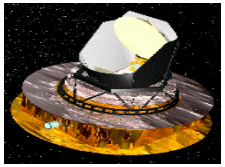
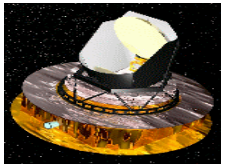


Planck and Virtual Observatories: Far Infra-red / Sub-mm Specificities

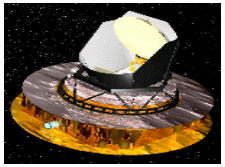
- Planck Mission, Planck Data and its Specificities (4)
- Data Treatment and its Specificities (4)
- Planck Tools and VOs, other Planck/VO interactions (2)



Planck Mission 1/4

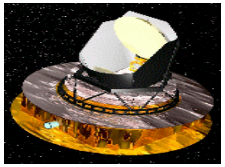
PLANCK
HFI

- Planck is a 1.5 year (2007-2009) far-InfraRed all-sky survey mission in 9 wavebands:
  - With frequencies from: 30 GHz to 853 GHz
  - With angular resolution: 30' to 5'
  - With temperature sensitivity: $\Delta T/T = 10^{-6}$
- Using two instruments:
  - High Frequency Instrument: HFI, using 0.1 K cooled bolometers
  - Low Frequency Instrument: LFI, using HEMTs
- Main Goals:
  - High resolution (l~2000) CMB mapping
  - Foregrounds
  - Signal Polarisation
- These data need to be in VOs (as COBE, IRAS, ..., should)



Herschel Mission 2/4

- Herschel will also provide extended surveys
  - up to 100 square degrees
  - in two bands common with Planck's (550 and 850 GHz, SPIRE)
  - as well as other bands (PACS)
  - with a much better resolution
  - both for Galactic and extra-galactic objects (program TBD)

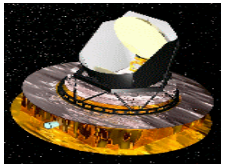


Planck Data 3/4

PLANCK
HFI

- Raw Data:
  - 100 Kbits/s times 1.5 year is 0.6 TBytes (not that huge for today's computer systems), de-compression increases this amount by a factor 4, processing by a factor > 10.

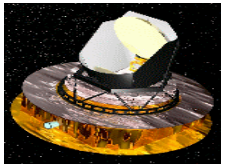
- Scientific Data:
  - Cosmic Background: CMB Anisotropies, Statistical Analysis ...
  - Diffuse Foreground component: Extended Extra-Galactic & Galactic sources, Lensing Effects, Magnetic field effects …,
  - Sources: Expected Numbers (5 σ) from < 10 (30 GHz) to 14000 (853 GHz)



Planck Data 4/4

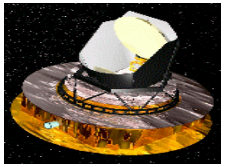
PLANCK
HFI

- Specificities
  - Poor angular resolutions (ex: 1.5' for ISO at 150 μm, 6.0' for Planck and 0.3' for Herschel around 350 μm) lower than Radio [VLA, …], Optical, X, …, same magnitude as ones for Gamma-Ray Astronomy.
  - Contrary to optical instruments, we need to use cooled and/or satellite experiments, i.e. small telescopes which gives a "bad" angular resolution
  - High ratio of Diffuse Component over Point sources: due to interplanetary dust emissivity (very smooth) and to interstellar cirrus (not smooth at all) with a power one order of magnitude bigger than one from extra galactic sources.
  - This behavior is shared by all of today's IR and Sub-mm experiments: SIRTF (NASA) and, ISO, Planck, Herschel (ESA missions)



