



Cornell University



# Mid-/Far IR follow-ups to the ALFALFA survey

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For the ALFALFA Cornell Group



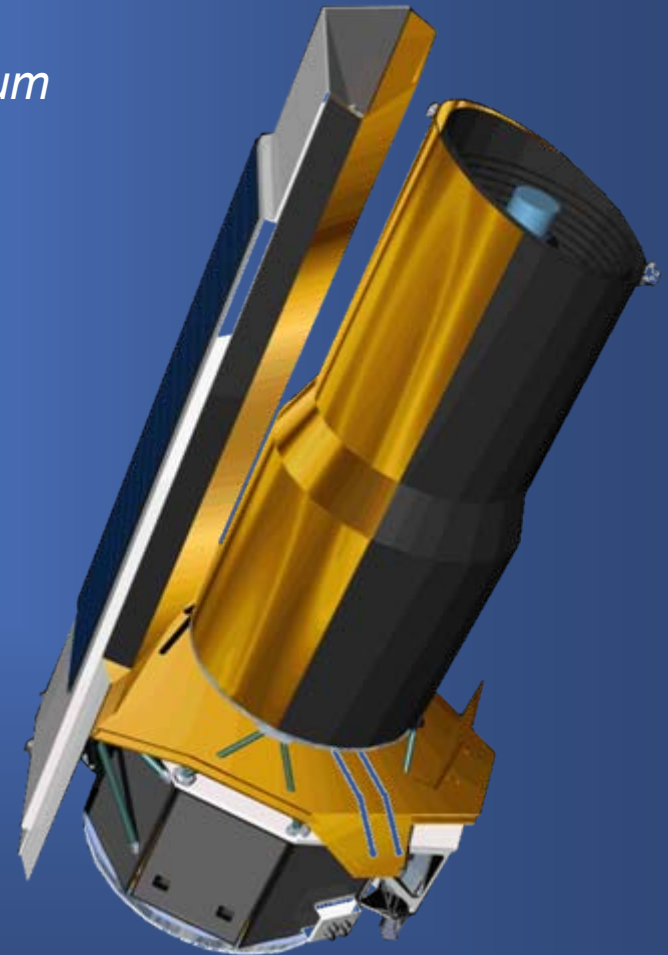
# Outline of the talk

## □ Topics:

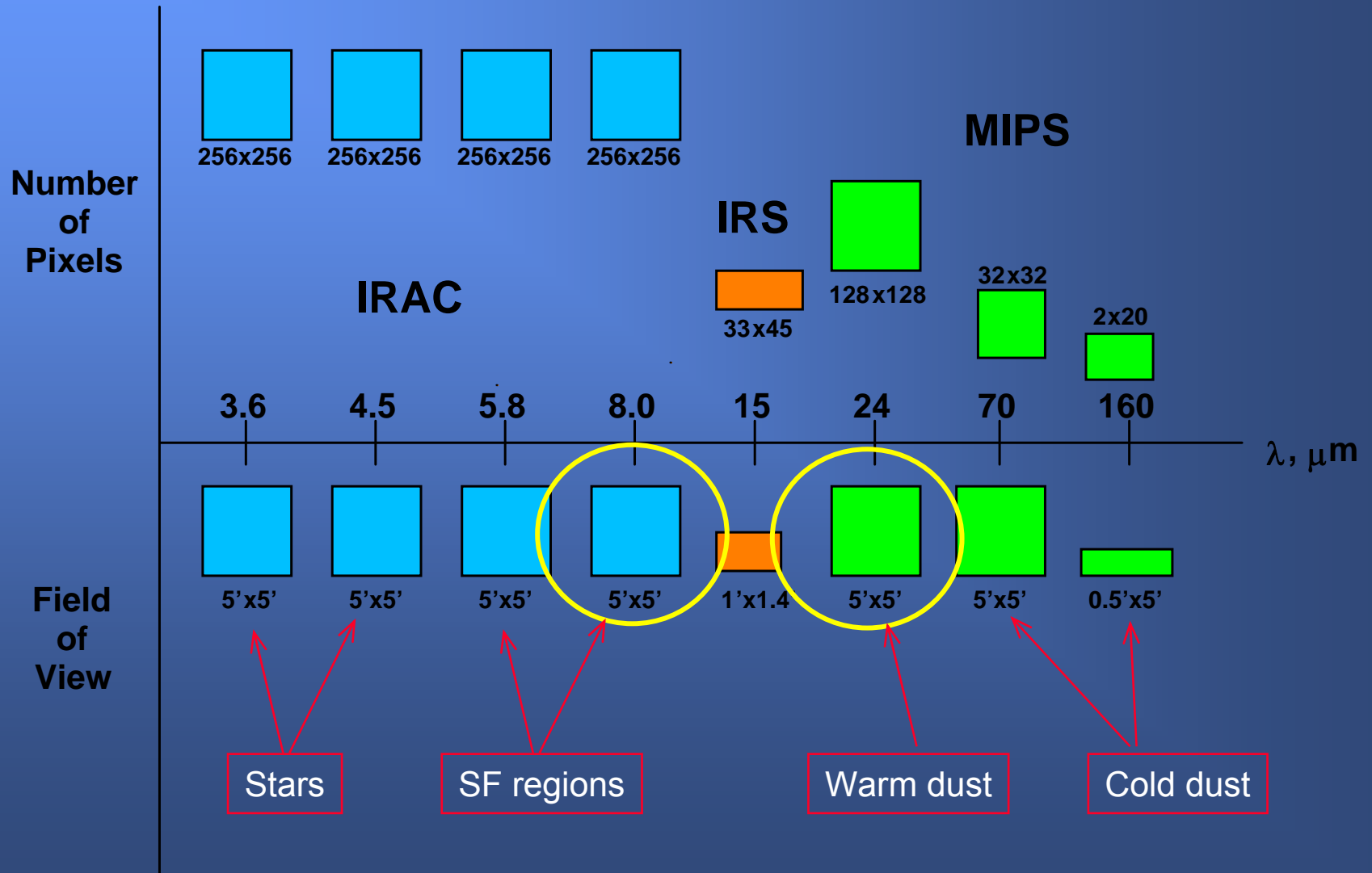
- The Spitzer Space Telescope
- Available mid-/far-IR surveys of Spitzer
- Use of the IR to trace dust, star forming regions, and warm H<sub>2</sub>
- Upcoming Proposal Deadlines

# Spitzer Space Telescope

- ❑ *Background Limited Performance 3 -- 180 $\mu$ m*
- ❑ *85 cm f/12 Beryllium Telescope < 5.5K*
- ❑ *6.5 $\mu$ m Diffraction Limit*
- ❑ *Launched Aug. 2003 (Delta 7920H)*
- ❑ *Expected lifetime until 2009*
- ❑ *New Generation Detector Arrays*
- ❑ *Three Focal Plane Instruments*
  - ❑ *Imaging/Photometry, 3-180 $\mu$ m*
  - ❑ *Spectroscopy, 5-40 $\mu$ m*
  - ❑ *Spectrophotometry, 50-100 $\mu$ m*
- ❑ *>75% of observing time for the General Scientific Community*
- ❑ *Solar Orbit*



