Bolocam Galactic Plane Survey
Herschel Hi-GAL Plane Survey

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The Bolocam Galactic Plane Survey (BGPS)

- 1.1 mm survey of cold, dense dust :BGPS (CSO)

  CSO 10 m (Mauna Kea); 30" beam, 150 sq.deg. ~10^4 cores

- Heterodyne NH_3 (GBT)

  Radial velocity (DISTANCE!), line width, T_{gas}

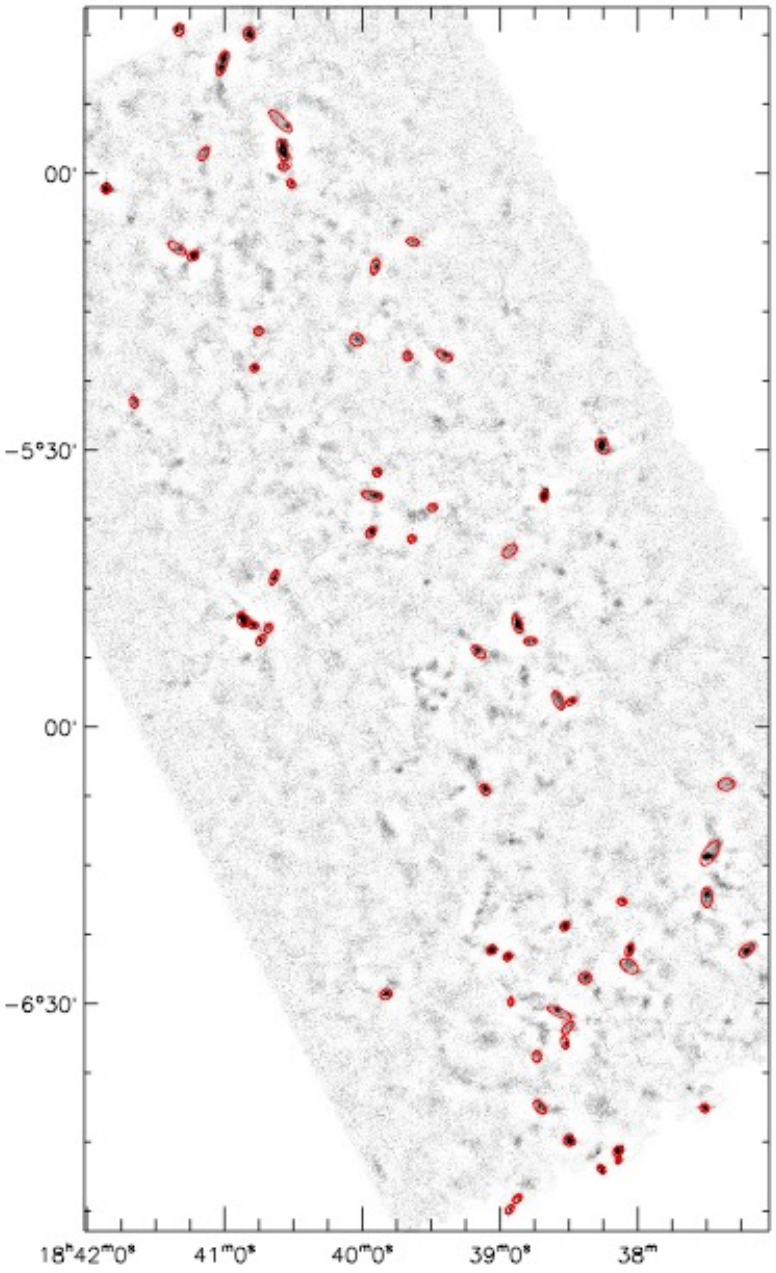
  Proposal for 7000 BBPS cores submitted 1 Oct 08

- Heterodyne CO Molecular Ring, W3/4/5 (FCRAO, JCMT)

  CS J=5-4 ~ 300 cores (CSO)

  HCO^+, N_2H^+ ~ 2,000 cores (Mt. Graham HHT)

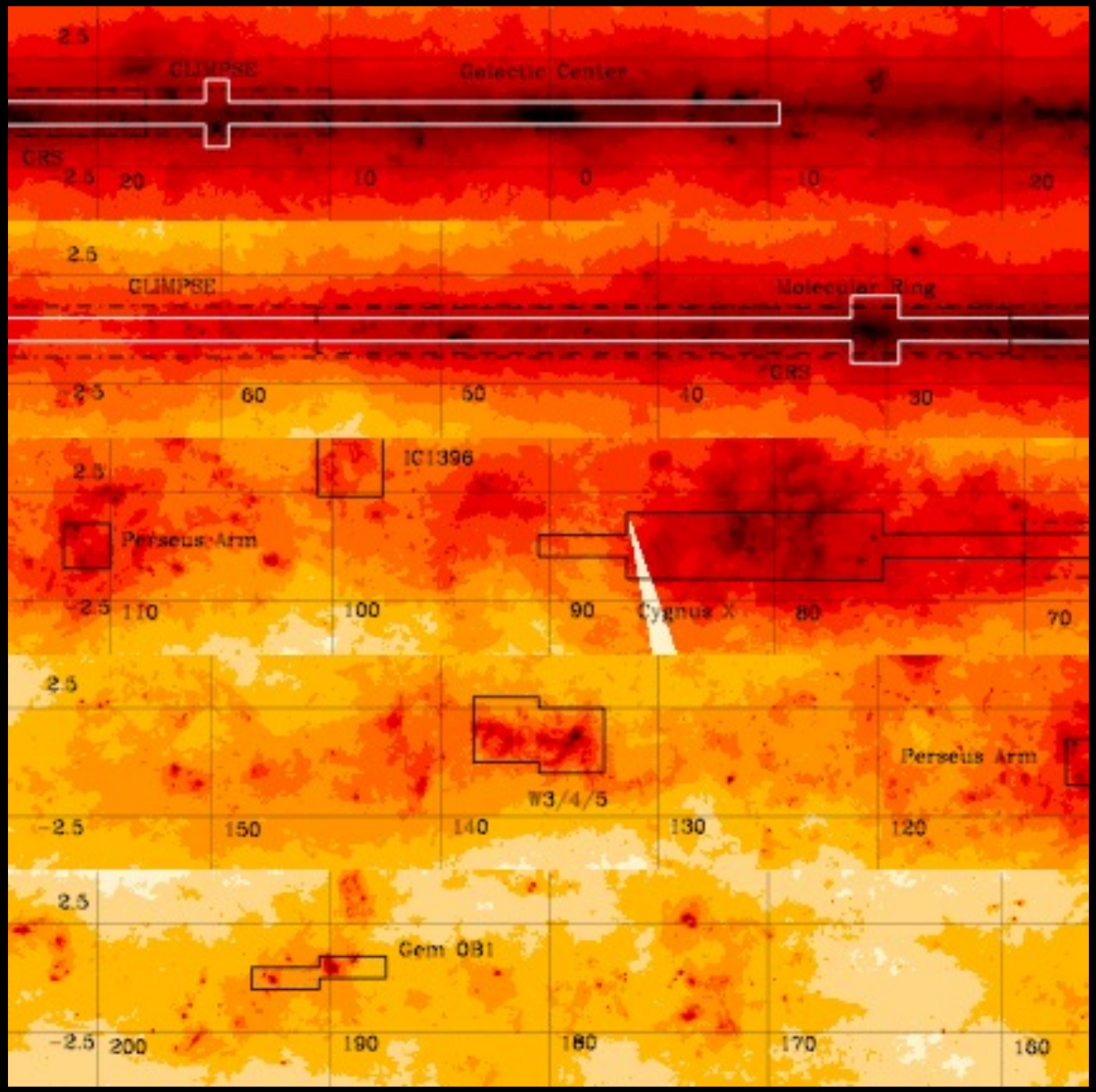
- SHARC2 350 μm in selected regions (CSO)



