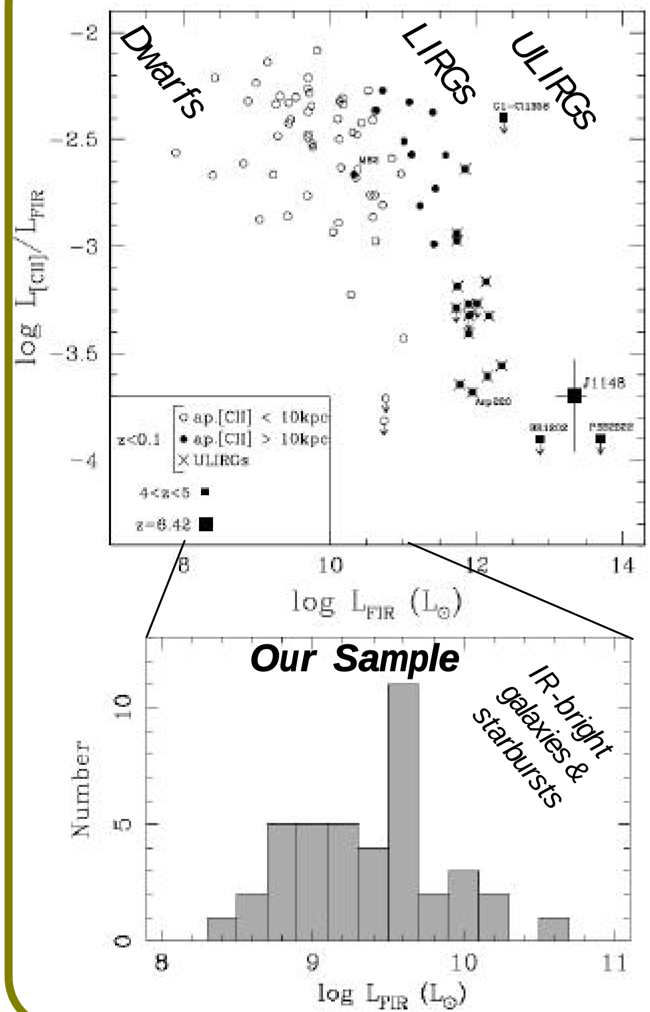
SAMPLE: 49 galaxies from the *Herschel Galaxy Reference Survey* with GALEX UV + MIPS + Hα + drift-scanning + IFU

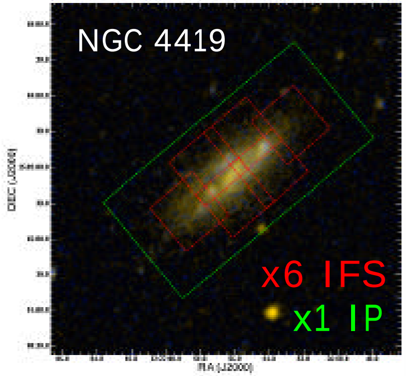
STRATEGY: 168 h of [CII] 158 μm PACS IFS line mapping + 21 h of 110+170 μm PACS IP imaging

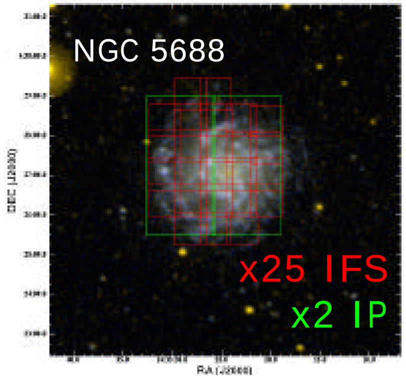


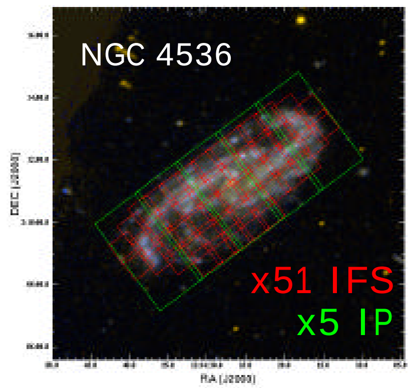
Fischer et al. (1999)

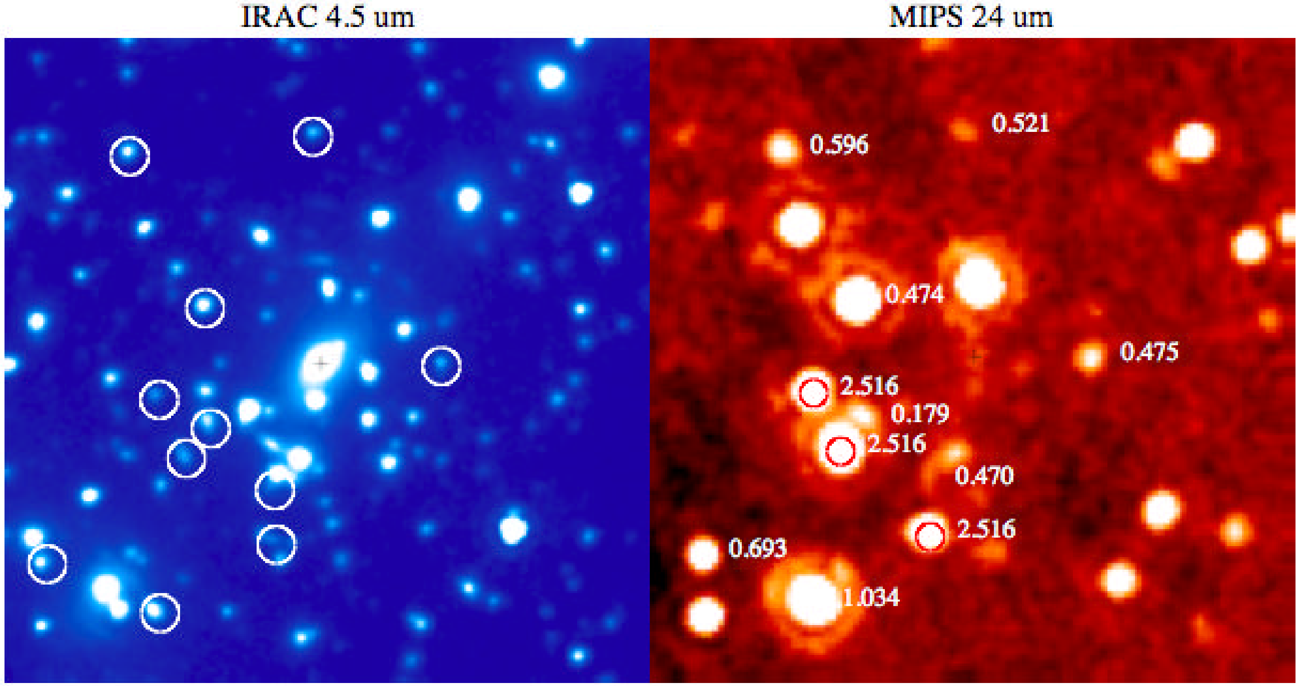
from Maiolino et al. (2005)

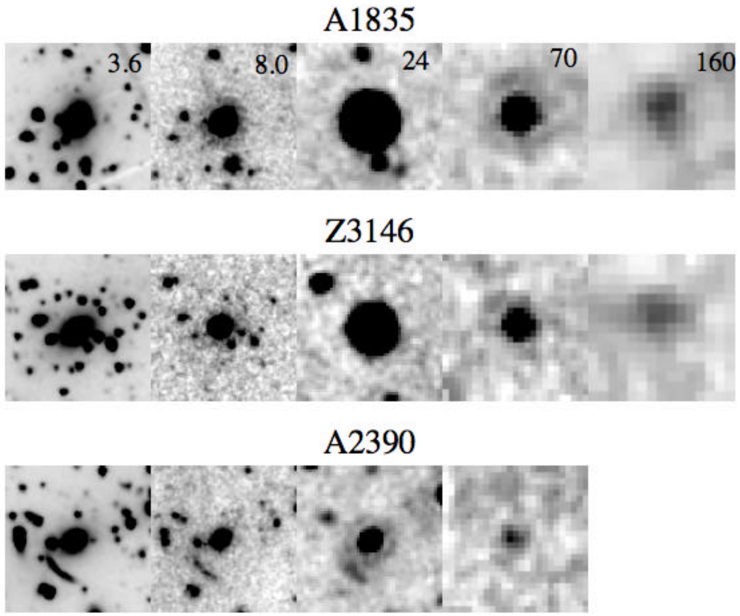












Eiichi Egami
Steward Observatory
University of Arizona

HSO Far-Infrared Spectroscopy of high-redshiftLuminous Infrared Galaxies

Dimitra Rigopoulou (Oxford UK) et al…

We propose a comprehensive survey of the far-infrared fine-structure lines [OI]μm, [OIII]μm and [NIII]μm for a sample of Spitzer/MIPS 160 μm selected galaxies with redshifts in theb range 0.4--1.2. The lines will be used primarily to probe the ISM at high redshifts and also to construct FIR diagnostic diagrams (Sb vs AGN).

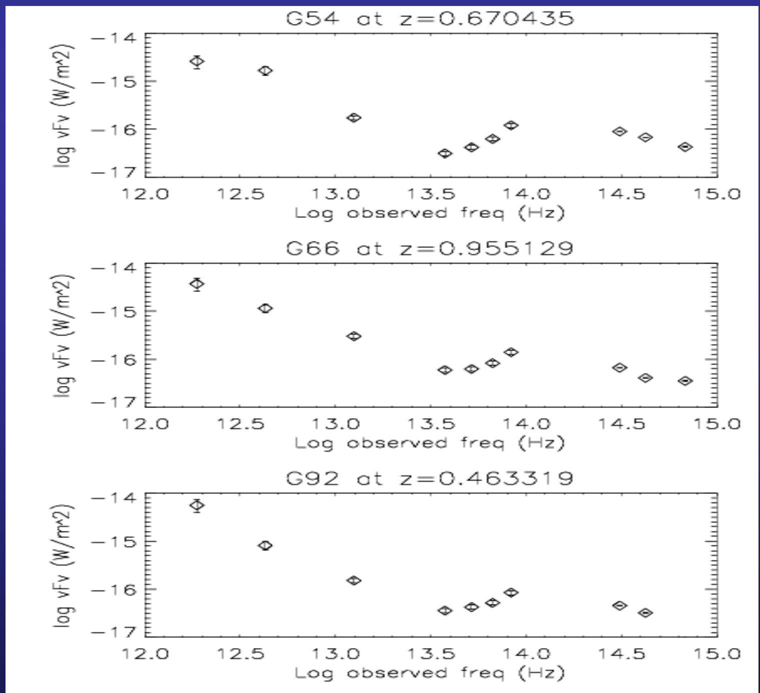


Figure 1: multiwavelength SEDs of MIPS 160μm selected sources

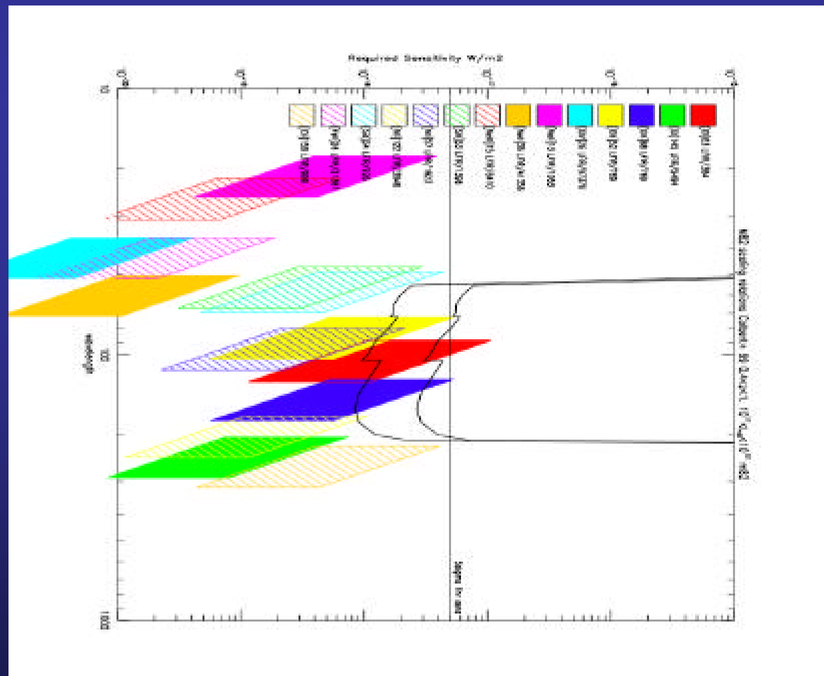


Figure 2: PACS sensitivity estimates

D2D – disks to debris: the fate of gas in planetary systems

W.Dent, W-F.Thi, S.Ramsay, J.Greaves, D.Ardilla, H.Fraser, …

- A legacy project to study the gas in disks at the last stages of their evolution.
- Conduct a systematic survey of 1-30Myr transition through to debris disks.
- Use a well-defined set of key gas tracers, with models.
- Comparable to the Spitzer C2D and FEPS key projects (which mainly looked at the *dust* content).

