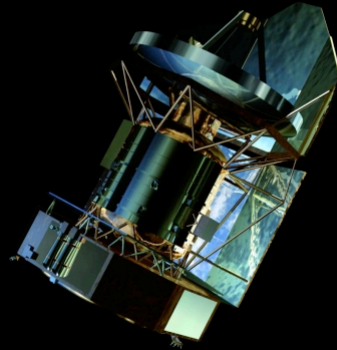


The Herschel Space  
Observatory:  
Opening New Windows on  
the Universe



William B. Latter

Project Scientist and Task Lead for the  
NASA Herschel Science Center



Herschel Space Observatory  
Carrying on Sir William's Legacy



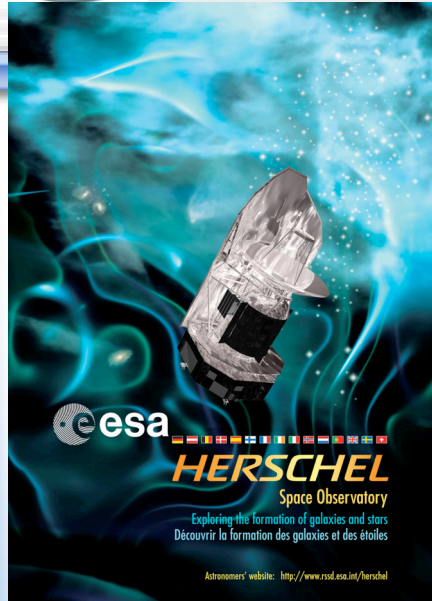
- Herschel is an ESA Cornerstone mission, equivalent to a NASA Great Observatory in scientific and programmatic scope.
- Herschel will be the **largest** single element space telescope for astronomical use launched to date.
- Herschel will be the first long-duration, space-based observatory to open up the spectral window between **200 and 700 microns**.
- Herschel will be the **only** infrared/submillimeter space observatory to fill the gap between Spitzer and JWST.
- Herschel will carry out important Spitzer follow-up.

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## Herschel in a nutshell



- **ESA Cornerstone Observatory**
  - ♦ instruments 'nationally' funded, int'l - NASA, CSA, Poland – collaboration
  - ♦ ~1/3 guaranteed time, ~2/3 open time
- **FIR/Submm (57 - 670  $\mu\text{m}$ ) space facility**
  - ♦ large (3.5 m), low emissivity (< 4%), passively cooled (< 90 K) telescope
  - ♦ 3 focal plane science instruments
  - ♦  $\geq 3$  years routine operational lifetime
  - ♦ full spectral access
  - ♦ low and stable background
- **Unique and complementary**
  - ♦ for  $\lambda < 200 \mu\text{m}$  larger aperture than cryogenically cooled telescopes (IRAS, ISO, Spitzer, Astro-F,...)
  - ♦ more observing time than balloon- and/or air-borne instruments
  - ♦ larger field of view than interferometers

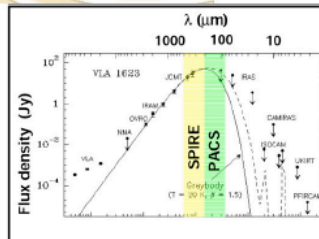
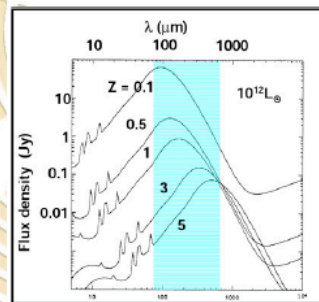
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## The Cool Universe



- **Herschel spectral coverage**
  - black-bodies 5-50 K
    - continuum radiation
    - dust grains (re-)radiating
  - gases 10-few100 K
    - brightest atomic/molecular lines
- **Herschel strengths**
  - covers IRgal & ISM SED peaks
  - wide area mapping
  - spectral scans, water lines
- **Herschel emphasis**
  - formation and evolution of galaxies & stars
  - ISM physics & chemistry
  - solar system bodies