BGPS Goals

- How do cores, stars, massive stars, & clusters form?
  - Isolated collapse?
  - Competitive Accretion?
  - Cooperatives?
- Is star formation triggered?
  - HII, winds, SN, super-bubbles?
  - Spiral arm shocks?
- How do clouds cluster?
- What is the core mass function?
- How long do they last?
- How do core properties vary with environment?

Bolocam Galactic Plane survey: (to Sept 07)



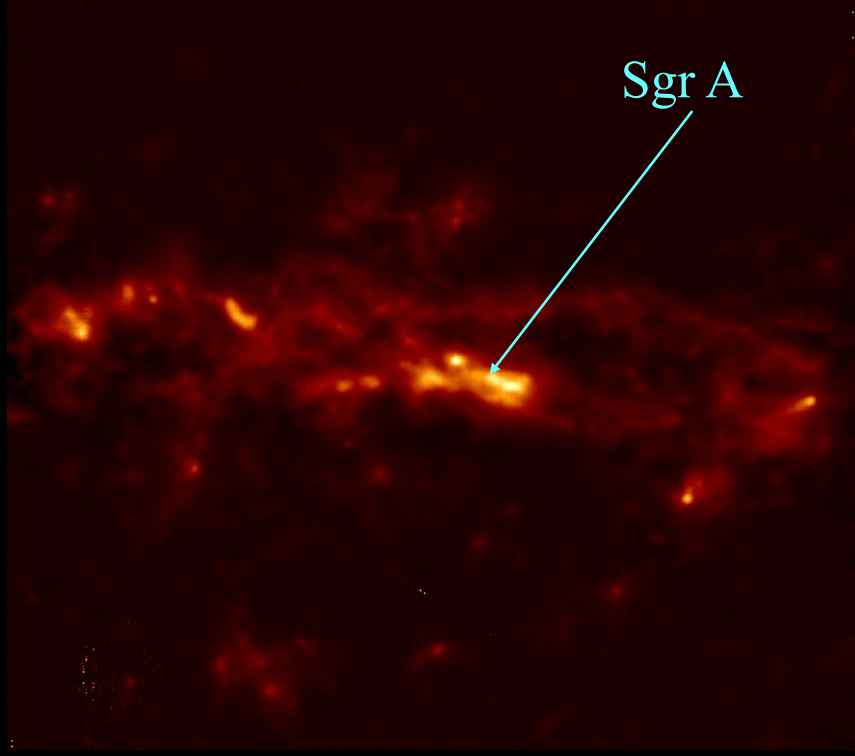
On MSX survey

- **150 Square deg.**
- **10^4 cores**

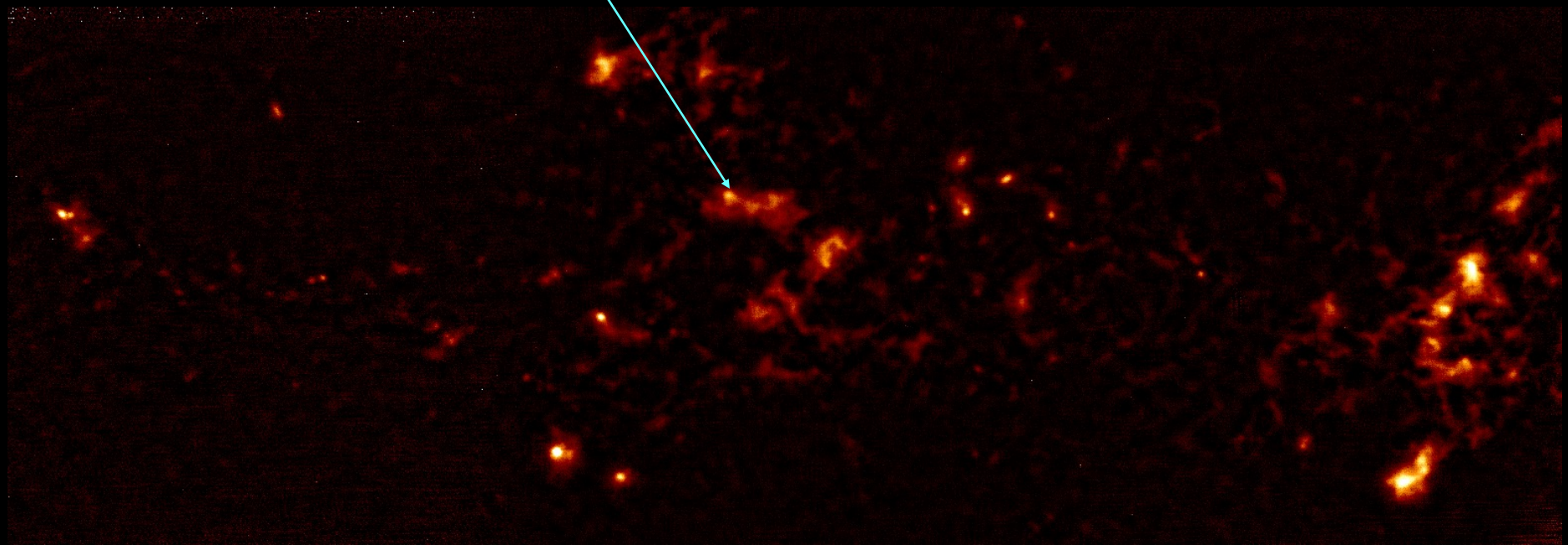
Coverage:

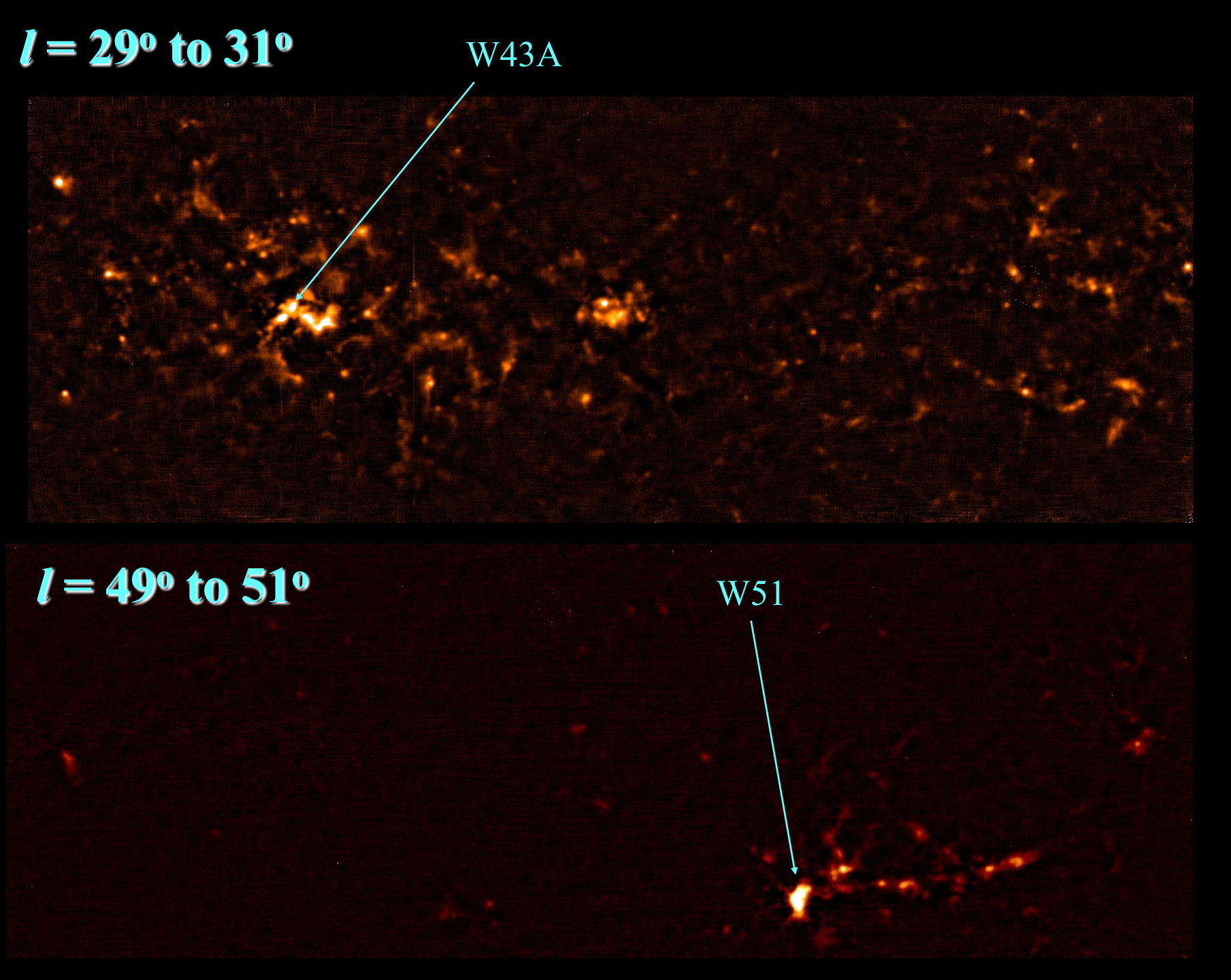
- **1st quadrant (l = -10 to 54)**
- **Cyg-X**
  - **IC 1396**
- **Perseus Arm**
  - **l = 110 / NGC 7538**
  - **l = 145 / W3/4/5**
  - **Gem OB1**