Science questions:

1. How are the gas and dust structures of the disks related?
2. What is the gas structure of the disk surface?
3. What is the chemical and ionisation structure of the disk atmosphere?
4. How is this gas affected by parameters such as stellar luminosity, disk flaring, disk mass, fractional excess, stellar age, and dust composition?

Issues:

1. How to interpret emission? Models
2. Lines mostly from disk surface. Models
3. How to extract disk emission from ambient cirrus? Imaging, small beam
4. Target selection: only disks with low F (<0.1)

Studying the connection between star burst and X-ray activity in AGN

Scientific case:

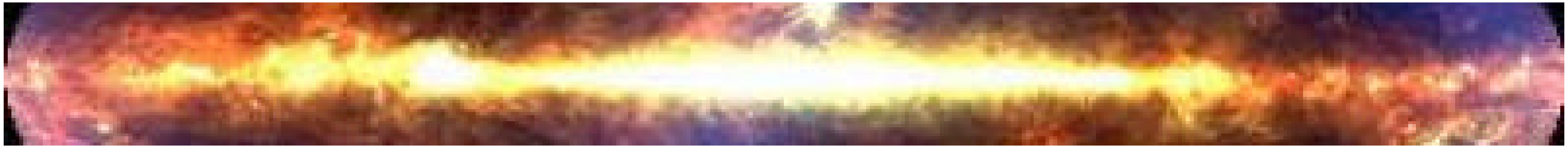
- AGN activity influences star burst
- hard X-rays prove strong AGN activity
- absorption and Compton reflection proves strong interaction of AGN with environment

The Sample:

- local, hard X-ray bright sources from *Swift*/BAT and *INTEGRAL*/IBIS all-sky survey
- 15 brightest, highly absorbed sources and 5 brightest, low absorbed sources
- all sources at $z < 0.06$

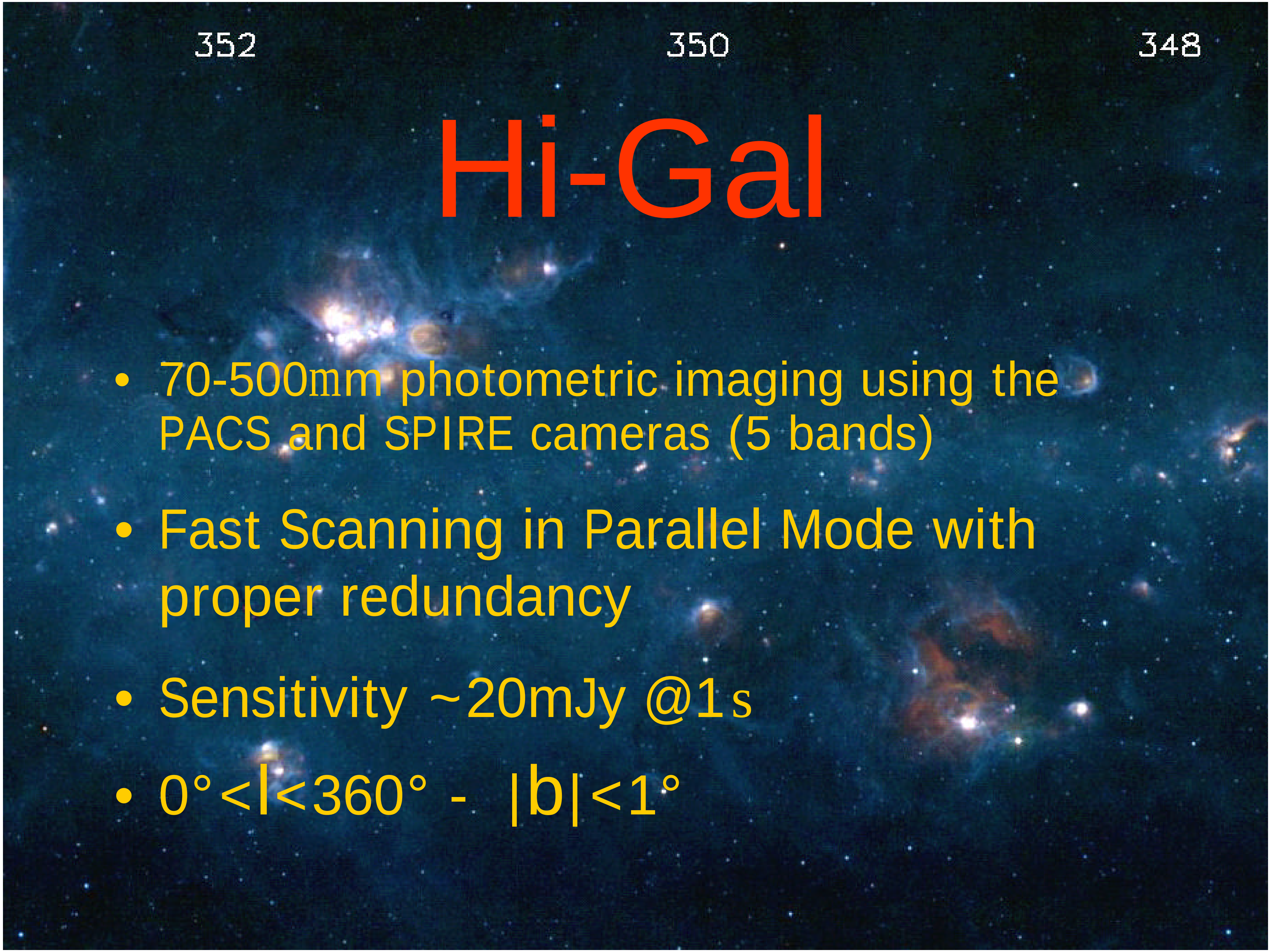
Observation: use *Herschel*/SPIRE in large mapping mode for a **total** exposure time of ~ 200 ksec.
See Poster

Hi-GAL: the Herschel infrared GALactic Plane Survey



S. Molinari - IFSI/INAF, Rome
& the Hi-GAL team
IFSI-Arcetri-Rome Univ. (Italy), CESR-LAM-IAS-Saclay (France), RAL-Hertsfordshire-Liverpool-Cardiff-UCL (UK), IPAC-SSC-JPL-CfA (USA), Toronto-CITA-Laval (Canada)

- Measure the star formation rate and history Galaxy-wide
- Obtain the complete inventory of cold dust in the Galactic Plane
- Establishing the existence and nature of star formation thresholds as a function of ISM properties across a full range of galactocentric radii metallicity and environmental conditions
- Determining the relative importance of global *vs* local mechanisms that give rise to star formation.
- Provide templates, recipes and prescriptions for Xgal science


352
350
348
Hi-Gal
• 70-500mm photometric imaging using the PACS and SPIRE cameras (5 bands)
• Fast Scanning in Parallel Mode with proper redundancy
• Sensitivity ~20mJy @1s
• 0°<l<360° - |b|<1°

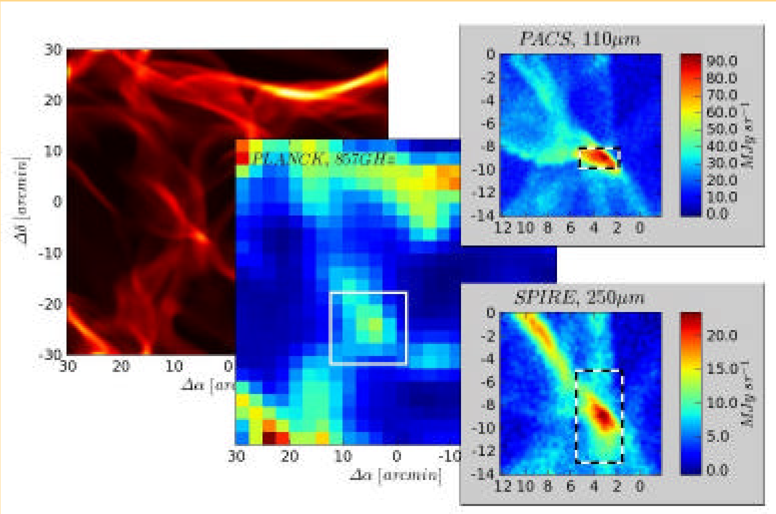
Cold cores in the Galaxy:
Proposal for a PLANCK-HERSCHEL OT Key Programme

Coordinated by M.Juvela (University of Helsinki) & I.Ristorcelli (CESR)

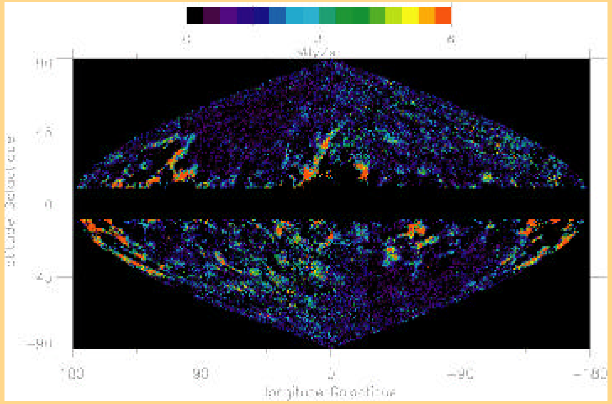
Aim: Combine the capabilities of Planck and Herschel to carry out a an unbiased and systematic study of cold cores in the Galaxy : cores characteristics: temperature, mass distribution, dust properties …

Method:

- Build an unbiased catalog of Galactic cold cores from Planck data during its proprietary period:
  - ~ 10 000 cold cores expected to be detected in this survey
- A follow-up with both PACS & SPIRE on a representative sample selected as a function of
  - Temperature, dust emissivity, density, mass, morphology
  - Magnetic field properties (polarization degree)
  - Galactic distance and/or environment (radiation field, large-scale morphology, core shape, structure)
  - Isolated / clustered cores

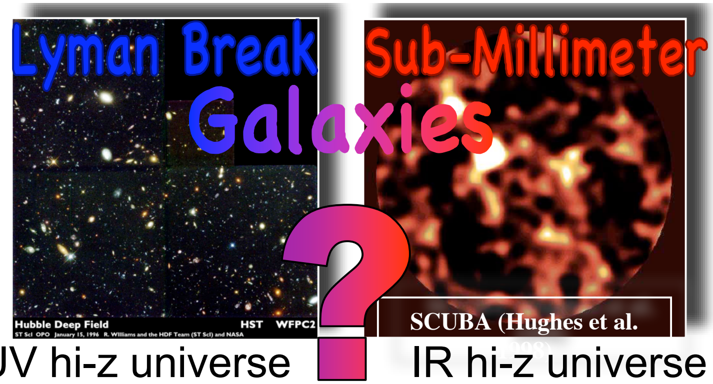


Complementary to the PACS & SPIRE GT Star Formation K-programmes and Hi-GAL OT KP



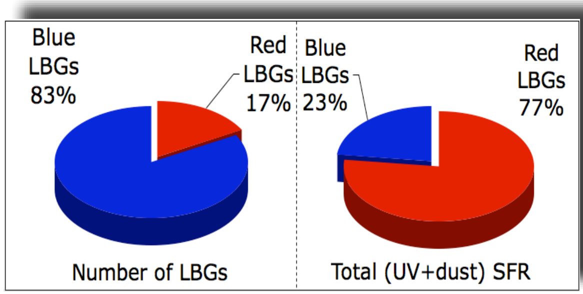
(UV+IR)-bright hi-z Galaxies & Evolution of L_{dust} / L_{UV} with z

Denis Burgarella, denis.burgarella@oamp.fr
Observatoire Astronomique Marseille Provence, LAM



UV hi-z universe ? IR hi-z universe

Are there 2 disjoint hi-z universes ?