Data Specificities 1/4

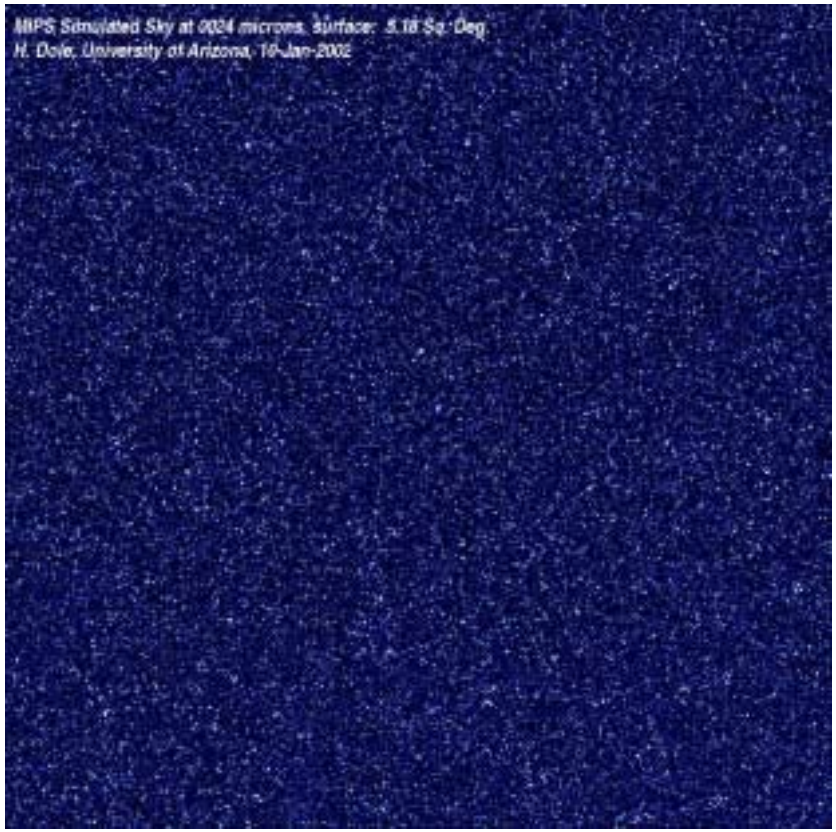
- The above characteristics are the main driver for data processing
  - Source Identification will be difficult due to large possibilities of ambiguous identifications (examples: SCUBA or FIRBACK “distant” sources, or the fact that in a single Herschel beam one will find dozens, if not hundreds, of NGST sources)
  - Source Confusion and Band Merging for galaxies (due to lack of angular resolution and/or high “noise” from weak sources): using multiple frequency data enables to extract more information.
    Similar problems for clusters.
  - Component Separation: in Planck, should be efficient because of the careful choice of wavebands



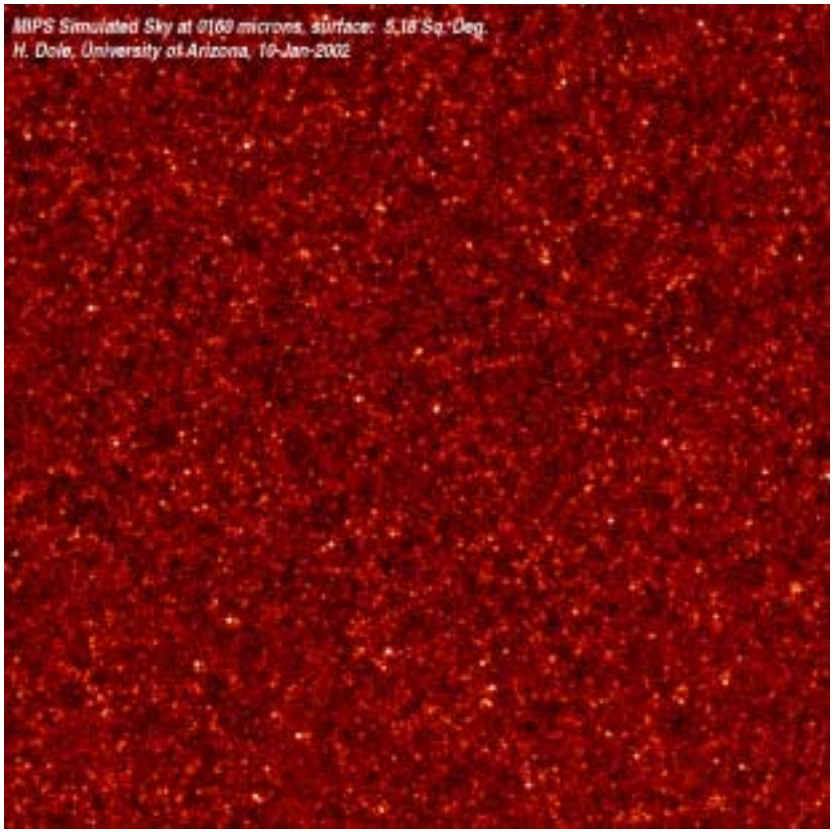
Data Specificities 2/4

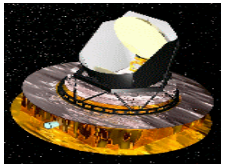
PLANCK
HFI

Simulated SIRTF sky 24 μm
(no cirrus)



Simulated SIRTF sky 160 μm
(no cirrus)