Galactic Center
1.1 mm



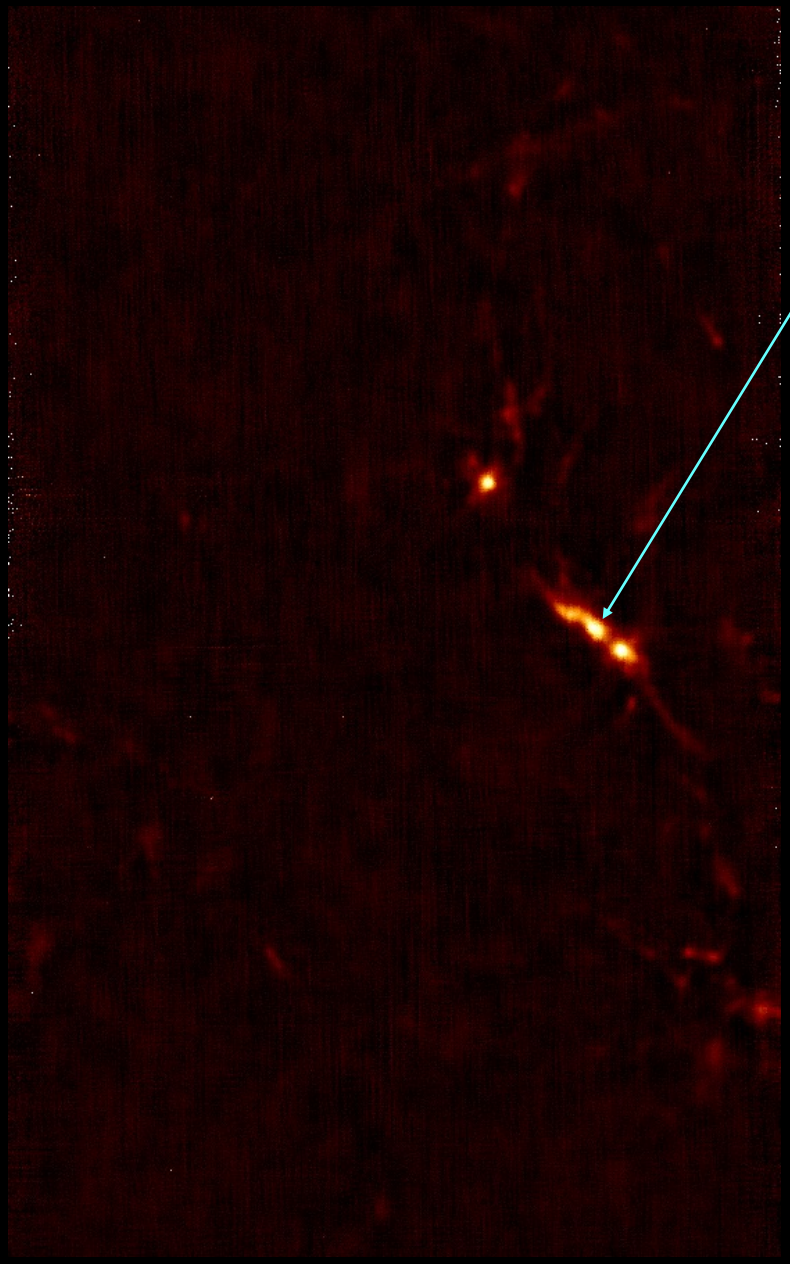
Bania's Clump 2 at $l = 3^{o}$




l = 29° to 31°
W43A
l = 49° to 51°
W51

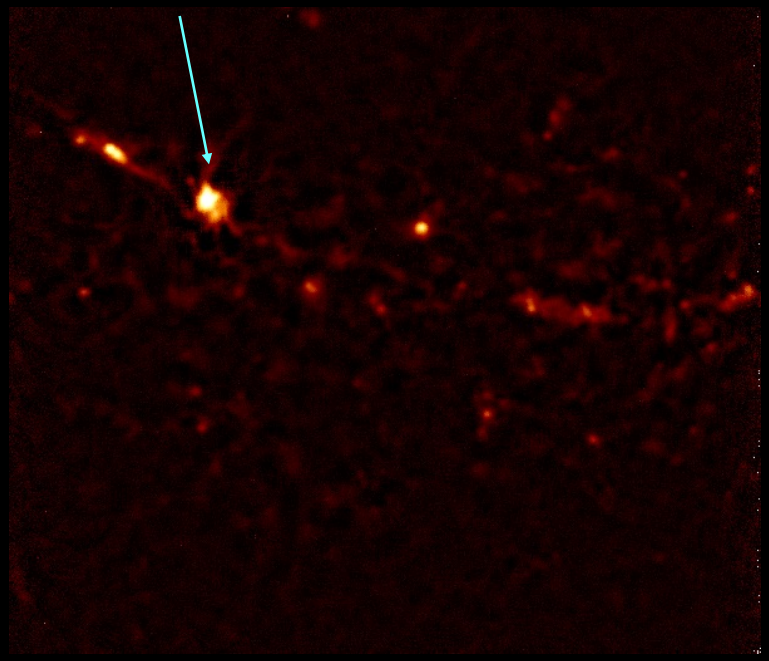
