

## Spitzer Observations of a Remarkable Star Forming Core in NGC 2264

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1

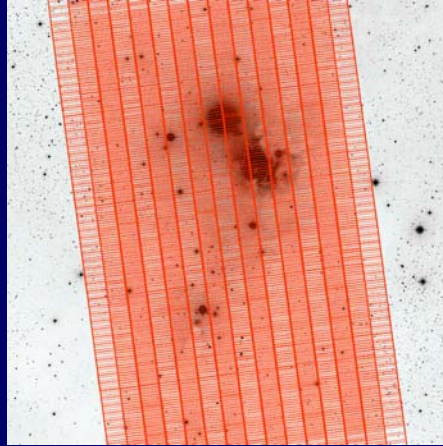
## NGC 2264 Collaborators

- Charlie Lada
- Paula Teixeira
- George Rieke
- James Muzzerolle
- Oliver Krause
- Nick Seigler
- Tom Megeath
- Massimo Marengo
- Luisa Rebull
- Eric Persson
- Amy Mainzer
- David Murphy

2

## Spitzer Young Cluster Disk Survey

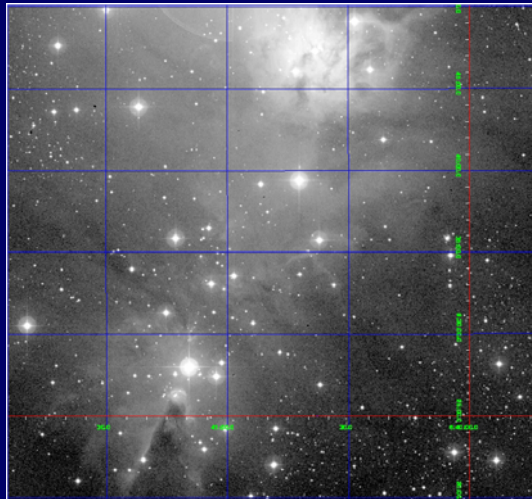
- Observing Strategy
  - 23 young fields
  - <1 Myr to 150 Myr
  - Efficient collection of data for hundreds of stars in a coeval group
  - SIRTf Mid and Far Infrared sensitive to dust much farther from star than ground-based observations
  - Typical Area :  $0.5^\circ \times 0.5^\circ$
- MIPS Scan Maps
  - 24, 70, & 160  $\mu\text{m}$
- Matching IRAC Maps
  - 3.6, 4.5, 5.8, 8.0  $\mu\text{m}$



NGC 2264

3

## NGC 2264



- One of the best studied star forming regions
  - Walker (1956) and many, many others
- Age: 1-3 Myr based on isochrone fitting
- Distance: 800 pc