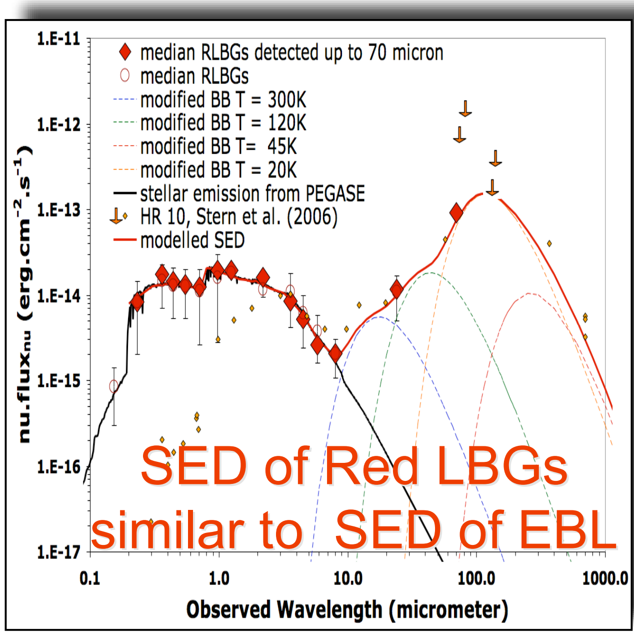


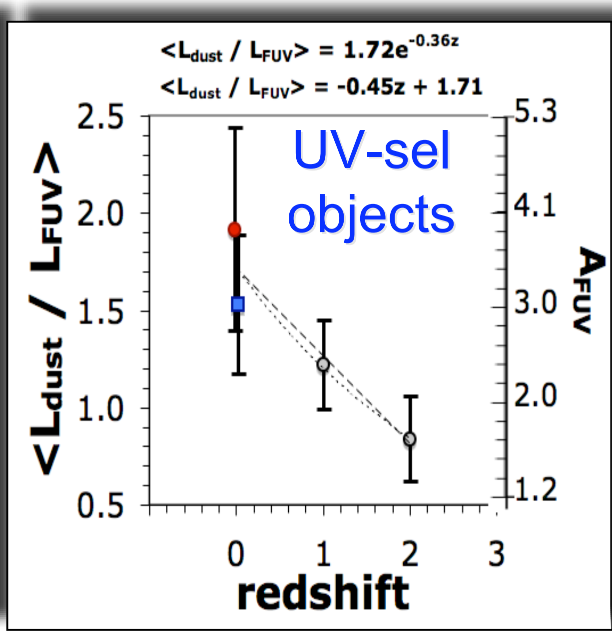
GALEX/Spitzer z~1 LBGs
Burgarella et al. 2007

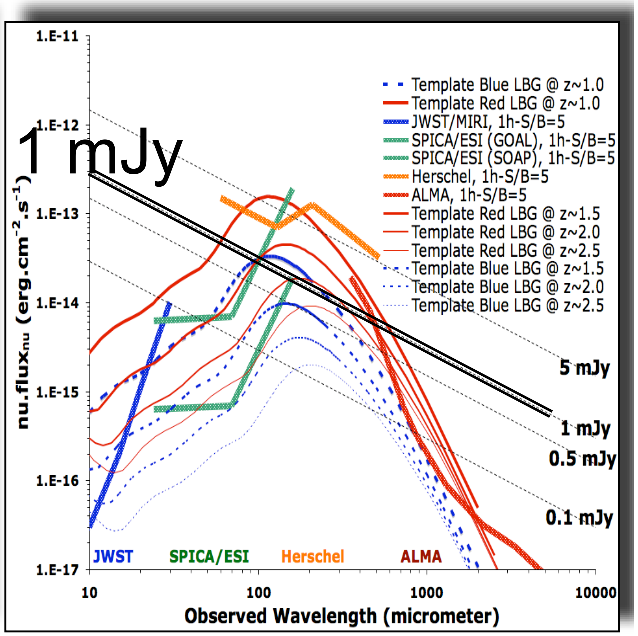
Q1: Populations of (UV+IR)-bright high z objects are observed with SED ~EBL: are they common or rare?

Q2: Ratio L_{dust} / L_{UV} at z = 1 and evolution at z > 1?

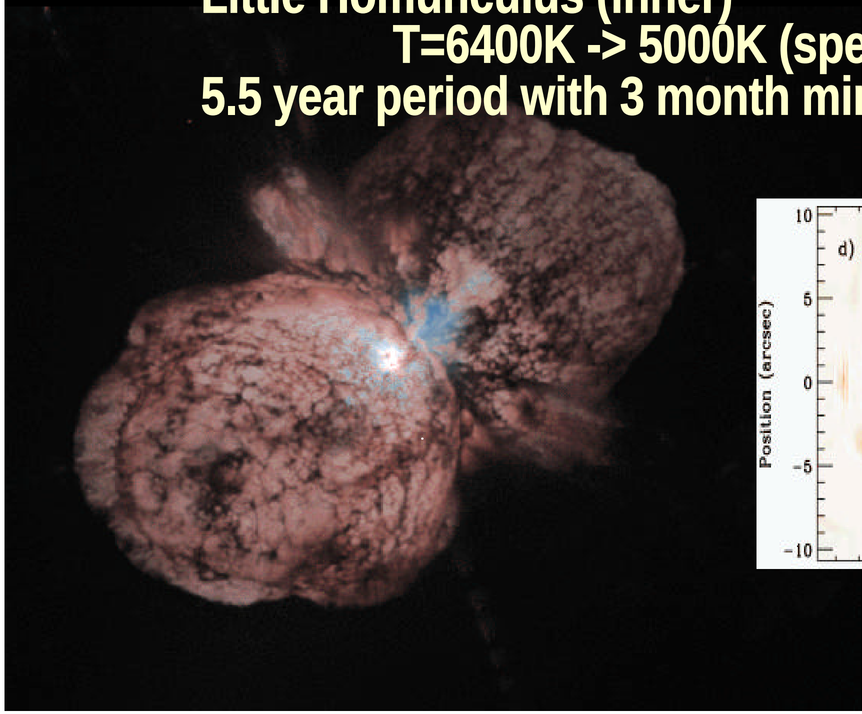
Needs: PACS T_{ext}~$T_{GTO-GOODS-S}$ on 0.04deg^2 for Cosmic variance (2×0.04deg^2) & Statistics (~2×50 LBGs)

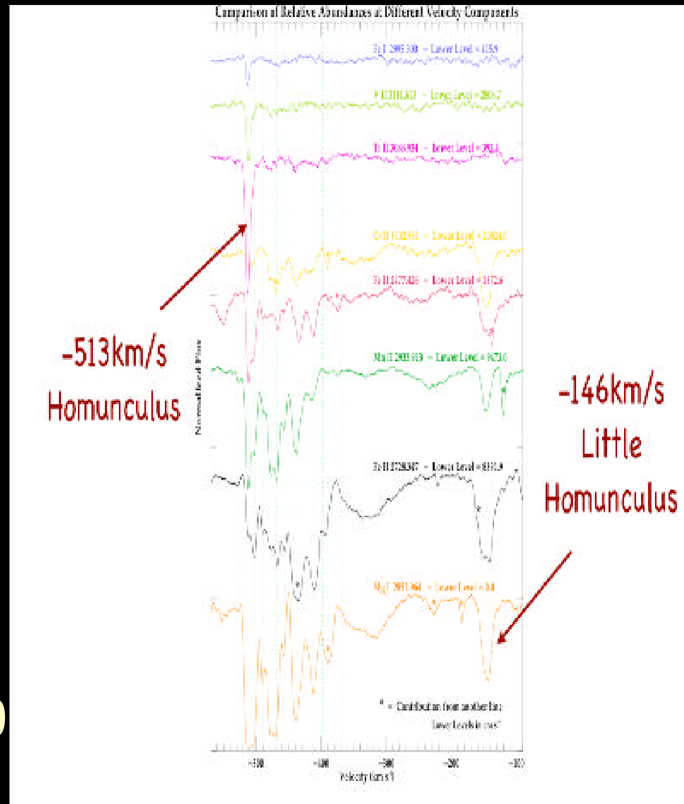


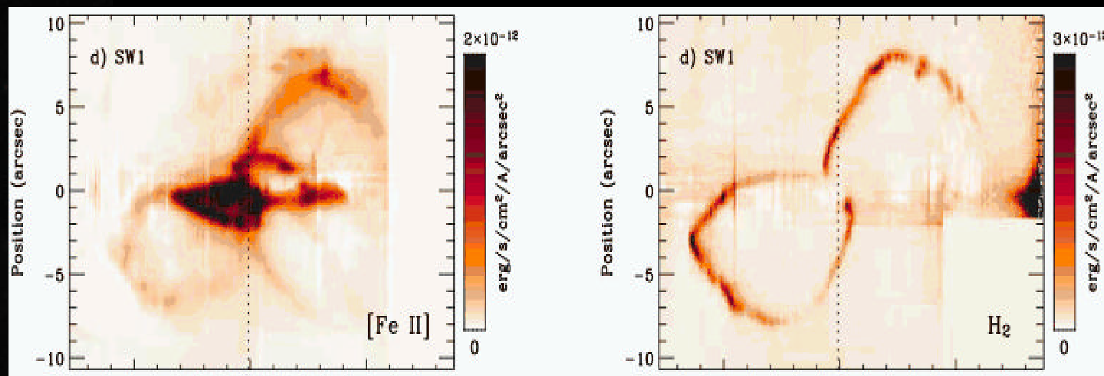




Eta Carinae and Homunculus:
10 to 30 M_o ejected in 1840s and 1890s
N, He overabundant, C, O 1/80th solar.
Homunculus(outer)
inner skin ionized metals 760K
(Fe II, Cr II, Ni II, Sr II, V II, Sc II)
outer shell: molecules @60K
CH, OH, CH^+, NH, HCl
No CO detected
H_2 ~1000 abs lines 1300-1700A
Little Homunculus (inner)
T=6400K -> 5000K (spect min)
5.5 year period with 3 month min Jan-Mar 2009



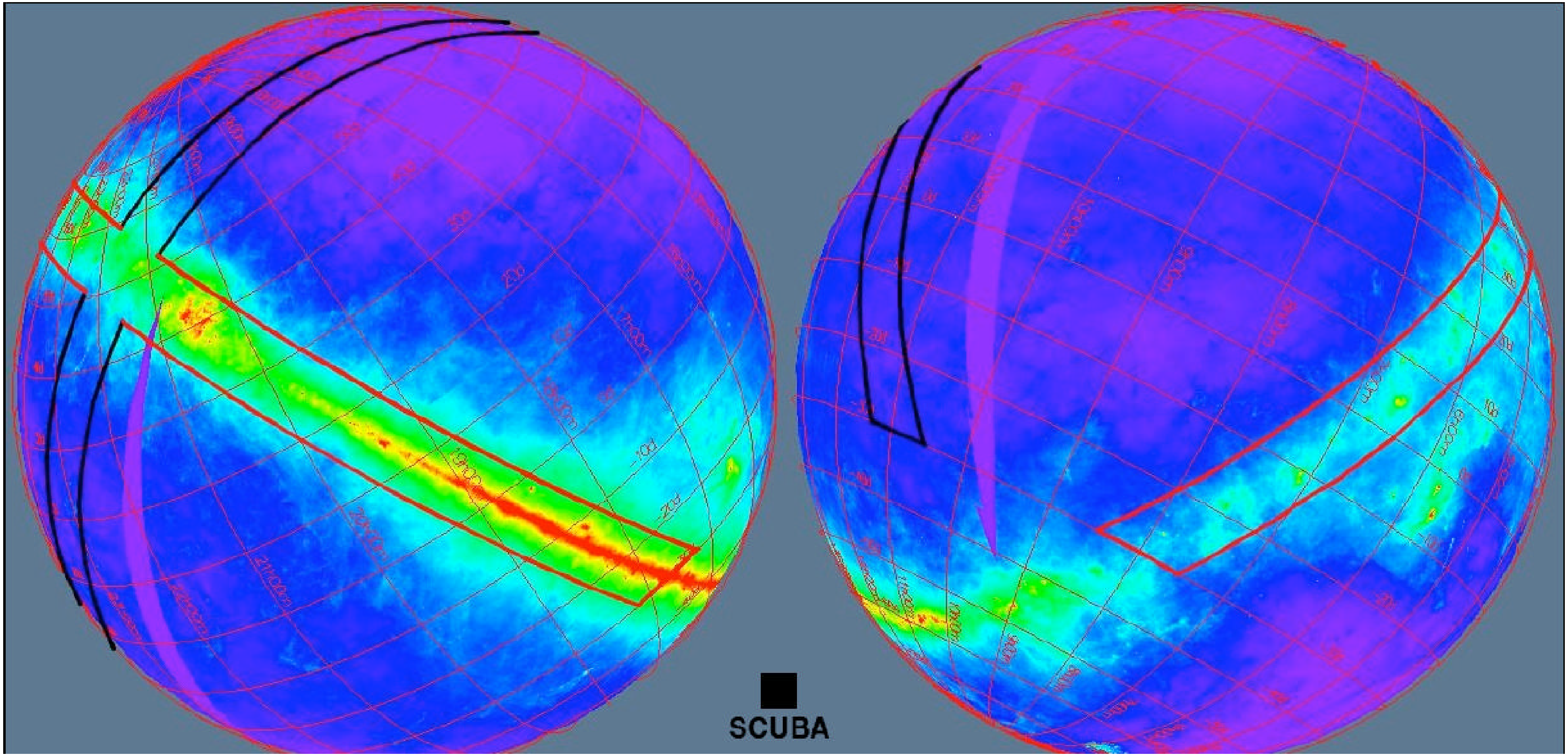




Herschel follow-up of the SCUBA-2 All-Sky Survey (SASSy)

- JCMT-accessible sky to a 5σ 850μm depth of 150mJy from late 2007; expect up to ~1000 galaxies
- More timely for Herschel Planck ERCSC, 14'' beam
- AKARI drop-outs at z>3
- Photometric & spectroscopic HSO OTKP goals:
  - SEDs, L_{bol}, M_{dust}, photo-z
  - "blind" spectroscopic redshift
  - Atomic line species (e.g. C+, O++, N+) and molecules (e.g. OH, H_2O) to probe SFR, ρ, T of ISM, radiation field, etc.