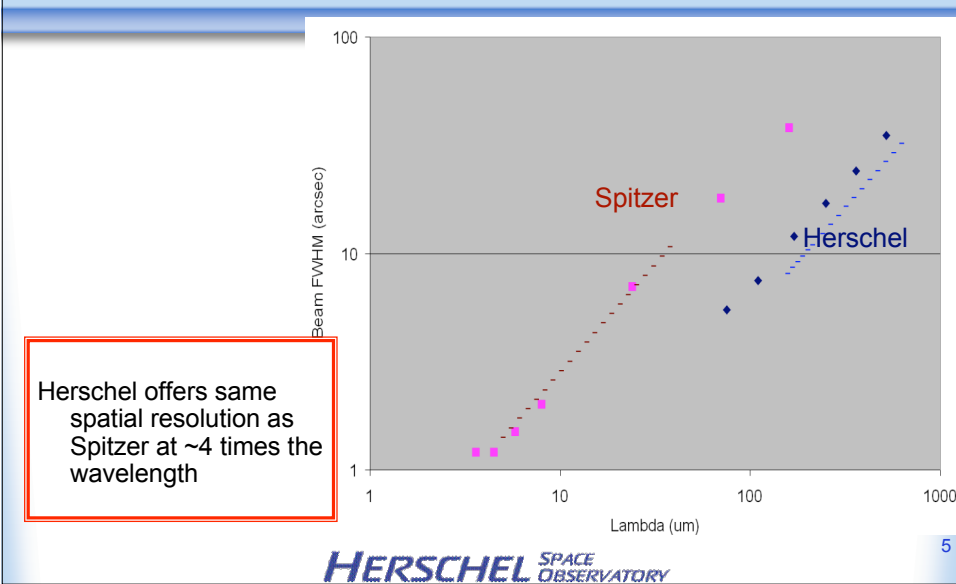


Herschel AAS#207 3 Jan 2006  
Göran L. Pilbratt VG # 4  
<http://www.rsd.esa.int/herschel>

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## Spatial Resolution: Spitzer vs. Herschel



## More about Herschel



### HIFI - Heterodyne Instrument for the Far-Infrared

PI: T. de Grauw, SRON, Groningen, The Netherlands  
 Spectroscopy with 5 or 6 receiver bands  
 480 - 1250 GHz and 1410-1910 GHz,  $\lambda/\Delta\lambda$  up to  $10^7$   
 (625-240  $\mu\text{m}$  and 213-157  $\mu\text{m}$ )

### SPIRE - Spectral and Photometric Imaging Receiver

PI: M. Griffin, U of Cardiff, Wales, UK  
 200 - 670  $\mu\text{m}$ , 3 color imaging photometry  
 Broadband Spectroscopy, 2 arrays,  $\lambda/\Delta\lambda \sim 20 - 1000$

### PACS - Photodetector Array Camera and Spectrometer

PI: A. Poglitsch, MPE, Garching, Germany  
 60 - 210  $\mu\text{m}$  simultaneous 2 color imaging photometry  
 Broadband Spectroscopy, 2 arrays,  $\lambda/\Delta\lambda \sim 1000$



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## Some Herschel Science Topics



- **Formation and evolution of galaxies**
  - ♦ how and when did galaxies form?
  - ♦ is there an unknown population of very young and distant galaxies?
  - ♦ star formation rates? total luminosities? what fraction have black holes in their cores?
  - ♦ connect near-infrared and sub-millimeter observations of galaxies
- **Star formation and the physics/chemistry of the interstellar medium**
  - ♦ how do stars form out of the interstellar medium?
  - ♦ circulation/enrichment/modification of the interstellar medium – astrochemistry and astrobiology
  - ♦ detailed studies of star formation in nearby Milky Way-like galaxies
- **Study cometary, planetary, and satellite atmospheres**
  - ♦ history of the solar system
  - ♦ pristine material from the origin of the solar system in comets
  - ♦ important studies of water content in solar system bodies

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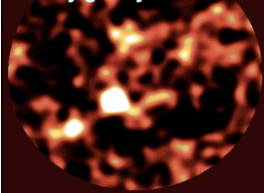
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## Herschel Science Goals



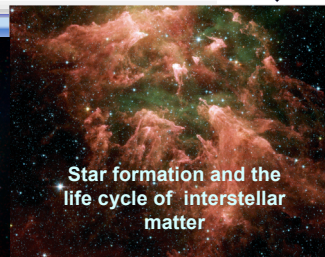
Statistics and physics of early galaxy formation



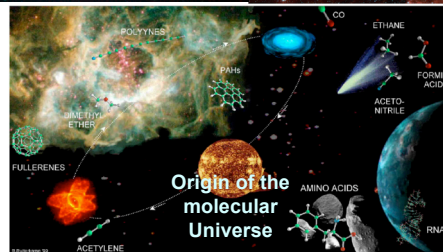
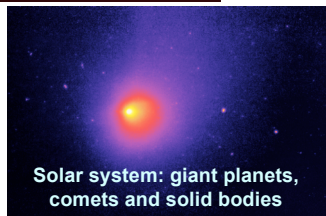
Galaxy evolution and energetics – normal, starburst and AGN