# Spitzer Imaging Functionality



# Spitzer Surveys

## □ Large Extragalactic Spitzer Surveys

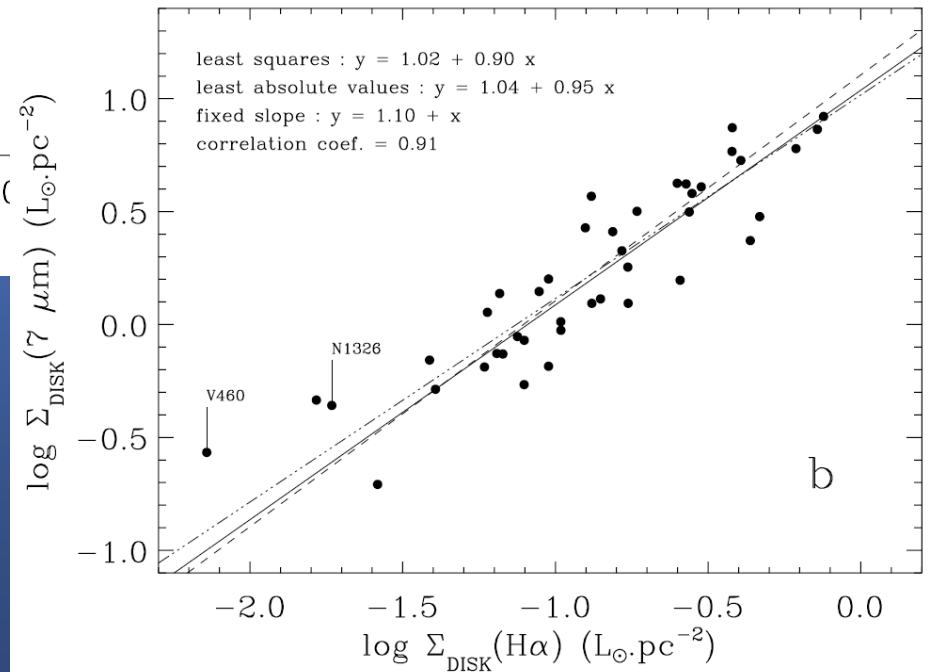
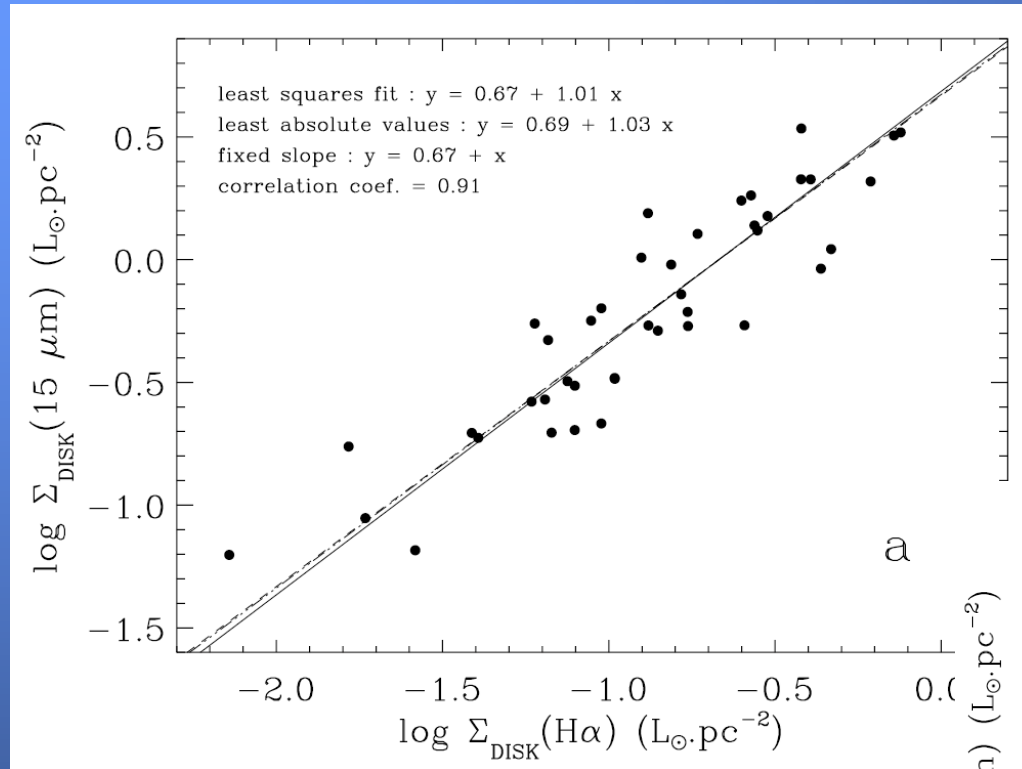
- SWIRE: ~43 sq deg over 7 fields. No coverage with ALFALFA :-)
- Spitzer First Look Survey: ~4 sq. deg @17h10m+61d :-)
- NOAO Wide Deep Survey: ~9 sq. deg @ 14<sup>h</sup> 32<sup>m</sup>, +34° 16' :-))
  - *B,R,I, ~26mag, J,H,K: ~21mag*
  - *Spitzer/IRAC: @3.5, 4.5, 6, 8μm down to 5σ of 12, 15, 76, 76 μJy*
  - *Spitzer/MIPS: @24, 70, 160μm down to 5σ of 0.3, 50, 120mJy*
  - *Optical/near-IR data and catalogues are public*  
<http://www.noao.edu/noao/noaodeep/>
  - *Mid-/far-IR data are becoming public at the end of summer 2005!*