Herschel follow-up of the SCUBA-2 All-Sky Survey (SASSy)



Dust, Gas, Ice with time: from cores to disks

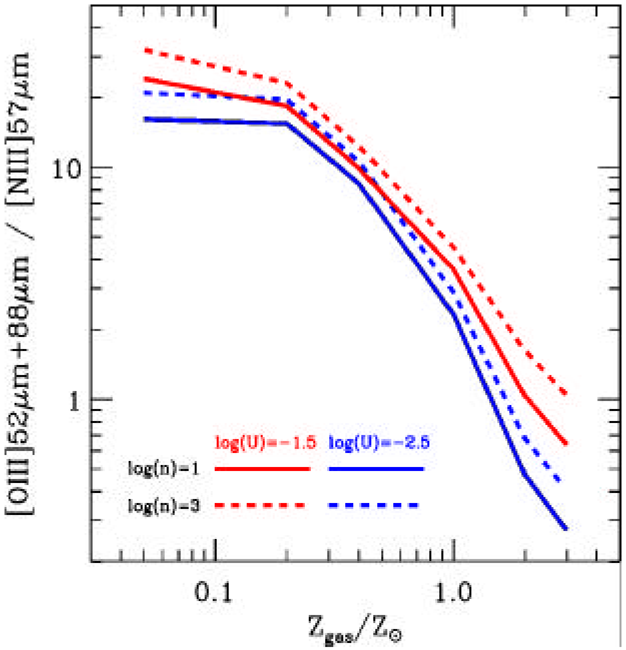
- **Follow the three components from embedded through disk phases**
  - **Range of masses, luminosities**
- **Sample from Spitzer programs and others**
  - **Embedded objects with disks**
  - **Revealed disks: cTTS, wTTS, cold disks, brown dwarf disks**
- **PACS & SPIRE spectroscopy and photometry**
  - **Atomic, molecular lines, ice/dust features as probes of physical structure + processes and chemical evolution**
  - **Complements existing Spitzer-IRS 5-40 mm spectra**

So far: Neal Evans, Ewine van Dishoeck, Ted Bergin, Geoff Blake, Lucas Cieza, Kees Dullemond, Paul Harvey, Michiel Hogerheijde, Dan Jaffe, Jes Joergensen, Claudia Knez, John Lacy, Jeong-Eun Lee, Sebastien Maret, Bruno Merin, Lee Mundy, Klaus Pontoppidan, Christoffel Waelkens

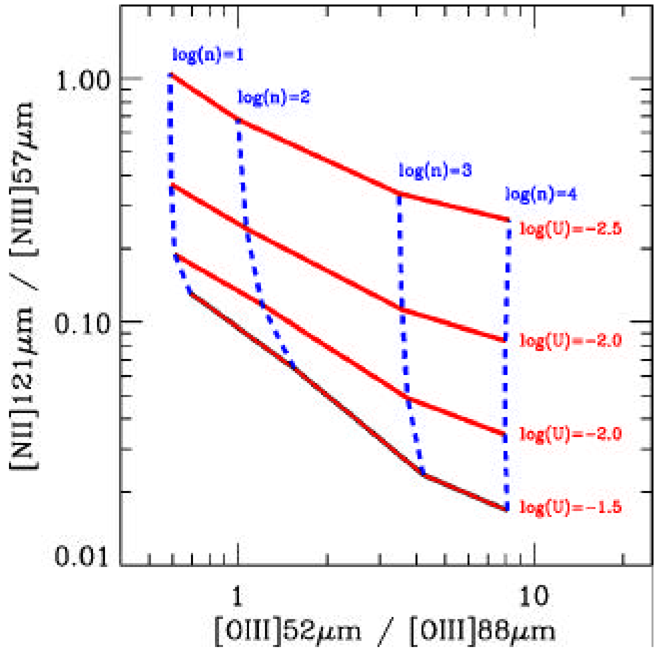
THE METAL CONTENT OF GALAXIES

R. Maiolino, T. Nagao, A. Marconi, L. Spinoglio,
P. Andreani, P. Panuzzo, P. Caselli

Determine the gas metallicity of galaxies by using far-IR diagnostics
→ piercing dust obscuration (which affects optical studies)



→ **[OIII] 52mm**
[OIII] 88mm
[NIII] 57mm
[NII] 121mm



Sample of ~30 galaxies at z~0.1 ([OIII]52 mm in PACS)
spanning a wide range of masses, ages, SFR and dust mass

Goals: re-asses the mass-Z, age-Z, SFR-Z, dust-Z relations
(→ galaxy evolutionary scenarios) from the FIR perspective

The Wide-Field Survey Explorer

WISE is a confirmed NASA Mid-Size Explorer (MIDEX) that will conduct a sensitive **survey of the entire sky in 4 mid-IR bands** (3.3, 4.7, 12, 23μm) with 6-12” spatial resolution

Image Atlas - ~1 million calibrated FITS images in the four survey bands
Source Catalog - Positions and fluxes of ~300 million objects (*minimum* 5σ pt.src. 120/160/650/2600 μJy; 0.5” wrt 2MASS)

Launch in 11/2009 - 1 month IOC, 6 month baseline mission.
Preliminary data release in 12/2010 - 50% of the sky; initial processing
Final data release in 11/2011 - 100% of the survey area, complete reprocessing

Herschel Survey of the Magellanic Clouds

***** ISM, SF, Mass-loss *****

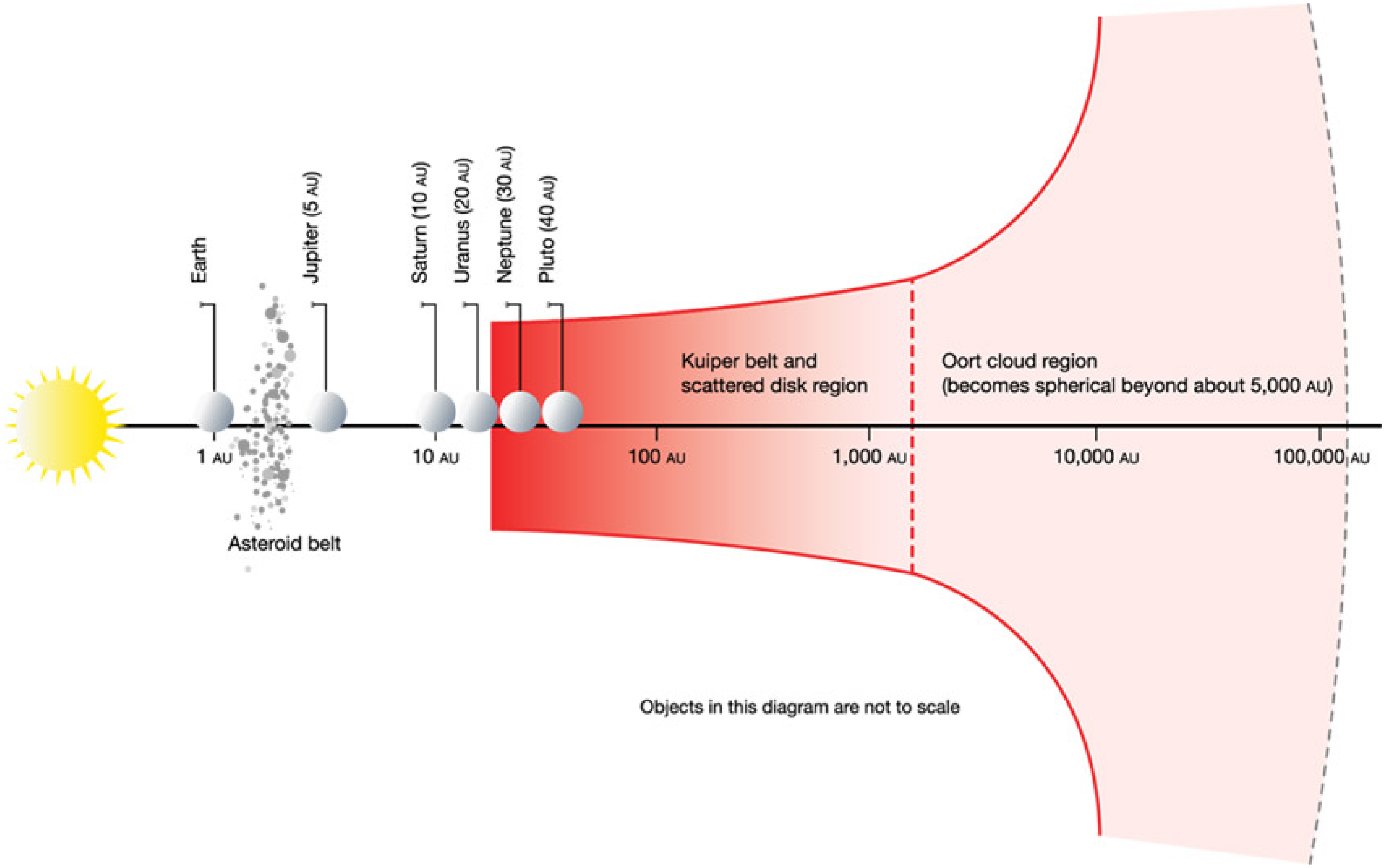
- Quantitative and Resolved
- Very well studied (SAGE)
- 'All' YSOs, AGBs known
- ISM known at shorter wavelength

***** Physical conditions *****

***** Dust mass *****

Meixner and SAGE Team

Dwarf planets and other icy bodies in the outer solar system: Basic physical properties



A. Stern 2003, Nature

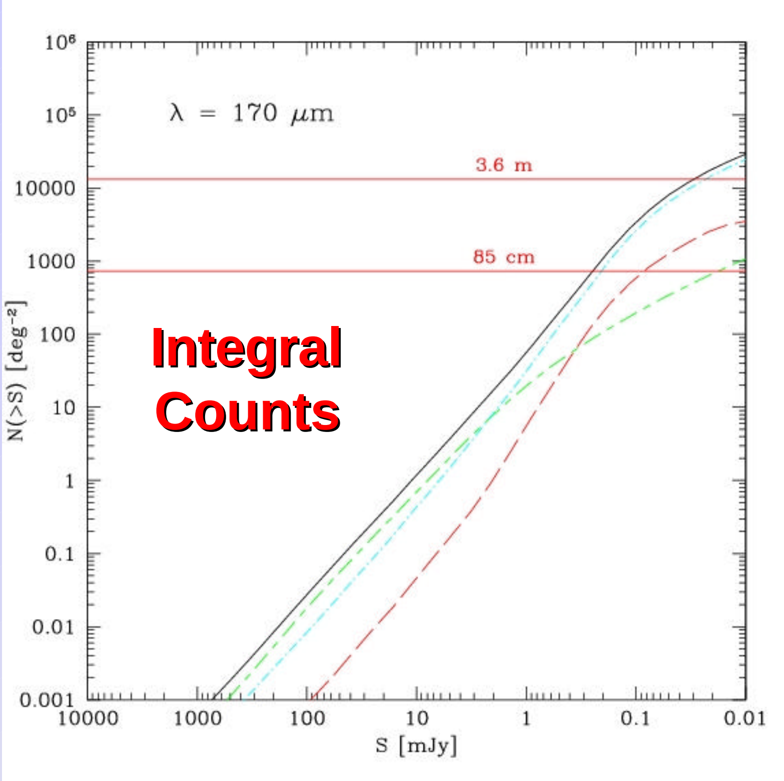
T. G. Müller, N. Thomas, H. Böhnhardt, E. Lellouch, B. Swinyard, D. Jewitt et al.