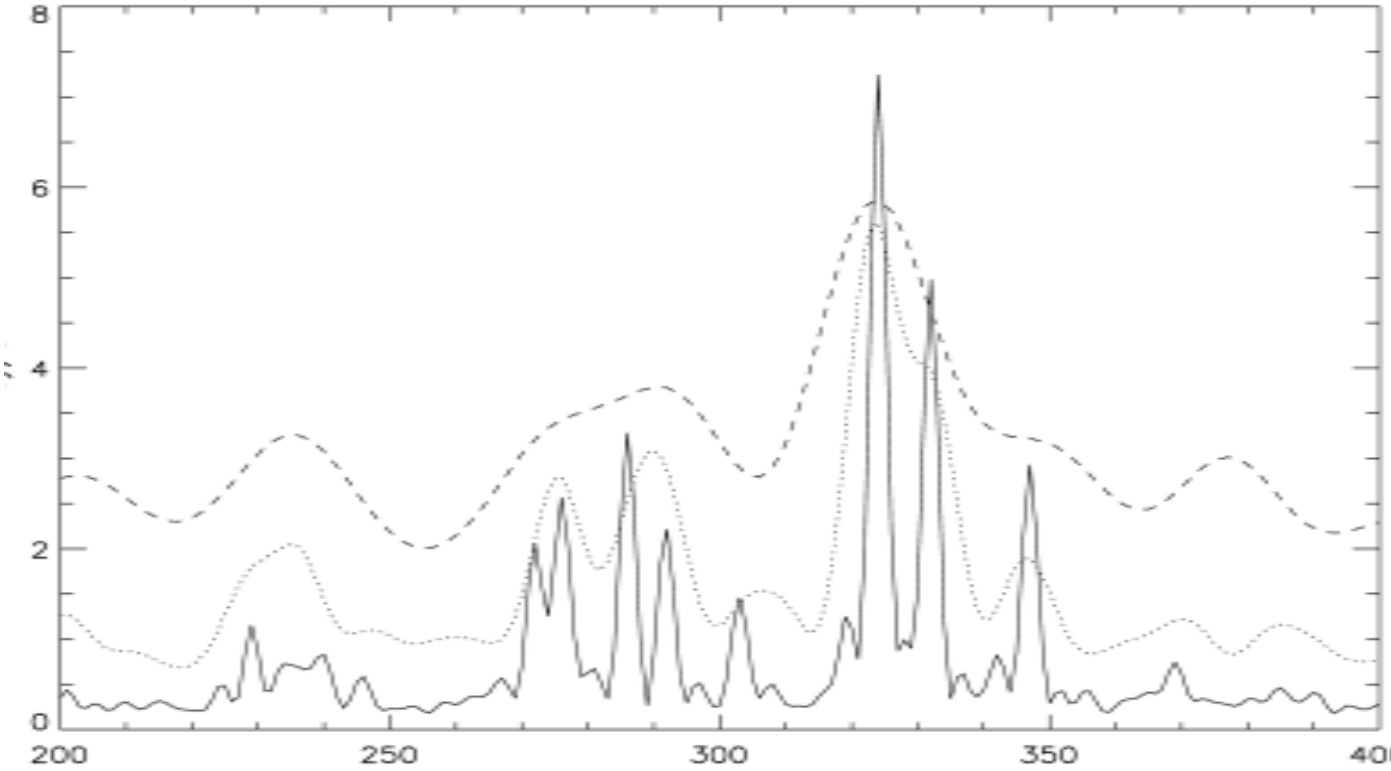




PLANCK HFI

Sources Identification / Band Merging 3/4

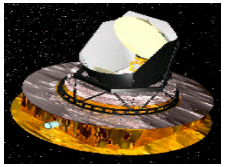
Cross identification of sources between wavelength is difficult when angular resolution is very different. The problem get even worse due to galactic foregrounds. (Example: SIRTF)