Filaments, Arcs, Clumps

$l = 50^o$



$l = 34^o$

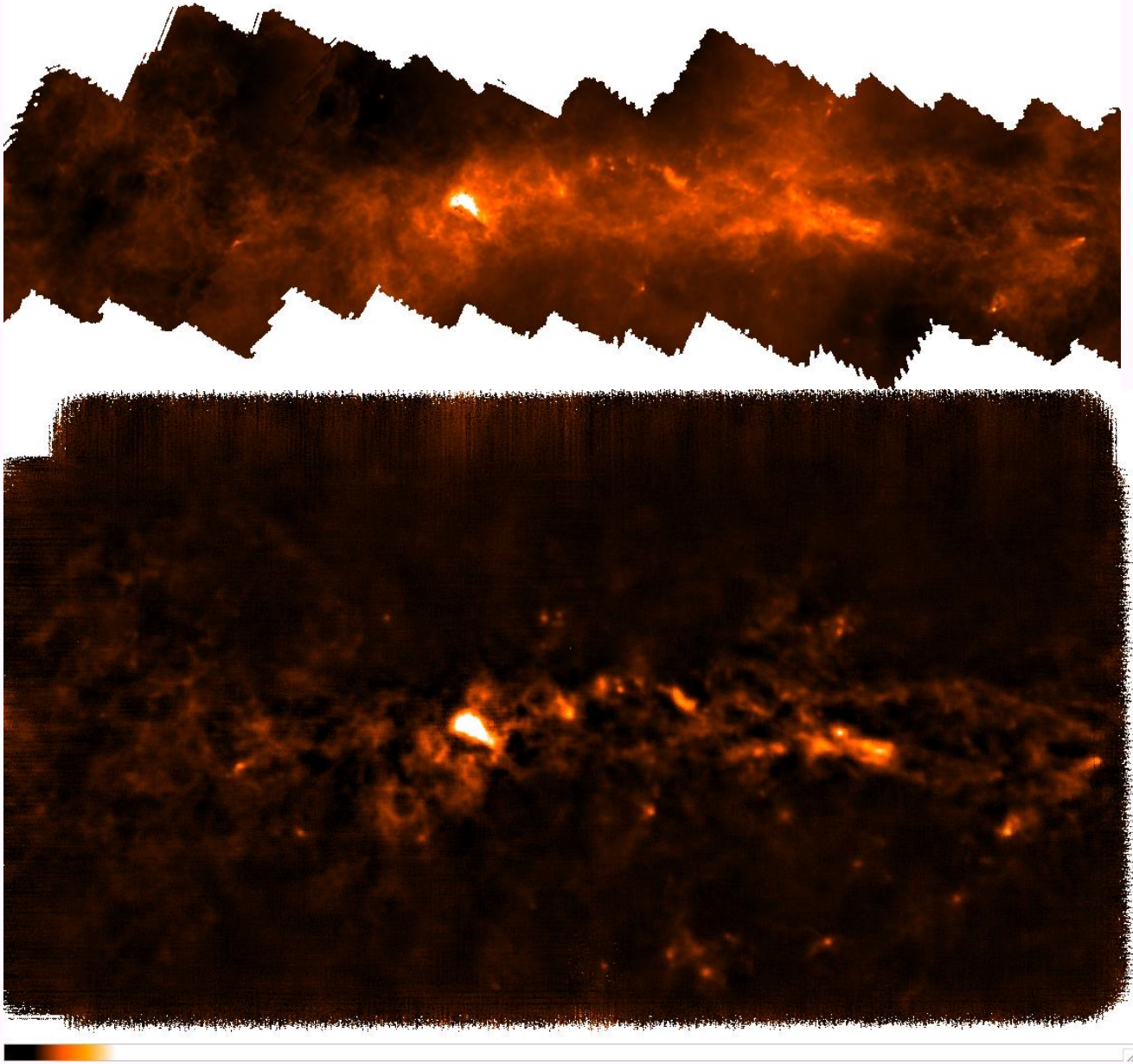
G34.26+0.15



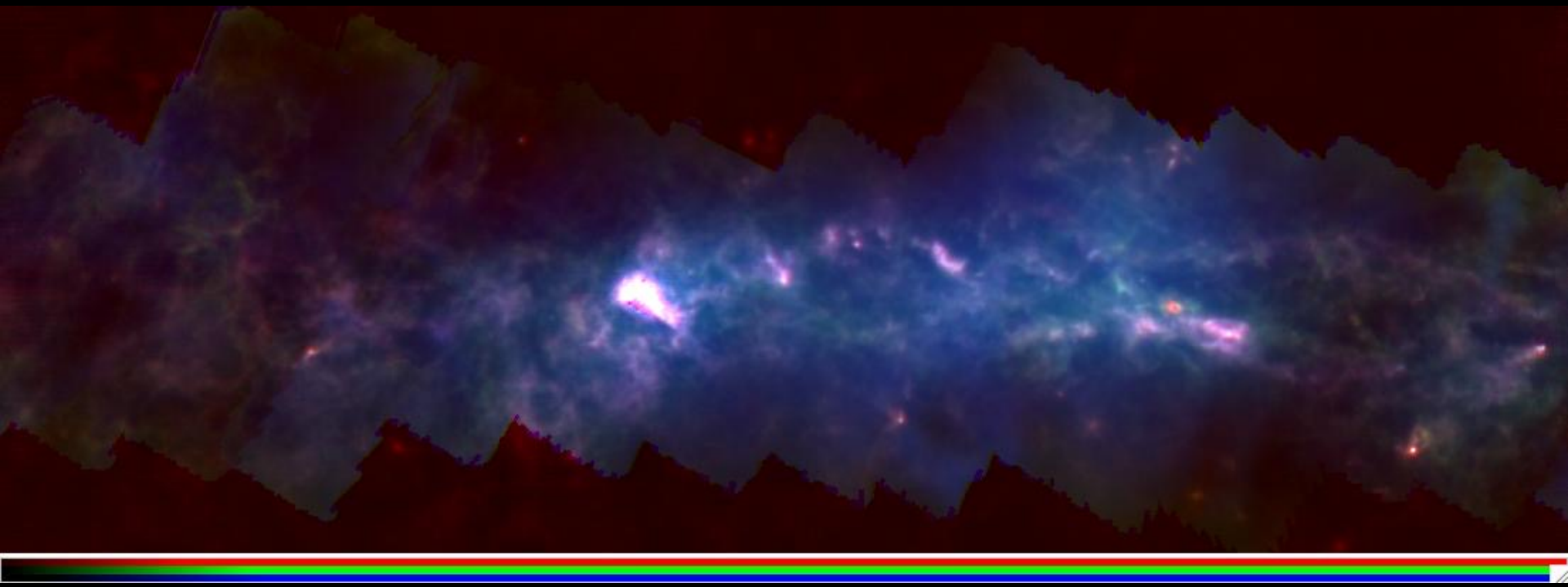
Galactic Center: 1.1 mm SCUBA vs. Bolocam:

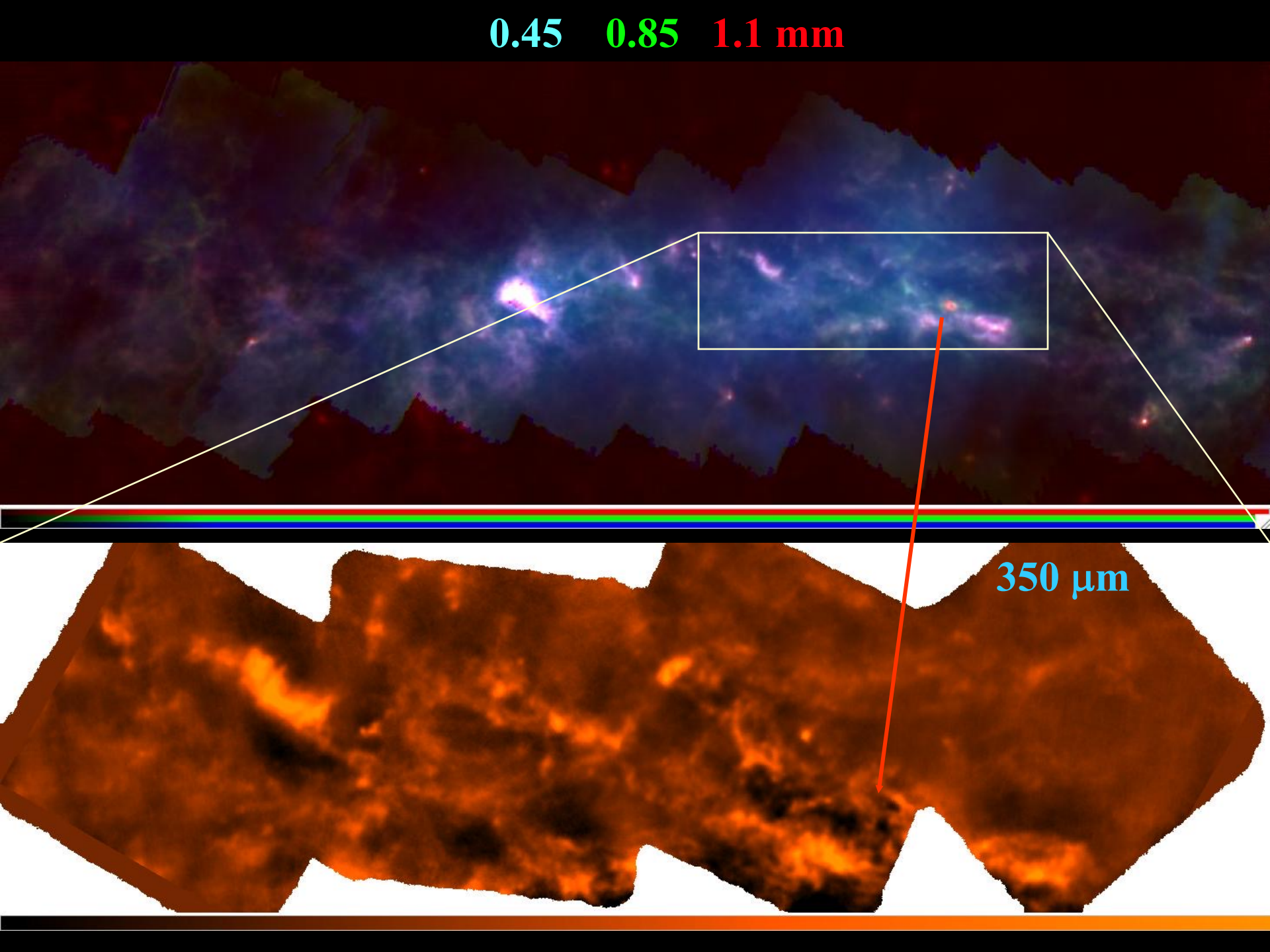
SCUBA 850 μm

BGPS 1100 μm



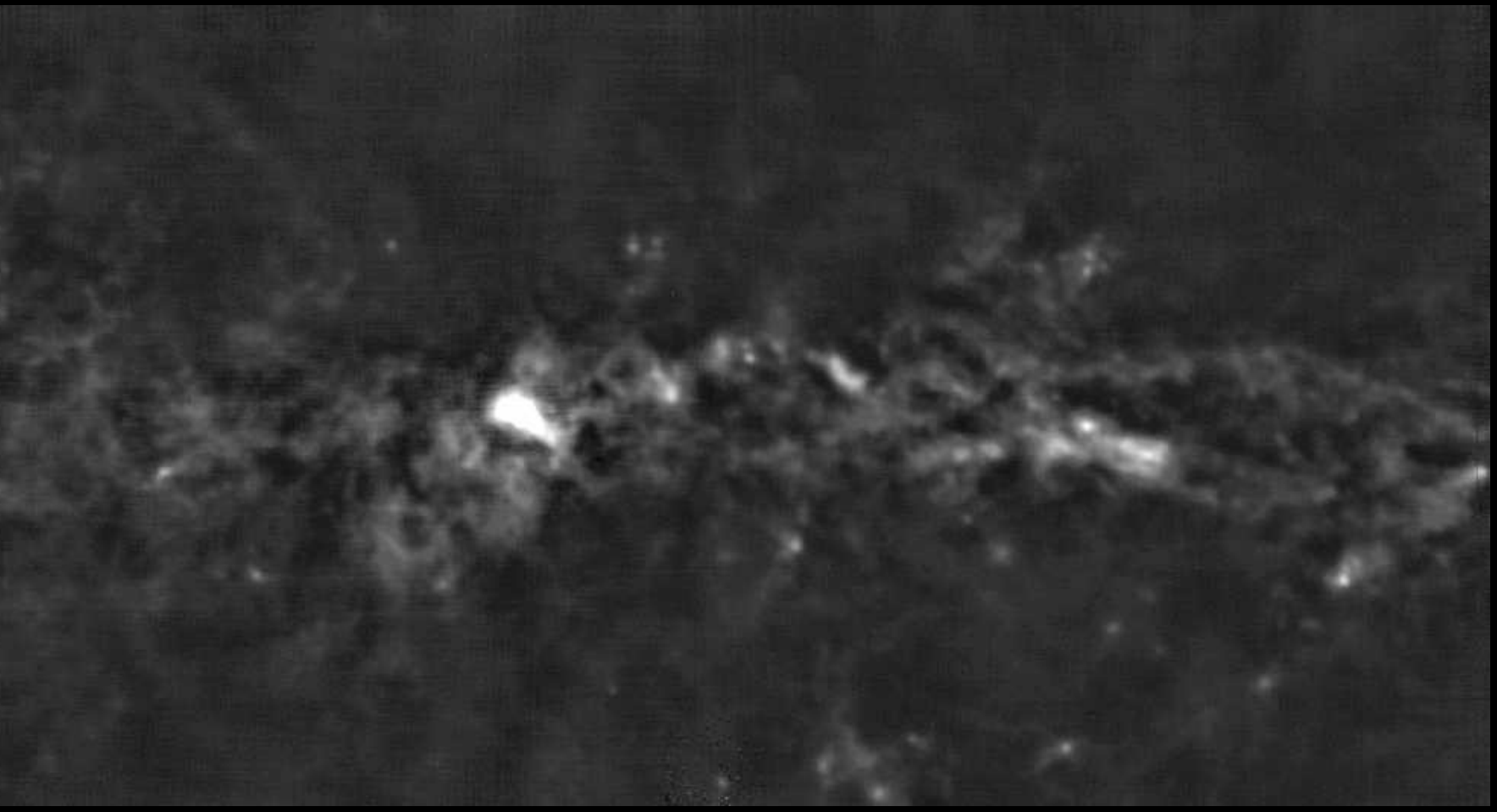
Galactic Center: 0.45 0.85 1.1 mm



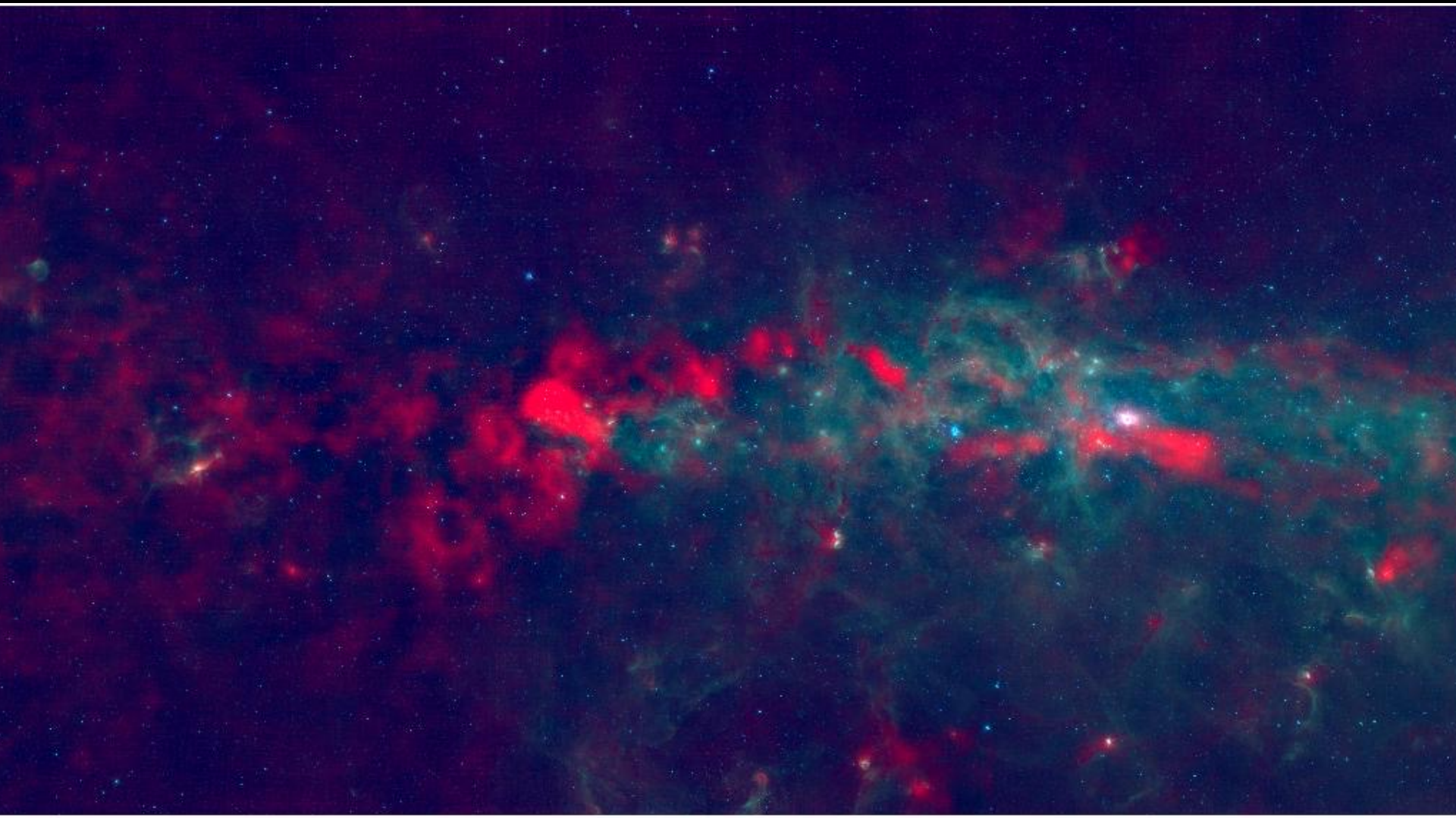