Main goals

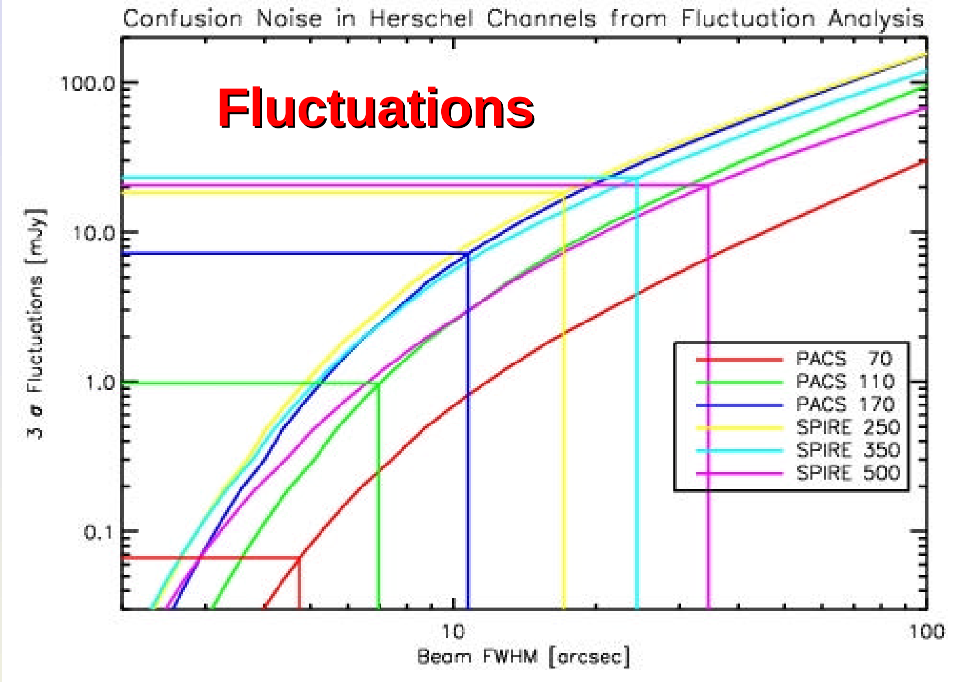
- study and characterisation of dwarf planets and dwarf planet candidates
- sizes and albedos for a representative subset of TNOs, Centaurs and Scattered Disk Objects
- study and characterisation of different populations in the outer solar system (Inner Centaurs, Outer Centaurs, Scattered Disc objects, Plutinos, Cold EK disc objects, Hot EK disc objects) with respect to size distribution and taxonomic classification
- investigations of surface/regolith properties, like thermal inertia, roughness and emissivity
- exploration of the FIR wavelength range, either via spectroscopy (the very brightest objects only) or via PACS/SPIRE multi-band photometry
- study of transition objects between different populations; investigations of the link to short period comets and the effects of surface modifications
- shape information from thermal lightcurves will give important hints on the formation and collisional evolution

→ **to "color" the picture of the outer regions of our solar system & locate the comet source**

EG Confusion Limits in Herschel KPs



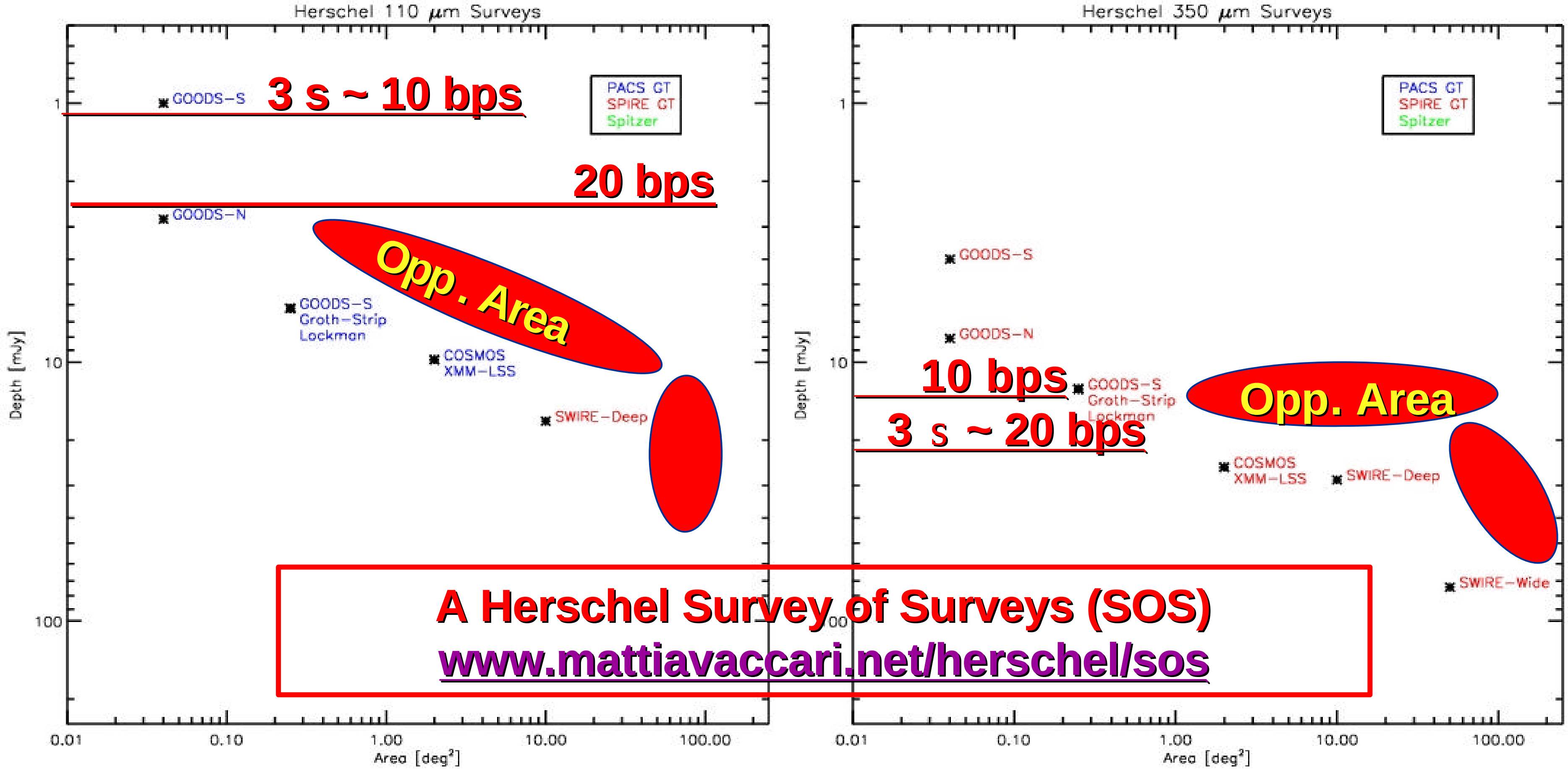
Mattia Vaccari - University of Padova



Channel	PACS1	PACS2	PACS3	SPIRE1	SPIRE2	SPIRE3
λ [μm]	70	110	170	250	350	500
Beam FWHM	4 .74”	6.96”	10.76”	17.1”	24.4”	34.6”
3 σ [mJy]	0.07047	1.002	7.484	18.12	22.55	20.19
10 bps [mJy]	0.1100	1.263	7.090	14.00	15.23	13.23
20 bps [mJy]	0.3029	2.746	11.82	20.49	21.65	18.31

What EG OT KP surveys can we ask for?

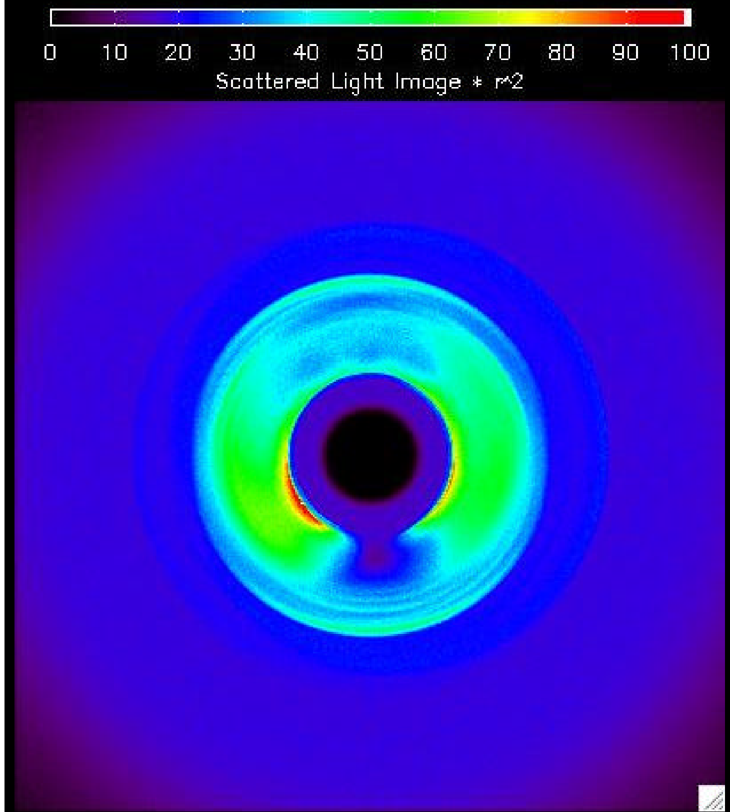
Rich opportunities exist to extend GT KP mid- & large-area planned surveys (~ 1 deg^2 or larger) to deeper levels & wider areas



Debris Disk Models with 25,000 Particles

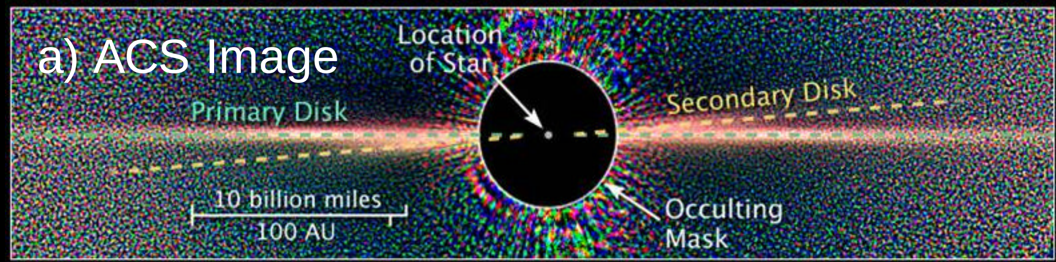
Christopher Stark, Daniel Jontof-Hutter & Marc Kuchner