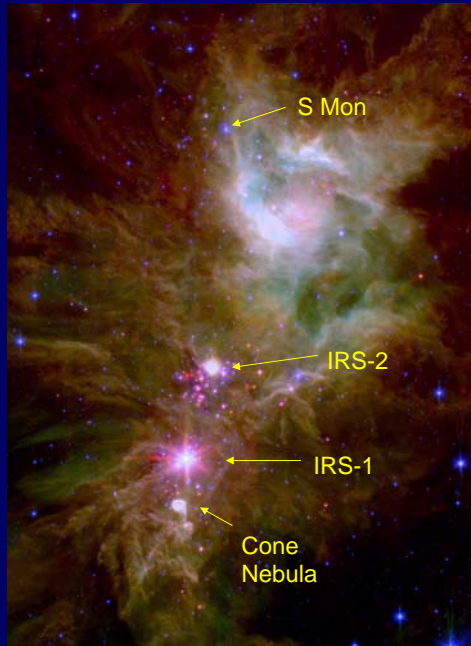
4

## NGC 2264 2MASS View

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5



## Spitzer mosaic of NGC 2264.

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Blue=4.5  $\mu\text{m}$ ,

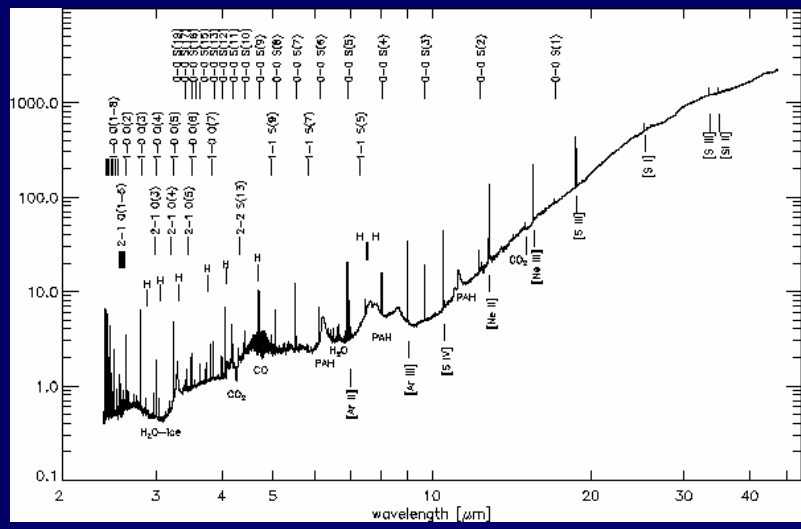
Green=8.0  $\mu\text{m}$ ,

Red = 24  $\mu\text{m}$ .

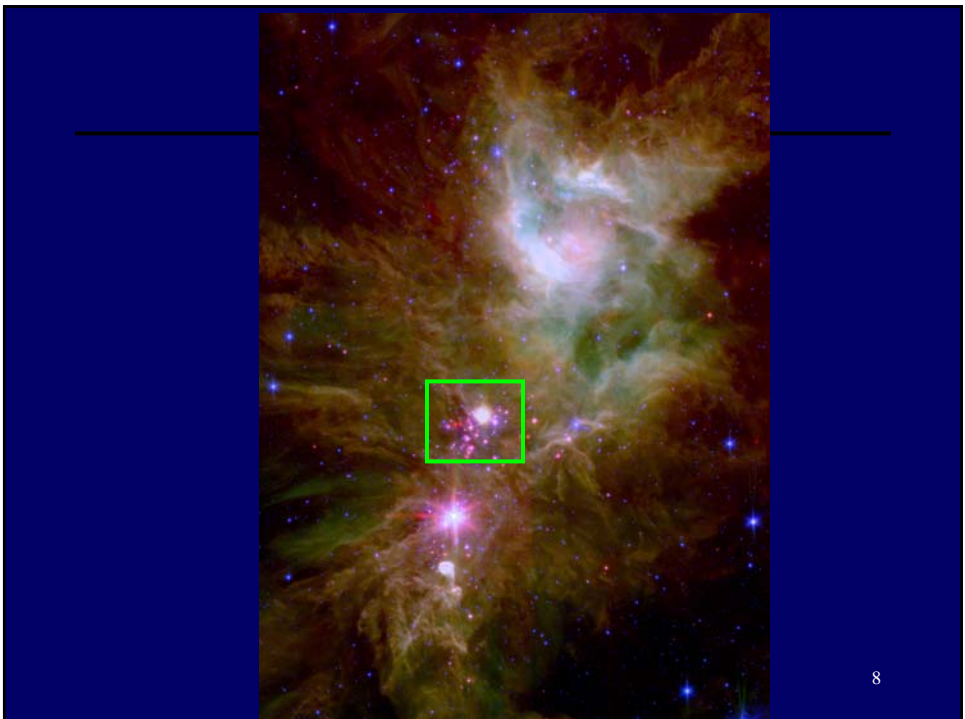
The image is  
approximately  $\frac{1}{2}$   
degree wide.