0.45 0.85 1.1 mm
350 μm

The Center of the Milky Way Galaxy

Spitzer Space Teles

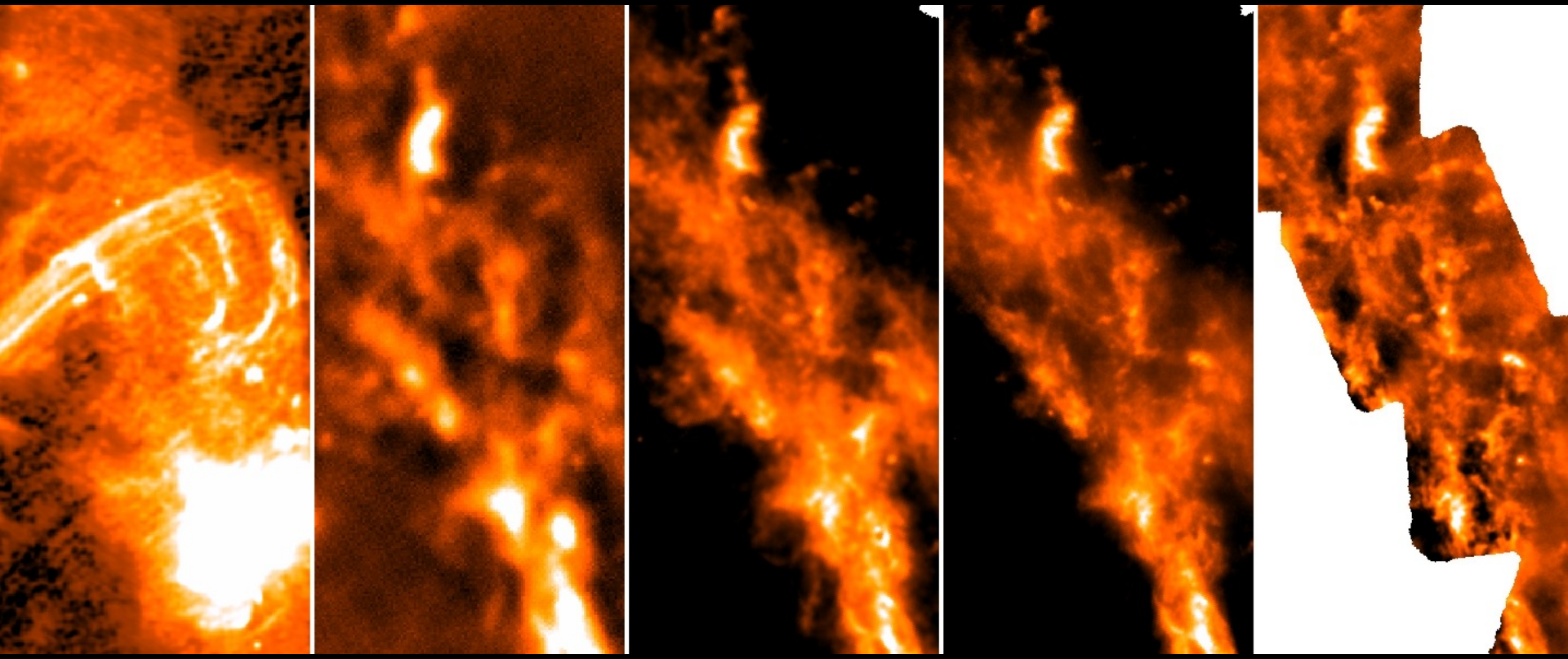


Galactic Center: Spitzer 3.6 4.5 8 μm 1.1 mm



The Galactic Center