No Gas, Planet

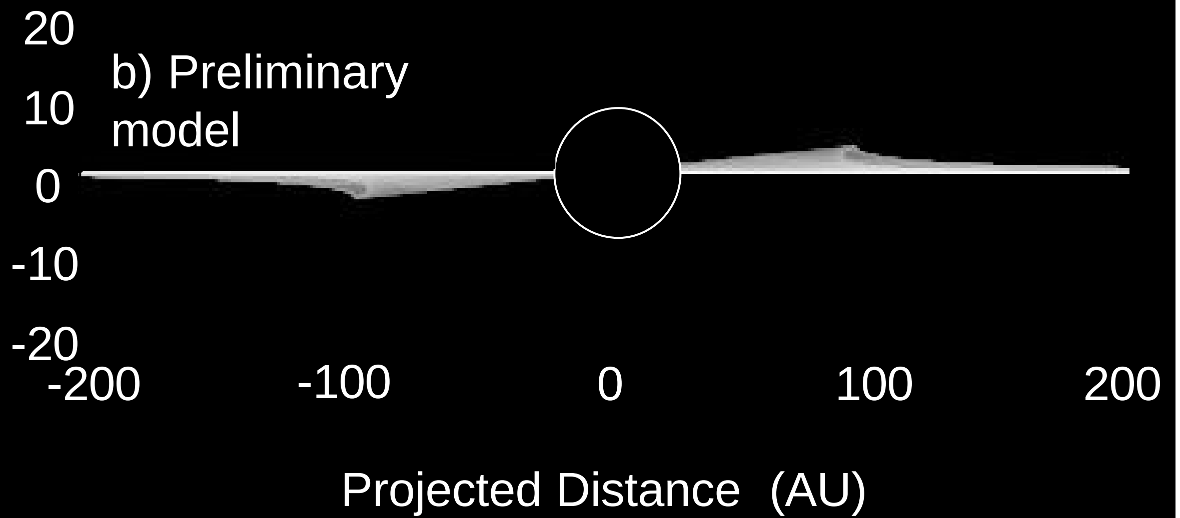


5 Earth Mass Planet, 10 AU

Gas, No Planet

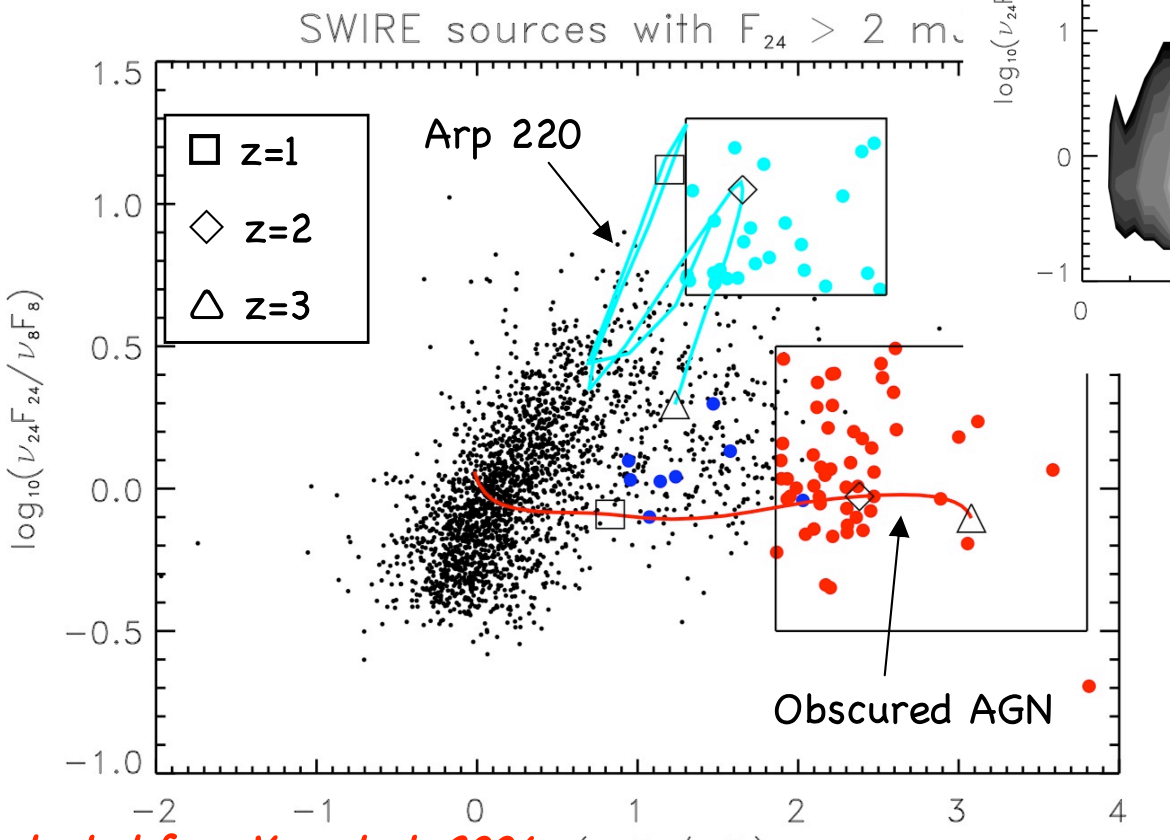


NASA, ESA, and D. Golimowski (Johns Hopkins University) STScI-PRC06-25

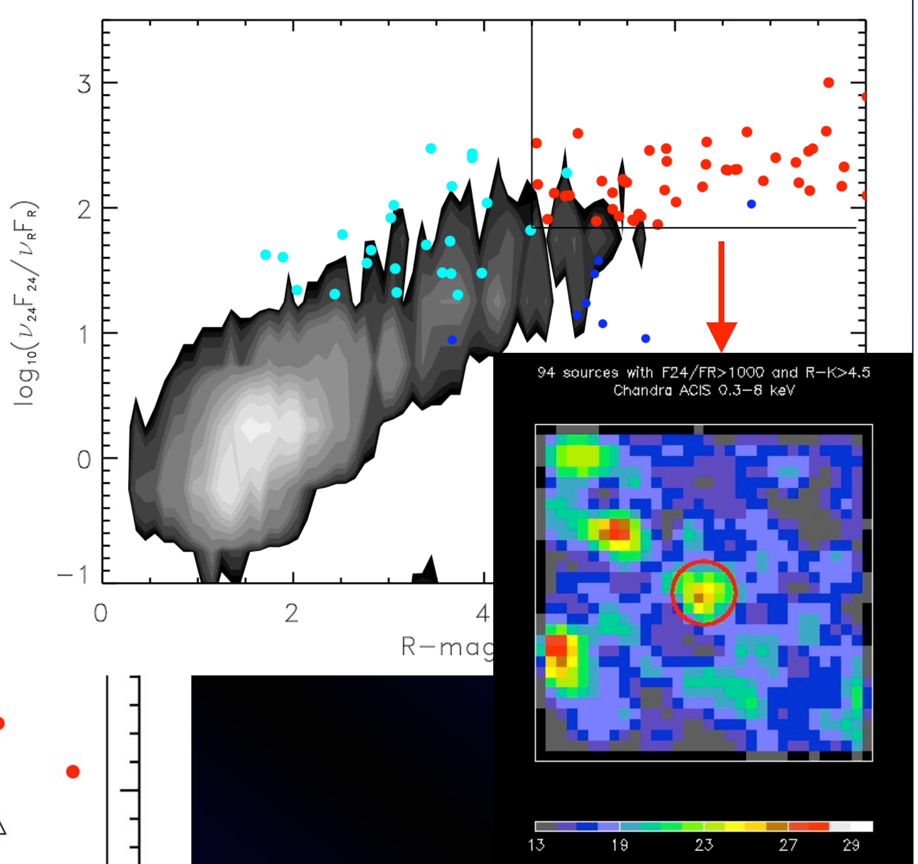


PIERCING THROUGH THE DUST: UNVEILING OBSCURED ACCRETION AT HIGH REDSHIFT

PACS+SPIRE photometry for 70-80 high-z (1.5<z<3.0) sources (obscured AGN and starbursts) with extreme 24/optical ratios



adapted from Yan et al. 2004



We require < 200 hours to determine the bolometric output and characterize SEDs of most obscured objects in the Universe

The Chemical Evolution of the ISM in nearby Galaxies

C.Kramer, J. Stutzki, J.Braine, S.Garcia-Burillo, R.Güsten, F. Israel, S. Lord, S.Aalto, J. Martin-Pintado, B.Mookerjea, S.Philipp, M.Röllig, K.Schuster, G. Stacey, P. van der Werf, M.Wiedner, M.Xilouris

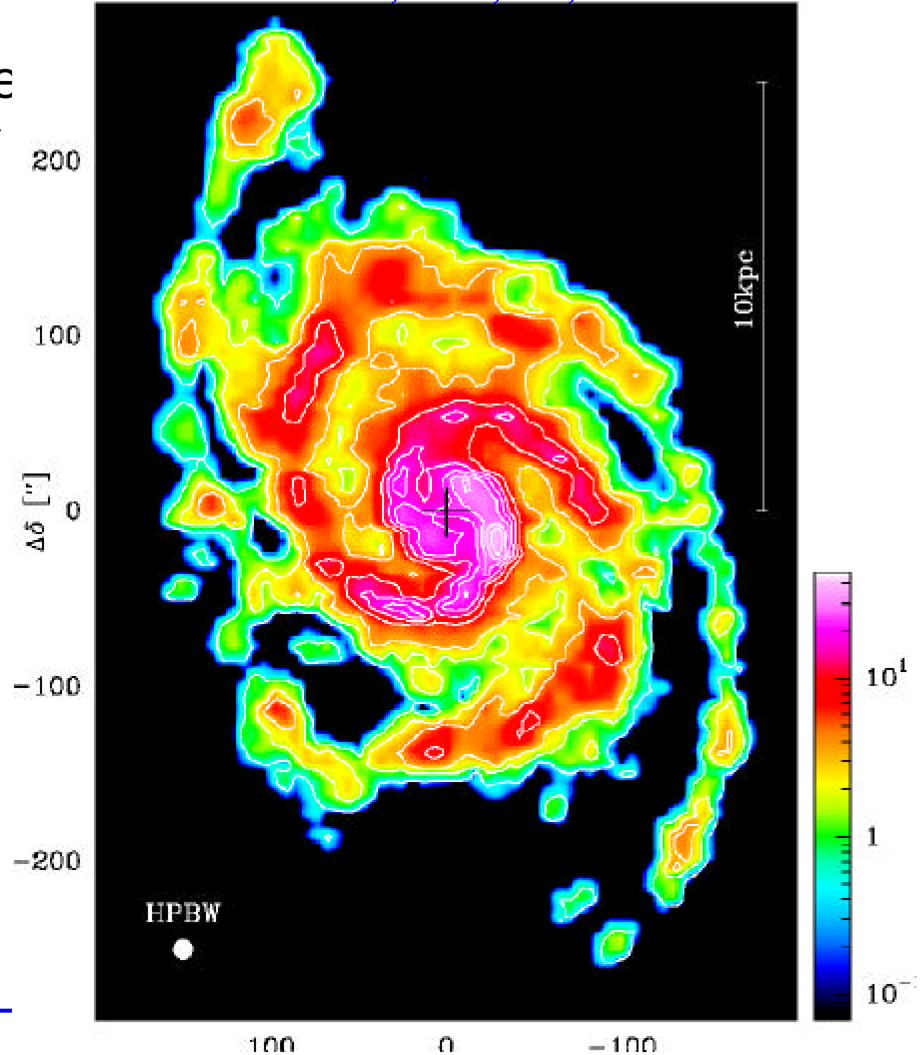
Use **HIFI/Herschel** to study the line profiles of the most important cooling lines in the ISM of nearby galaxies.

Interlinked key questions:

- **Gas cooling:** [CII], [OI], [C], CO, H_2O, ...
- **Gas heating**
- **ISM components:** the origin of [CII] ?
- Galaxy components:
    - **Outer disks**
    - **Spiral arms**
        - Formation and destruction of GMCs ?
        - Regulation of star formation ?

Contact us at poster # 42 !

Schuster et al. 2007, A&A, 461, 143



Herschel observations of the most isolated galaxies

L. Verdes-Montenegro, U. Lisenfeld (the responsible for the pink) & AMIGA team

1) Do you need a statistically significant template to classify/understand your weird galaxy/ies?

a) No I dont mind at all.

Then forget about it!

b) I dont need it now, but I will need it sooner or later.

See c) below.

c) It is exactly what I was looking for!

Great! You will like AMIGA project: Analysis of the Interstellar Medium of Isolated GAlaxies

Sample > 1000 galaxies selected with <u>strict isolation criteria,</u> <u>quantification of small companions,</u> <u>lower FIR than field cfa sample (interactions minimized)</u>

<u>Multiwavelength database</u> (see question 2)

2) Are you interested in the dust properties of isolated galaxies?

a) No.

Then you are at the wrong conference!

b) Yes.

Let's talk about our proposal to study dust properties and distribution of a z limited subsample of 89 isolated galaxies with SPIRE @250, 360 & 520 µm.