6

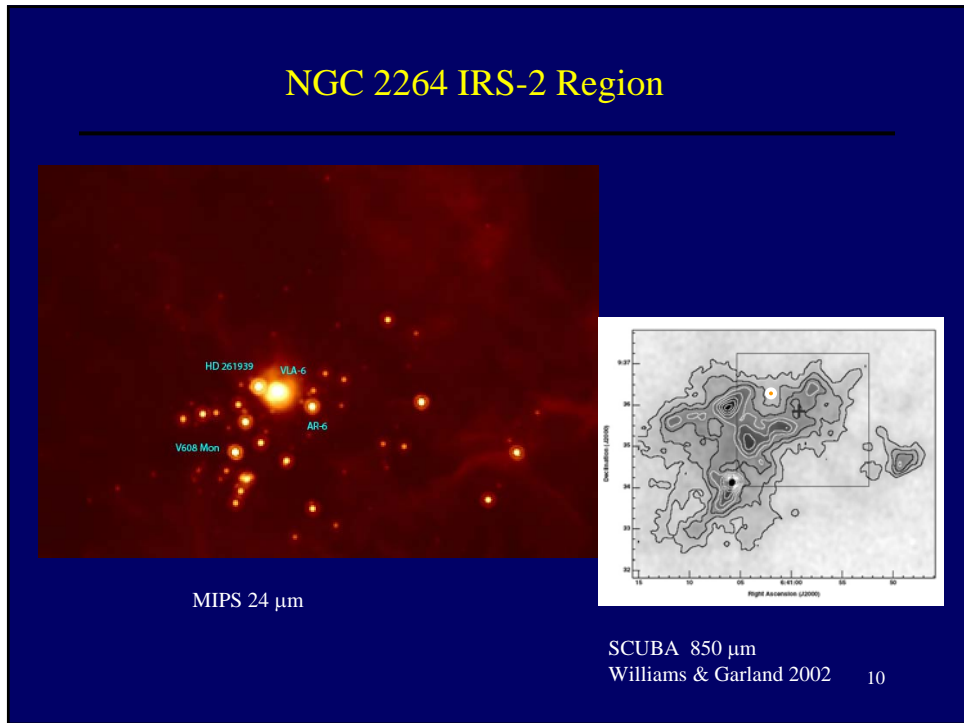
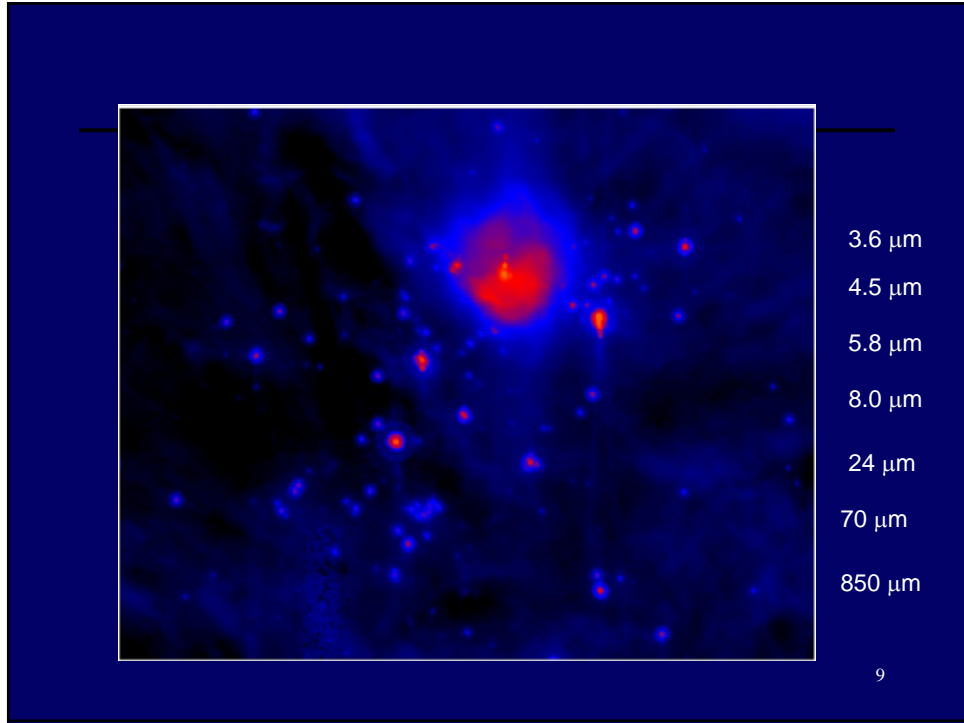
# ISO SWS Spectrum Orion Bar



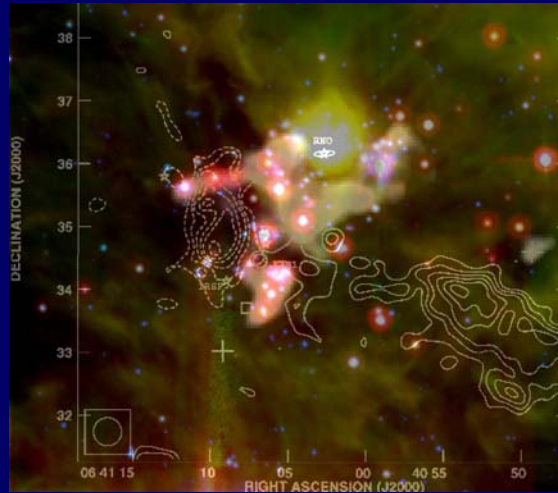
7



8



## Comparison with Gas Tracers



Color Image: Spitzer  
Composite

Brightness:  
850  $\mu\text{m}$  Continuum

Contours:  
High velocity CO

Wolf-Chase et al. 2003,  
MNRAS, 344, 809.