160 microns, ~ 40''FWHM

70 microns

24 microns, ~ 6'' FWHM

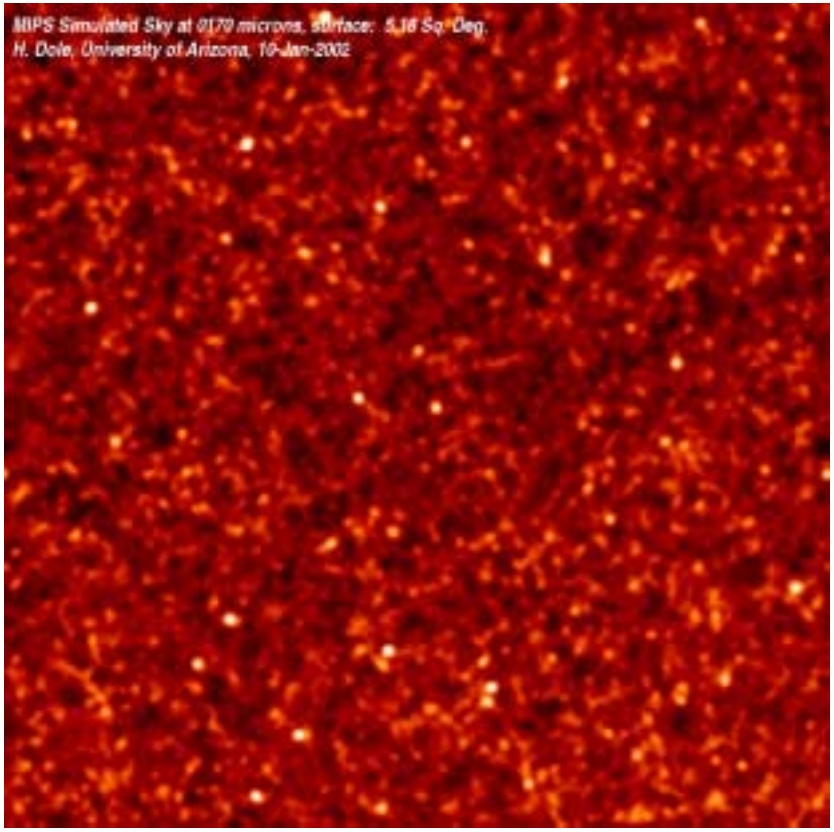


Component Separation 4/4

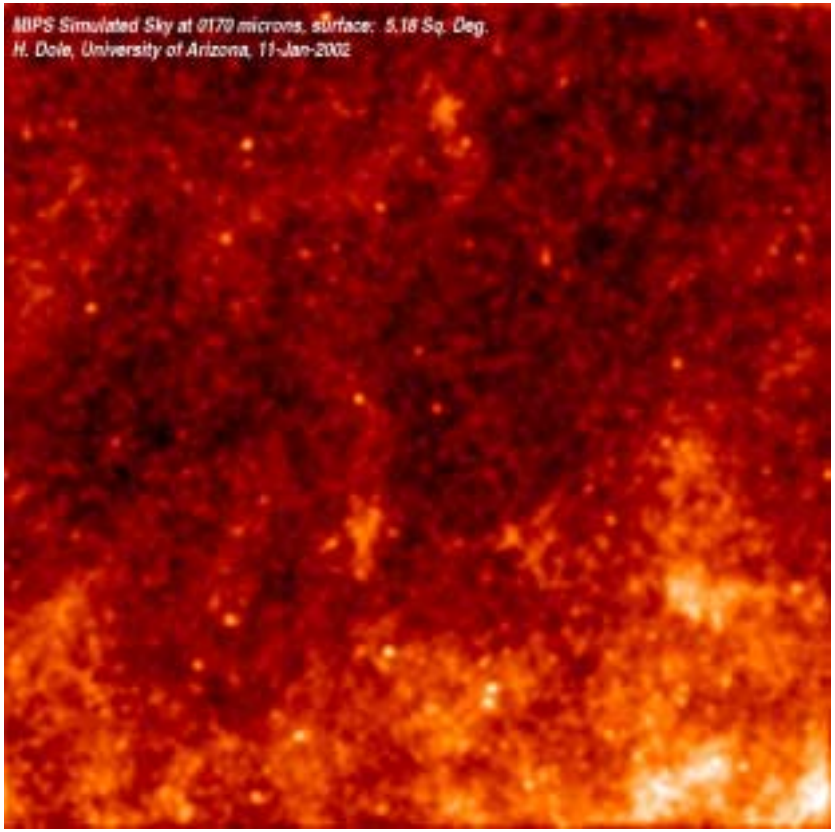
PLANCK
HFI

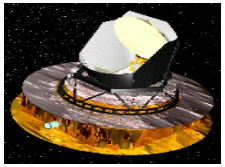
Other frequencies (line or continuum) will give tracers for diffuse cirrus emission (21cm, PAH-Bands, …)

Simulated sky 170 μm (no cirrus)



Simulated sky 170 μm (with cirrus)





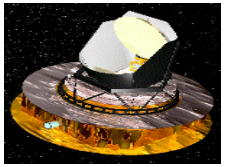
Planck Tools 1/2

• We (Planck and Herschel data reduction groups) therefore have to develop and use rather specific tools taking care of the above mentioned problems, that are common to most if not all the Far-InfraRed and Sub-mm data.

• We hope that (some of) these tools could also be used by various people, using different data sets.

• Needed because it's difficult to give access to IR data to a broad community without providing these specific tools.

• So it fits perfectly with VOs purpose :-)



Planck / VOs Interactions 2/2

• **TOOLS** (see above)

• **STRUCTURE**: The Planck Data Processing Centers (DPCs) for the 2 instruments are working in a geographically distributed way, and therefore have problems, (and solutions :-) common with VOs. We are currently building collaborative tools/structures know as Integrated Data Information System (IDIS) with distributed a Data Management Component, Document Management System, Software Repository, and Process Coordinator)

• **DATA NEEDED**: We will need to have access to “ancillary” data and we hope that (N and A)VO will provide them to us.

• **DATA PROVIDED:** Planck (and Herschel) will, after some proprietary period, give on-line/VO access to its data.