If your answers were c): Herschel characterization of this well defined and statistically significant sample of isolated galaxies is a must

Herschel observations of the most isolated galaxies

L. Verdes-Montenegro, U. Lisenfeld (the responsible for the pink) & AMIGA team

Science@IAA:

Staff: L. Verdes-Montenegro

Post-docs:

- G. Bergond,
- U. Lisenfeld,
- S. Verley,
- D. Espada

PhD students:

- J. Sabater
- V. Martínez

Soft for radio-VO@IAA:

Staff: E. García (30%)

Contracts:

- J. Santander
- V. Espigares
- J. E. Ruiz

IRAM-Granada:

Staff:

- R. Mauersberger
- H. Ungerechts

Post-docs:

- S. Leon
- S. Martín

PhD students:

- B. Ocaña

Soft:

- W. Brunswig
- A. Sievers

External collaborators for different parts of AMIGA:

- F. Combes (Paris)
- W. Huchtmeier (MPIfR, Bonn)
- S. Odewahn (Univ. Texas)
- M. Yun (UMass)
- J. Sulentic (Univ.Tuscaloosa)
- A. Bosma, E. Athanassoula (Obs. Marseille)
- T. Ponman, J. Rasmussen (Un. Birmingham)
- L. Hunt (Obs. Arcetri)

Herschel observations of the most isolated galaxies

L. Verdes-Montenegro, U. Lisenfeld (the responsible for the pink) & AMIGA team

Revised positions: Leon & Verdes-Montenegro (2003)

LB analysis: Verdes-Montenegro et al (2005)

Morphological revision: Sulentic et al (2006)

Isolation, Hα: Verley (2006, PhD, Obs Paris)

HI, CO: Espada (2006, PhD, Univ. Granada)

FIR: Lisenfeld et al (2007)

Radiocontinuum fluxes: Leon et al (submitted)

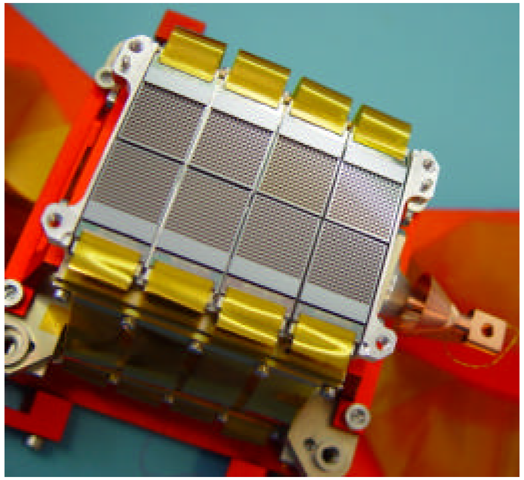
Radio-FIR correlation, AGNs (SDSS spectra): Sabater (Master Th 2006)

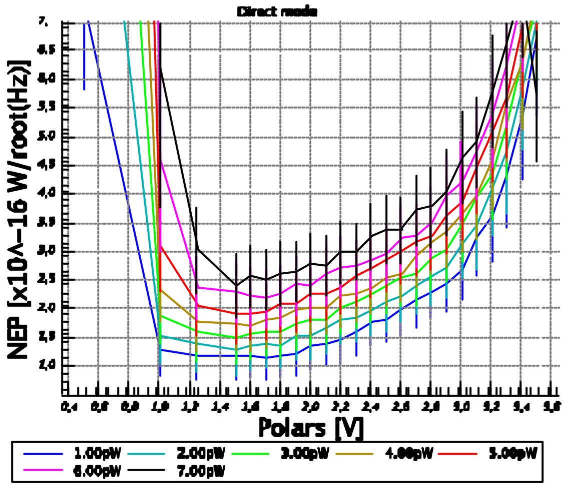
Data public at **www.iaa.es/AMIGA.html** with VO interface

The PACS Photometer

Billot N., Sauvage M., Okumura K., Rodriguez L., Boulade O., Dang D.
CEA - Saclay/DAPNIA/SAp

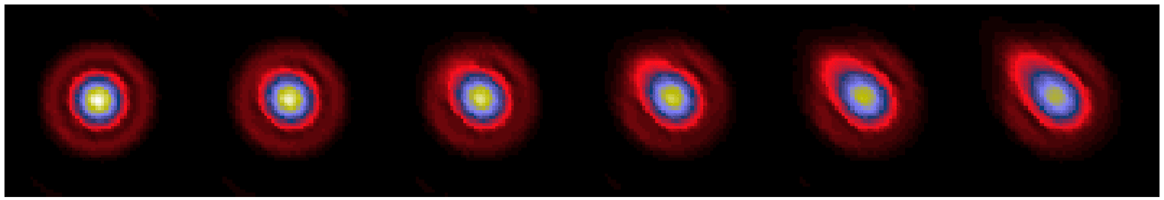
Overview of PACS *filled bolometer arrays*





Sensitivity optimization under various configurations

Investigation of *PSF degradation* of scanned point sources using the *PACS simulator*



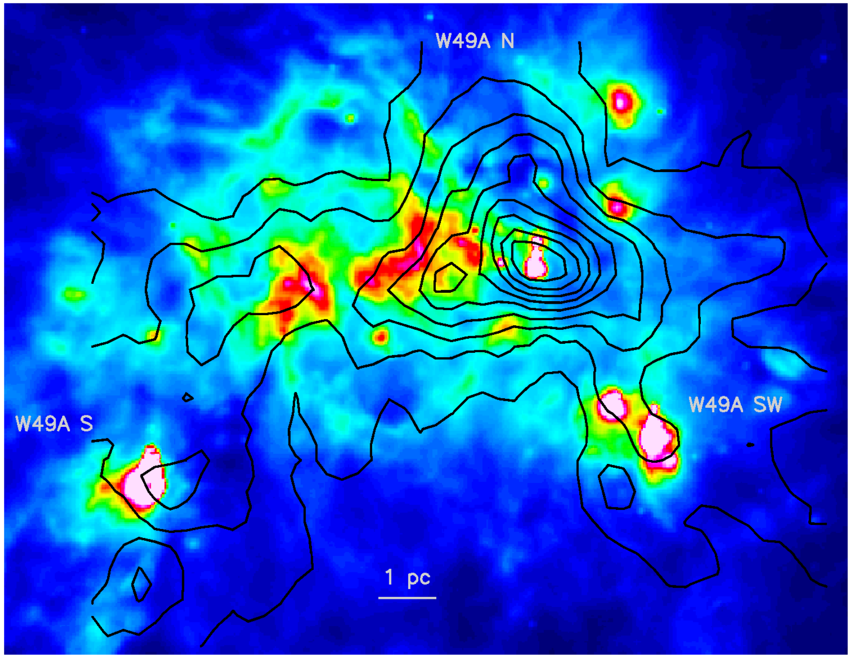
Poster # 61, outside poster room

A Herschel survey of the most luminous star forming regions in the Galaxy

F. Wyrowski, R. Güsten, K. Menten, T.-C. Peng, P. Schilke, A. Weiss (MPIfR Bonn),
S. Bontemps, J. Braine, A. Baudry, F. Herpin (Bordeaux),
F. van der Tak (Groningen), R. Plume (Calgary), C. Kramer (Köln)

- Study environment of most massive clusters in our Galaxy, e.g. the famous W49 region
- Image in water lines and high-J CO, selected fine structure and hydride lines to study cooling on various scales
- Use as starburst templates to connect scales of nearby SF cores and starburst galaxies. Important as intermediate step between galactic and extragal projects

IRAC 8.0 micron & HCO+(3−2)

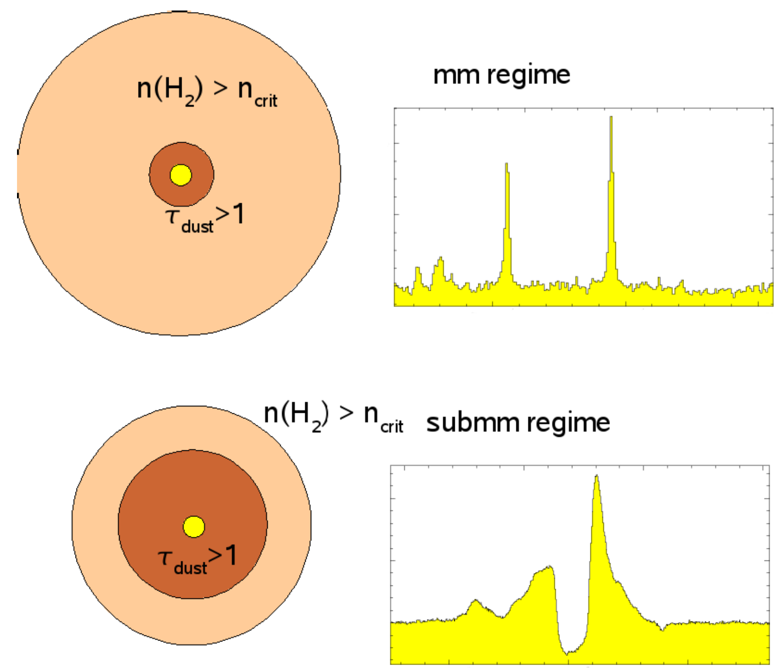


- Ground based preparatory work is ongoing
- Complementary to GT projects

HIMASSS – HIFI Massive Star Forming Regions Spectal Study

P. Schilke, C. Comito, K. Menten, F. Wyrowski, (MPIfR Bonn),
E. Bergin (Umich), D.C. Lis, T. G. Phillips (Caltech)
contact: schilke@mpifr-bonn.mpg.de

- HIFI gives access to lines requiring extremely high temperatures and densities --> provide glimpse into the very inner cores of MSF regions close to the powering source(s).
- Large column densities: enable absorption studies --> together with interferometry at lower freq: 3d view



- --> partial line surveys of larger sample of sources to probe M/L, age, environment space

PHOENIGS: from the SINGS `ashes'

Project for Herschel On an Extragalactic Normal Infrared Galaxies Survey

R. Kennicutt (PI; IoA, Cambridge, UK), L. Armus (SSC, USA), D. Calzetti (Umass, USA), D. Dale (Uwyo, USA), B. Draine (Princeton, USA), C. Engelbracht (UofA, USA), K. Gordon (UoA, USA), L. Hunt (Oss Arcetri, Italy), H.W. Rix (MPIA, Germany), H. Roussel (MPIA, Germany), M. Sauvage (CEA, France), E. Schinnerer (MPIA, Germany), J.D. Smith (UofA, USA), L. Vigroux (IAP, France), F. Walter (MPIA, Germany) + **TBD**

Broad Science Objectives:

- Trace and characterize the flow of energy through the ISM in galaxies;
- Link heaters-emitters: use Herschel spatial resolution to enable definitive modeling of radiative transfer of dust and gas cooling in galaxies;
- Probe the nature/origin of extended cold dust envelopes; link warm-cold dust emission;
- Improve dust and spectral diagnostics of star formation and ISM properties.

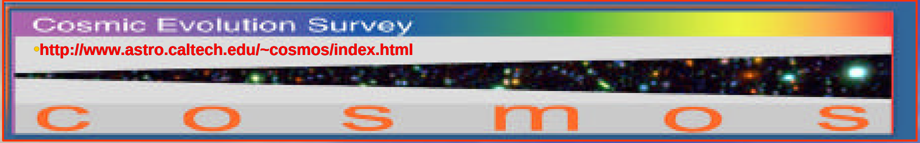
Approach:

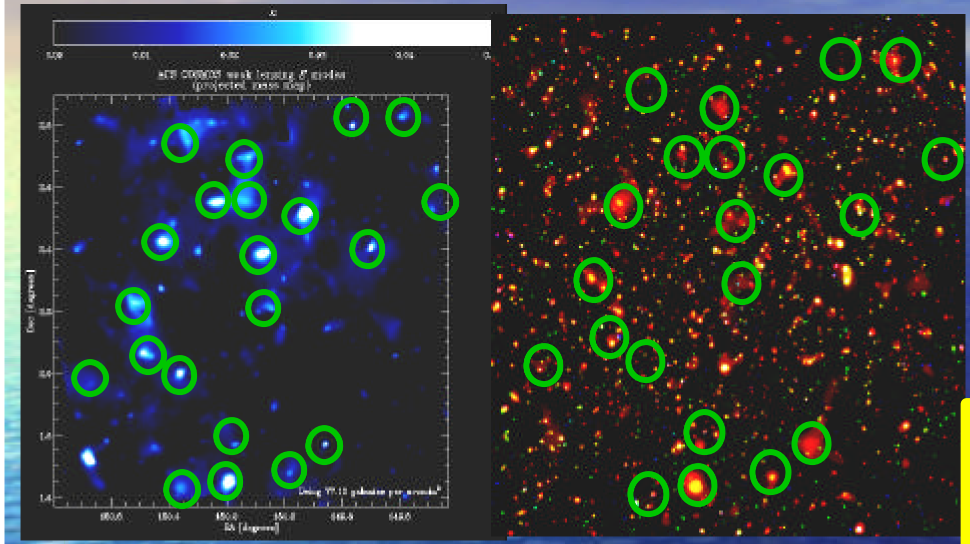
- An objectively selected sample of nearby galaxies (SINGS-inspired), optimized to cover a broad and representative range of properties, and broad range of local physical environments;
- Exploit angular resolution for resolving infrared components and dust heating populations.
- Leverage existing and new ancillary data: from UV to radio
- Data and high-level data products would be delivered quickly to the broad community.