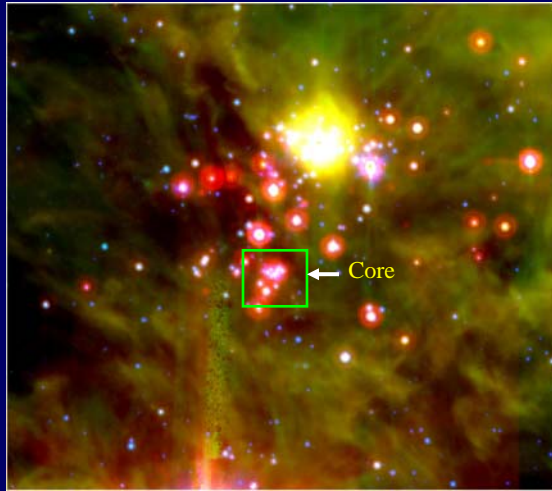
11

## Core Characteristics

- Associated with submillimeter source 12-S1 from Wolf-Chase et al. 2003
- Near Center of outflow identified by Margulis et al. 1988 (Flow D)
- Derived Characteristics
  - SED is well fit with graybody at 23 K
  - Luminosity  $100 L_{\odot}$
  - Envelope mass  $\sim 18 M_{\odot}$
- Recent observations at HHT
  - HCO+ mapped
  - HCN detected
    - Critical density of  $> 10^8 \text{ cm}^{-3}$
  - High velocity CO mapped

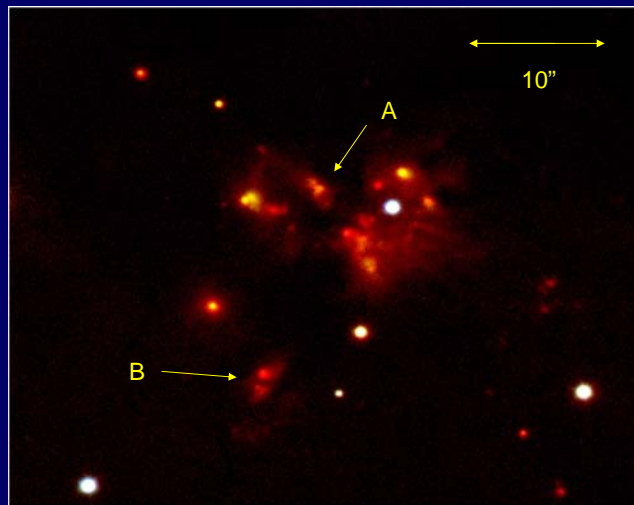
12

## Star Forming Core in IRS-2 Region



13

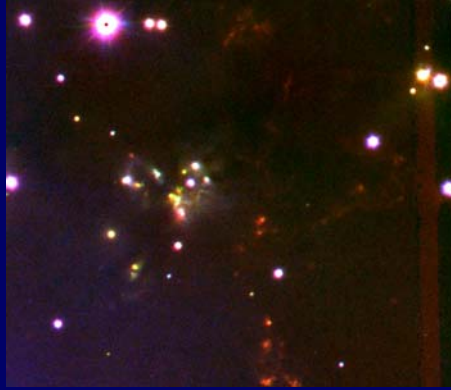
## PANIC JHK image of core



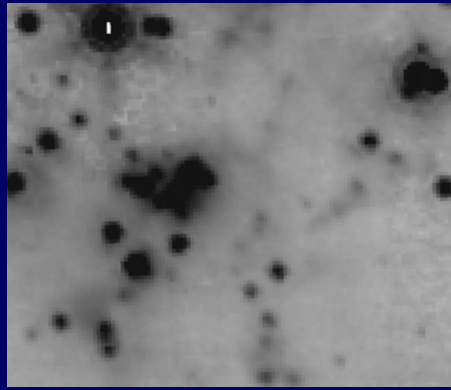
14

## IRAC 4.6 $\mu\text{m}$ Band is a Molecular Hydrogen Detector

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PANIC Mosaic  
H, K, H<sub>2</sub>



IRAC 4.5  $\mu\text{m}$  Band

15

## Results

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- While a good tracer of dense condensations in molecular clouds, sub-millimeter observations present an incomplete picture of the embedded population.
- MIPS 24  $\mu\text{m}$  observations are sensitive enough to easily detect even the most deeply embedded Class-0 sources
- Linear strings of recently formed stars appear to be a regular feature of very young regions
  - Some triggering mechanism seems inescapable
- Spitzer has discovered what appears to be a collapsing core exhibiting multiple sources, outflows, and complicated dynamical structure
- The IRAC 4.5  $\mu\text{m}$  band is very likely emission from molecular hydrogen at 4.695  $\mu\text{m}$

16