Star formation and the life cycle of interstellar matter



Solar system: giant planets, comets and solid bodies

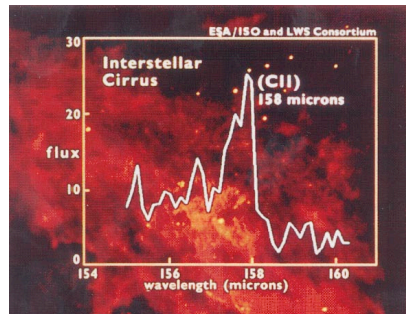
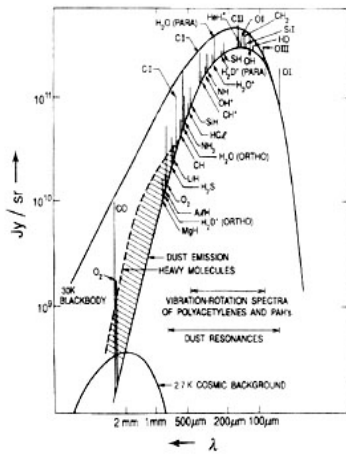


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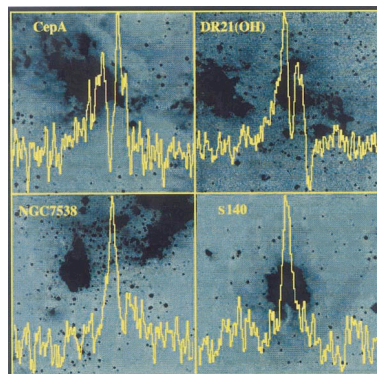
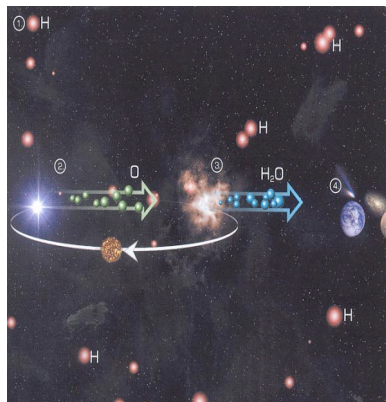
# Atomic and Molecular Species



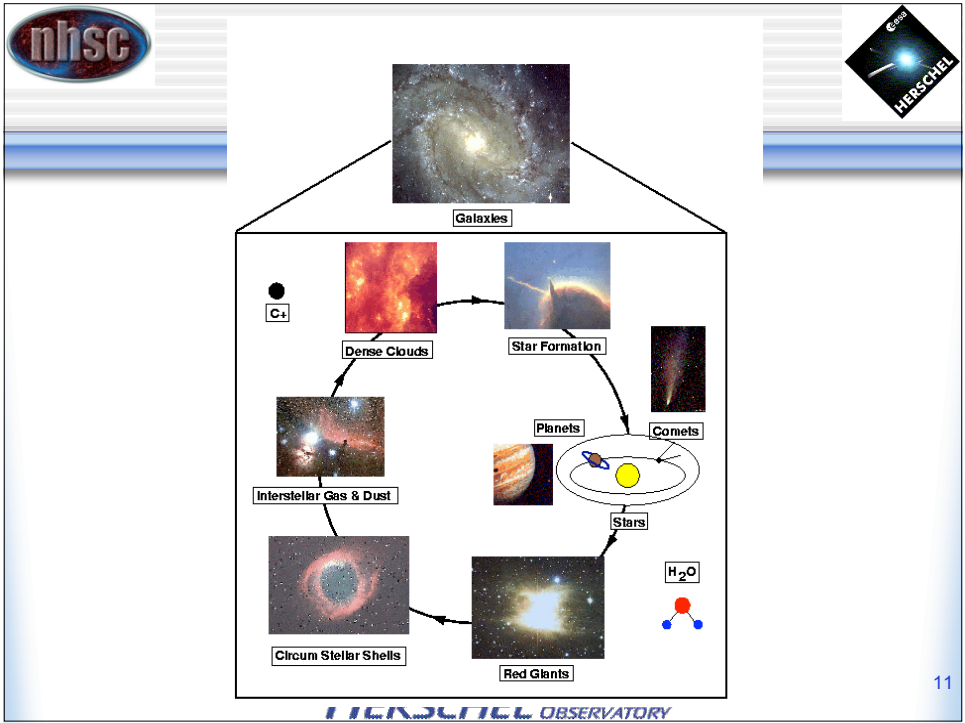
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# Water, water, everywhere?



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**nhsc** **What can You do for Herschel?** 

- Propose for Key Projects (AO coming soon)!
- Continue cutting edge explorations with current Great Observatories.
- Spitzer/MIPS Observers -- Please publish your 160 micron results!
- Take into account interstellar medium confusion at long wavelengths when planning observational fields.
- Support theoretical studies of molecular emission properties at THz frequencies.

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