THE CASE FOR AN HERSCHEL OPEN-TIME KEY PROGRAM FOR THE COSMOS FIELD

Alberto Franceschini & the *COSMOS Team*

alberto.franceschini@unipd.it

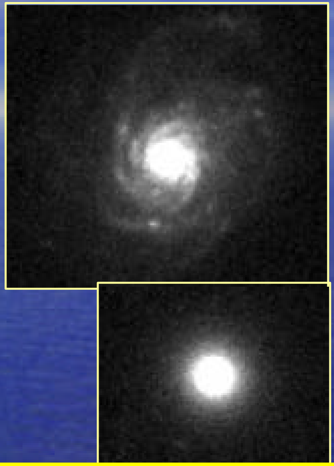




Herschel Extragalactic GT Survey Wedding Cake

Name	Area	Field	PACS Time	SPIRE Time	70	110	170	250	350	500
-	deg^2	-	hr	Hr	mJy	mJy	mJy	mJy	mJy	mJy
Level 4	2	COSMOS	~220	~50	6.0	11	14	21.1	25.5	29.1

An extraordinary variety of multiwavelength data in the COSMOS field



from space:
- HST_ACS I-band
- Spitzer IRAC 3.6, 4.5, 5.6, 8 μm, Spitzer MIPS 24 μm (3 Msec)
- GALEX far-UV, near-UV
- XMM 1.5 Msec
- Chandra 2 Msec survey
- Soon to come: sub-mm w. SCUBA2, APEX/ LABOCA

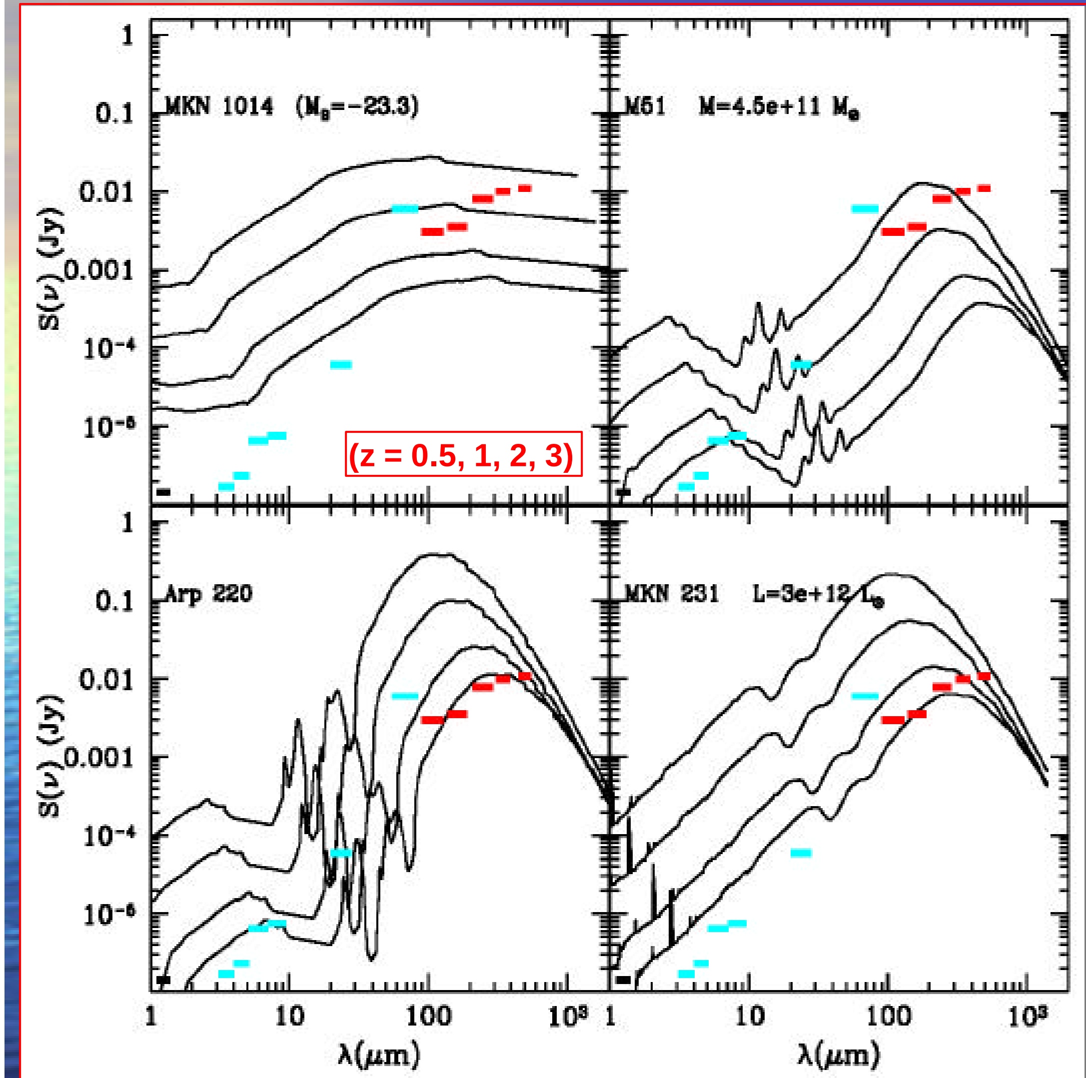
ground based:
- Subaru SCam B,V,r',i',z'
- NOAO K-band
- UKIRT J,H band
- VLA 20 cm
- IRAM 1.2mm
- VISTA 5-band medium-deep full-area & ultra-deep in a fraction
- ESO/VIMOS & Magellan optical spectroscopy for more than 35000 sources
- NOAO + CFHT K Band .

SCIENCE CASE FOR A KEY PROGRAM SURVEY IN THE COSMOS AREA

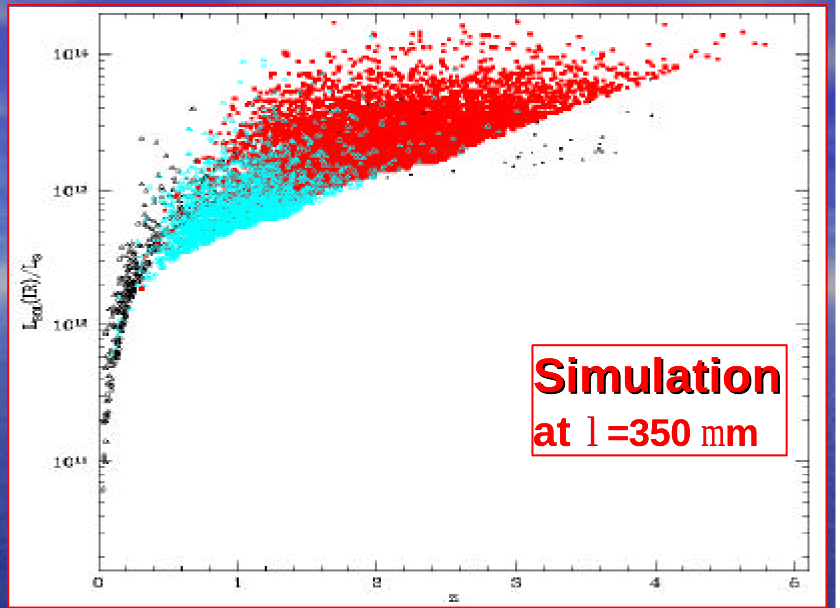
- The unprecedented concentration of high quality multi-wavelength data on such wide contiguous area, ideal for investigating - among others - the effects of the environment and LSS on galaxy & AGN formation and evolution, calls for adequate mapping by Herschel.
- Herschel will offer the only way - in the next several years at least - to measure the bolometric emission by cosmic sources, an essential parameter to characterize the main phases of the transformation of the primordial baryonic gas into stars and BH's.
- An extensive survey in the Open Time, essential to achieve this goal, will not only provide a factor 3 sensitivity gain in the 5 Herschel wavebands over the much shallower GTO mapping, but will also be essential in obtaining good enough PSF sampling and the overall image quality needed for reliable source identification from UV to the sub-mm, quite challenging in such a source-confused situation.
- By filling the last gap in the existing multiwave coverage of the COSMOS field, these "legacy" Herschel observations promise to provide the astronomical community with the ultimate mapping of galaxy and LSS evolution through cosmic times.

SOME ENVISAGED PLANS

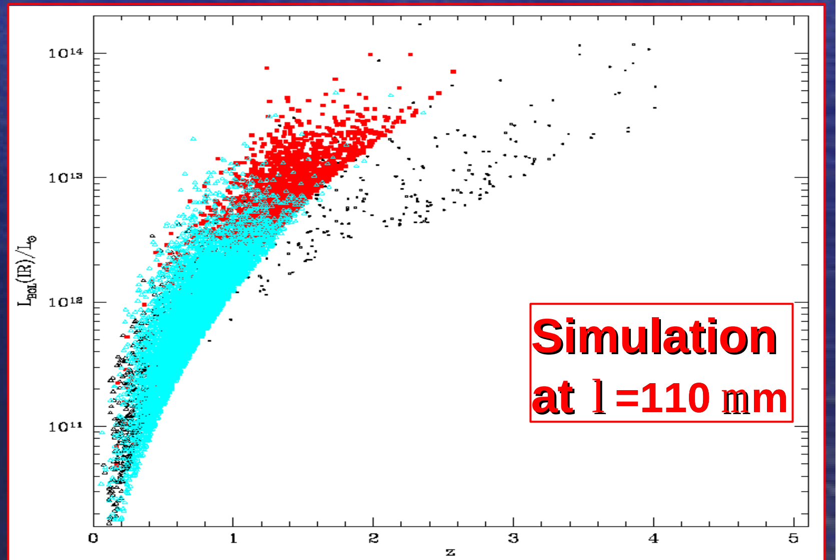
Name	PACS Time	SPIRE Time	Total time req.	70	110	170	250	350	500
-	hr	hr	hr	mJy	mJy	mJy	mJy	mJy	mJy
Spitzer & Guar. Time	~220	~50	160	6.0	11	14	21.1	25.5	29.1
H-COSMOS A	500	150	650	2000	18000	35000	16000	5800	
2 sq.deg.	720	200	810	6.0	4.2	4.5	10.6	12.8	14.6
H-COSMOS B	500	225	725	2000	12500	24000	11200	5600	
1 sq.deg.	610	250	825	6.0	3.1	3.3	8.0	9.7	11.
H-COSMOS C	1000	225	1225	2000	25000	47600	22400	11200	
1 sq.deg.	1200	250	1305	3.1	3.1	3.4	8.0	9.7	11.



MKN 1014 (M_B=-23.3)
M51 M=4.5e+11 $M_\odot$
Arp 220
MKN 231 L=3e+12 $L_\odot$
(z = 0.5, 1, 2, 3)
S(ν) (Jy)
λ(μm)
1
0.1
0.01
0.001
10^{-4}
10^{-5}
1
10
100
10^3



Simulation
at l =350 mm
$L_{BOL}(IR)/L_\odot$
z

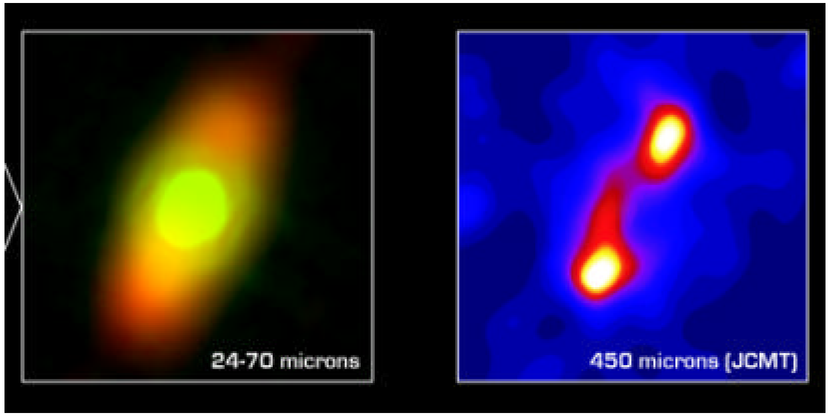


Simulation
at l =110 mm
$L_{BOL}(IR)/L_\odot$
z

Herschel Debris Disk Survey OT KP

Complementary survey to the JCMT SCUBA-2 Unbiased Nearby Stars Survey (SUNSS), starting Nov 2007

- 500 nearby stars (100 nearest M,K,G,F,A) to the confusion limit
- SPIRE + PACS
  - Superior resolution at λ < 200 micron
  - SEDs of detected disks
  - deeper than SCUBA-2 at PACS wavelengths



brenda.matthews@nrc-cnrc.gc.ca

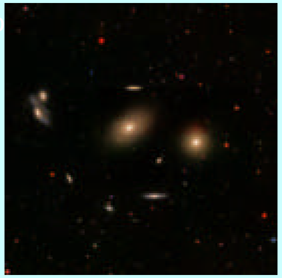
Herschel Infrared Cluster Survey (HICS)

J. Davies, S. Eales, L. Cortese and S. Dye
Cardiff University, UK

Science

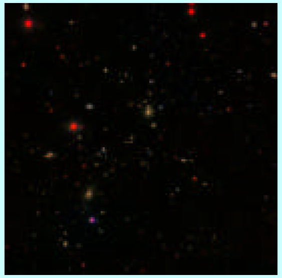
1. Complete samples of FIR selected galaxies.
2. Dust mass function to 10^4 Mo and temperature distributions.
3. Correlation with other surveys (SDSS, GALEX, ALFALFA). Dust attenuation.
4. Morphology and star formation in the cluster environment.
5. Comparisons with more distant clusters.
6. Cold dust in and around galaxies.
7. Cold dust in the inter-galactic medium.

Virgo



Virgo

Coma



Abell1367

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Dust being expelled into the inter-galactic medium?