# Mid-/Far-IR additions to ALFALFA

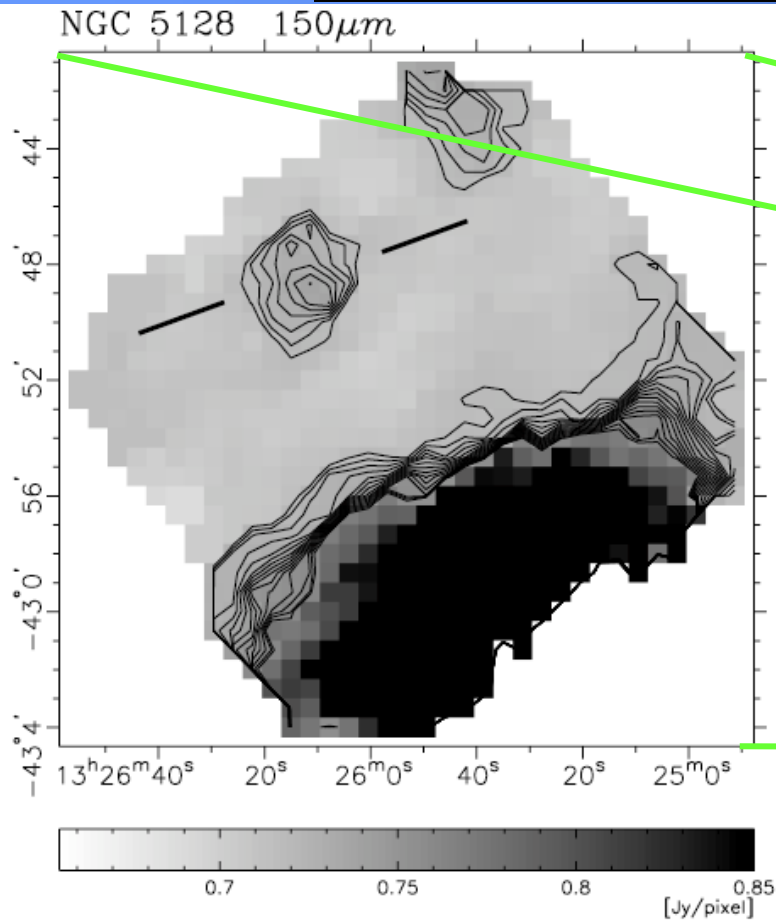
- Trace weak star forming regions using 8 $\mu$ m imaging
  - $SFR (M_{sun}/yr) = 6.5 \times 10^{-9} L_{15\mu m} = 2.4 \times 10^{-7} L_{7\mu m}$  (Roussel et al 2001)
  - *Could be done better in H $\alpha$  (?)*
- Trace cold dust associated with HI via 70/160 $\mu$ m imaging
  - *ISO indicated that there's a spatial correlation between HI and cold dust in galaxies.*
  - *Estimate dust/gas ratios for the HI detections*
- Detect warm molecular H<sub>2</sub> using the mid-IR rotational lines:
  - *S(3) @9.66 $\mu$ m, S(2) @12.28 $\mu$ m, S(1) @17.04 $\mu$ m, S(0)@28.22 $\mu$ m*
  - *Estimate the mass of warm H<sub>2</sub> :*
    - Typically for star forming galaxies ~1% of cold H<sub>2</sub> detected in CO.

