**GOODS-Herschel**

The Great Observatories Origins Deep Survey: far infrared imaging with Herschel

*David Elbaz (CEA Saclay) + many others...*

Dave Alexander, Durham University, UK
Bruno Altieri, ESAC, ESA
Herve Aussel, CEA / Saclay
Mark Brodwin, NOAO
Veronique Buat, OAMP, Marseille, France
Denis Burgarella, OAMP, Marseille, France
Daniela Calzetti, University of Massachusetts, USA
Catherine Cesarsky, ESO
Stephane Charlot, IAP, Paris, France
Vassilis Charmandaris, Dept. of Physics, Univ. of Crete
Ranga-Ram Chary, Spitzer Science Center, USA
Emanuele Daddi, SAp, CEA/Saclay, France

**Mark Dickinson, NOAO, USA**

Herve Dole, IAS, Orsay, France
Peter Eisenhardt, JPL/Caltech, USA
Henry C. Ferguson, STScI, USA
Natasha Forster Schreiber, MPE, Garching, Germany
Dave Frayer, IPAC, Caltech, USA
Rene Gaustad, CEA / Saclay
Mauro Giavalisco, University of Massachusetts, USA
Roberto Gilli, INAF, Bologna, Italy
Minh Huynh, Spitzer Science Center, USA
Rob Ivison, ROE, UK
Damien Le Borgne, SAp, CEA/Saclay, France

Emeric Le Floc'h, University of Hawaii, USA
Dieter Lutz, MPE, Garching, Germany
Benjamin Magnelli, SAp, CEA/Saclay, France
Glenn Morrison, U. Hawaii/IFA, USA
Eric J. Murphy, IPAC, CalTech, USA
Casey Papovich, Texas, A&M University
Alexandra Pope, NOAO, USA
Paola Popesso, MPE, Garching, Germany
Naveen Reddy, NOAO, USA
Douglas Scott, University of British Columbia, Canada
Christian Surace, LAM, Marseille, France
Harry Teplitz, Spitzer Science Centre, USA
Ivan Valentini, ESAC, ESA
Min S. Yun, University of Massachusetts, USA
Grant Wilson, University of Massachusetts, USA

**Collaborators (39):**

France, USA, Germany, UK, Greece, Italy, Canada
ESO, ESA

362.6 hours (100µm & 160µm PACS, including 31 h SPIRE)
Major goals of GOODS-Herschel

1. to resolve most of the cosmic SFR density up to $z \sim 4$, by detecting $\sim 2000$ galaxies in the unexplored regimes of normal galaxies up to $z \sim 1$, LIRGs up to $z \sim 2$, ULIRGs to $z \sim 4$

2. to bridge IR and UV selected galaxies down to the level where both SFR agree up to $z \sim 1.5$ and potentially up to $z \sim 4$

3. to identify and study the buried Compton Thick AGNs responsible for the still unresolved 30% fraction of the cosmic X-ray background (CXB), which peaks at 30 keV
An ultradeep survey at 100\(\mu\)m (0.6 mJy) + superdeep (1.5mJy)

- Trade-off between k-correction, which favors the longest wavelengths, and source confusion, increasing with beam size:
  - PACS-70\(\mu\)m requires 9x longer integrations to reach same SFR than PACS-100\(\mu\)m
  - Longer wavelengths are limited to >8x shallower depths than PACS-100\(\mu\)m due to their larger beam sizes and steeper source counts.

\[ L_{\text{IR}} > 6 \times 10^{10} L_\odot \text{ up to } z \sim 1 \]
\[ L_{\text{IR}} > 4 \times 10^{11} L_\odot \text{ up to } z \sim 2 \]
\[ L_{\text{IR}} > 10^{12} L_\odot \text{ up to } z \sim 3 ; L_{\text{IR}} > 3 \times 10^{12} L_\odot \text{ up to } z \sim 4 \]

Resolve 75% of global SF density out to z\sim4 by measuring 20-50\(\mu\)m rest-frame at 1<z<4 model Le Borgne et al. (2008)
Comparison between GOODS-Herschel (red) and GTO KP (blue)

from mock Herschel catalogs

generated by Damien Le Borgne (see afternoon talk)

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Detecting the Compton Thick AGNs making the missing part of the hard X-ray background

GOODS-Herschel (0.6mJy-100µm) will trace CT AGNs over z~0.5-3 (below knee of X-LF at z<2)

Synthesis models (Gilli et al 07) => ~70% (20-30%) of X-ray undetected AGNs are at z~1 (z~2)

From the results of Daddi et al. 07 (3200 CT AGNs/sq.deg at z~2):

→ detect ~70 X-ray undetected AGNs with 45% z~0.5-1.5 and 55% z~1.5-2.5
→ provide constraints on the expected ~150 X-ray detected AGNs.
→ study of coeval growth of massive BH and bulges and building of $M_{BH}-M^*$ relation.
**GOODS** *(P.I. M. Dickinson)*

Great Observatories Origins Deep Survey

GOODS: 4200 z(spec), 60% complete to $z_{AB}=23.5$

- $>20\mu Jy @ 24\mu m$ (S/N>3)

GOODS-N: 2648 src, 988 z(spec)

GOODS-S: 2054 src, 654 z(spec)

Total (320$^2$): 4702 src, 1642 z(spec)

- **X** UV U B V I Z J H K 3.6$\mu m$ 4.5$\mu m$ 5.8$\mu m$ 8$\mu m$ IRS16 MIPS24 MIPS70 radio
- $2x10^{-16}$erg/s/cm$^2$ ~28AB 22AB ~1$\mu Jy$ 50$\mu Jy$ 20$\mu Jy$ ~1.8mJy 12$\mu Jy$
Simulations & confusion limit (by Benjamin Magnelli)

GOODS-S 0.6 mJy - 100 µm

(F_{measured} - F_{input}) / F_{measured}

0.6 mJy@100 µm

GT KP (1.7 mJy depth)

F_{measured, µJy}

0.6 mJy - 100 µm

1.7 mJy - 100 µm

0.02 mJy - 24 µm