# Tracing SF in the mid-IR

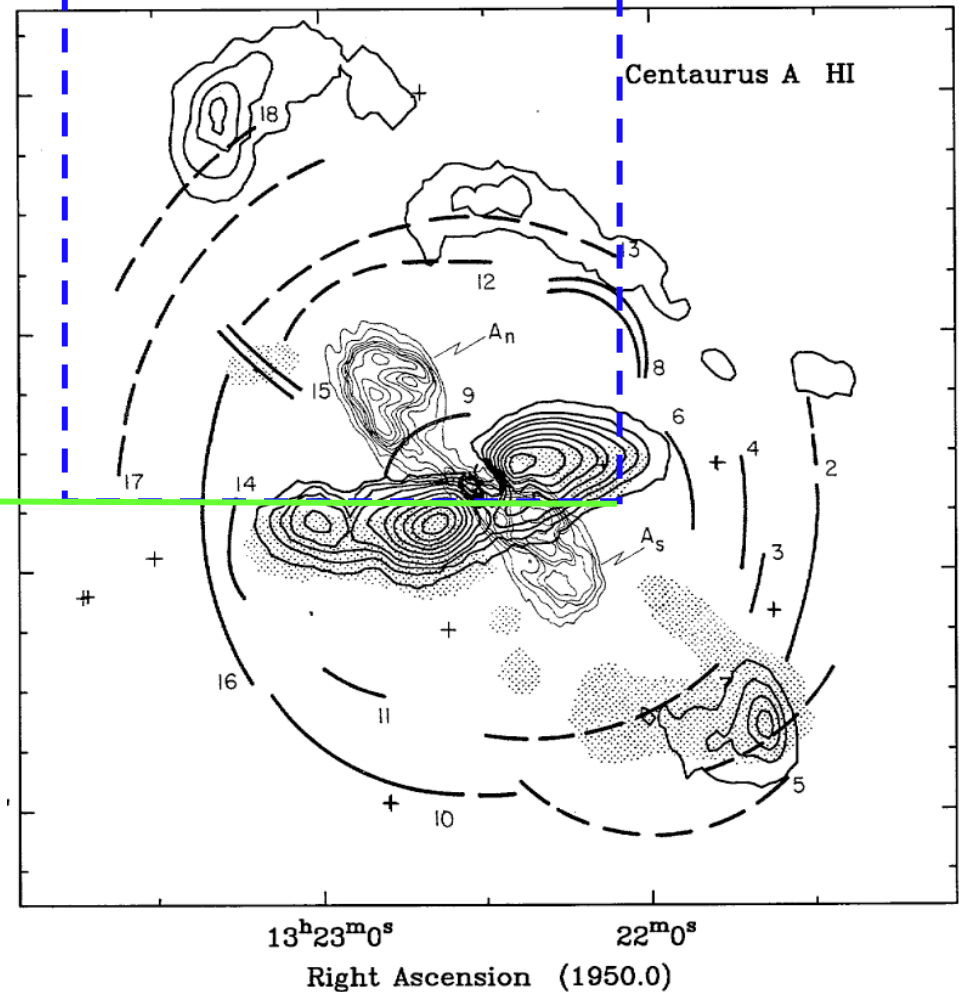
*(Roussel et al 2001)*



# Cold dust associated with extraplanar HI



(Stickel et al 2004)



**Fig. 2.** Gray-scale representation with overlaid isocontours of the ISOPHOT 150  $\mu\text{m}$  map. In addition to the strong FIR emission of the central region of NGC 5128 near the lower edge, a resolved emission region  $\approx 15'$  northeast of NGC 5128 (marked with a bar) can clearly be seen. Map pixel size is  $40''$ .



## Conclusions / Action items

- ❑ Check the NOAO/Bootes data against ALFALFA scans and targets when available.
- ❑ Work on feasibility of Spitzer follow ups to interesting targets.
  - ❑ *Next Spitzer proposal deadline ~ February 2006*