21 cm 1.1 mm 0.85 mm 0.45 mm 0.35 mm

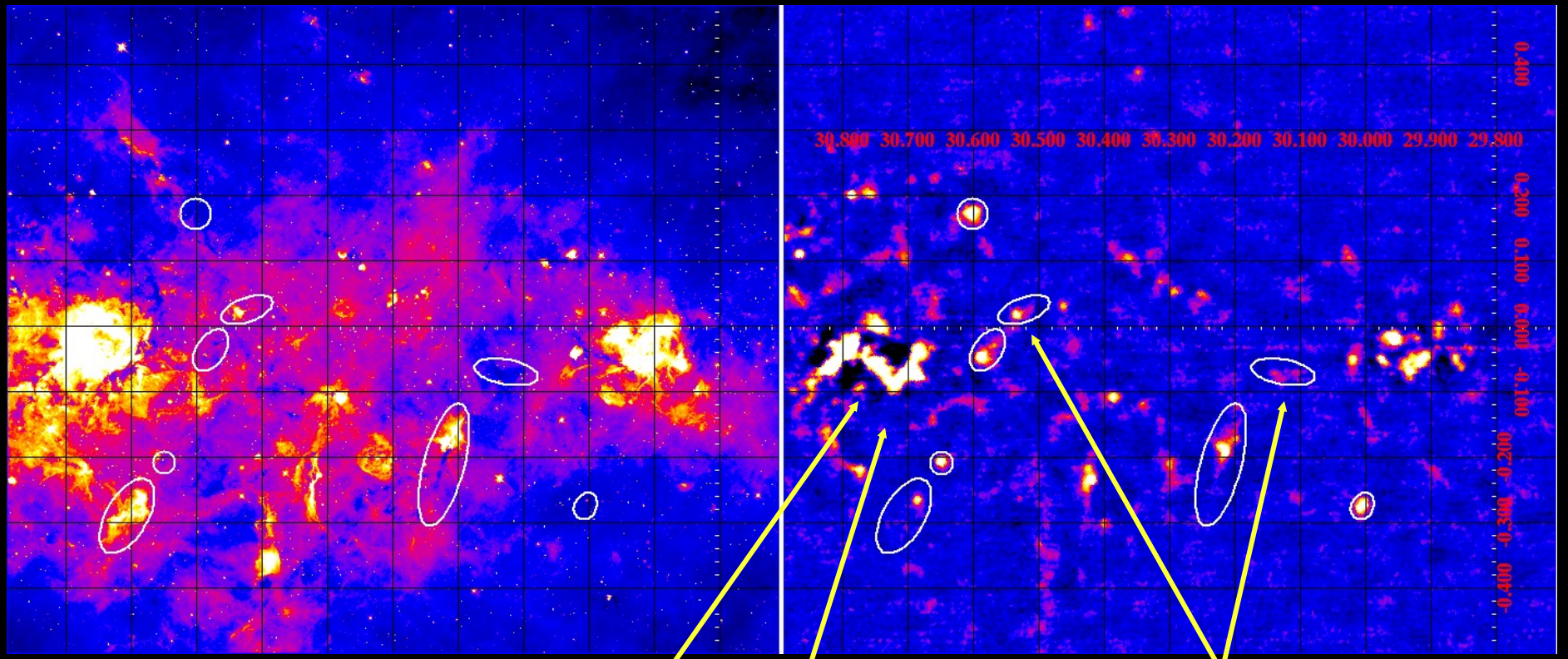


3.6 - 8 μm 1.1 mm 20 cm

Adam Ginsburg: NRAO 2008 photo-contest First Prize!
NRAO submission for AAS Calendar, 2009 Feb

MSX 8 μm

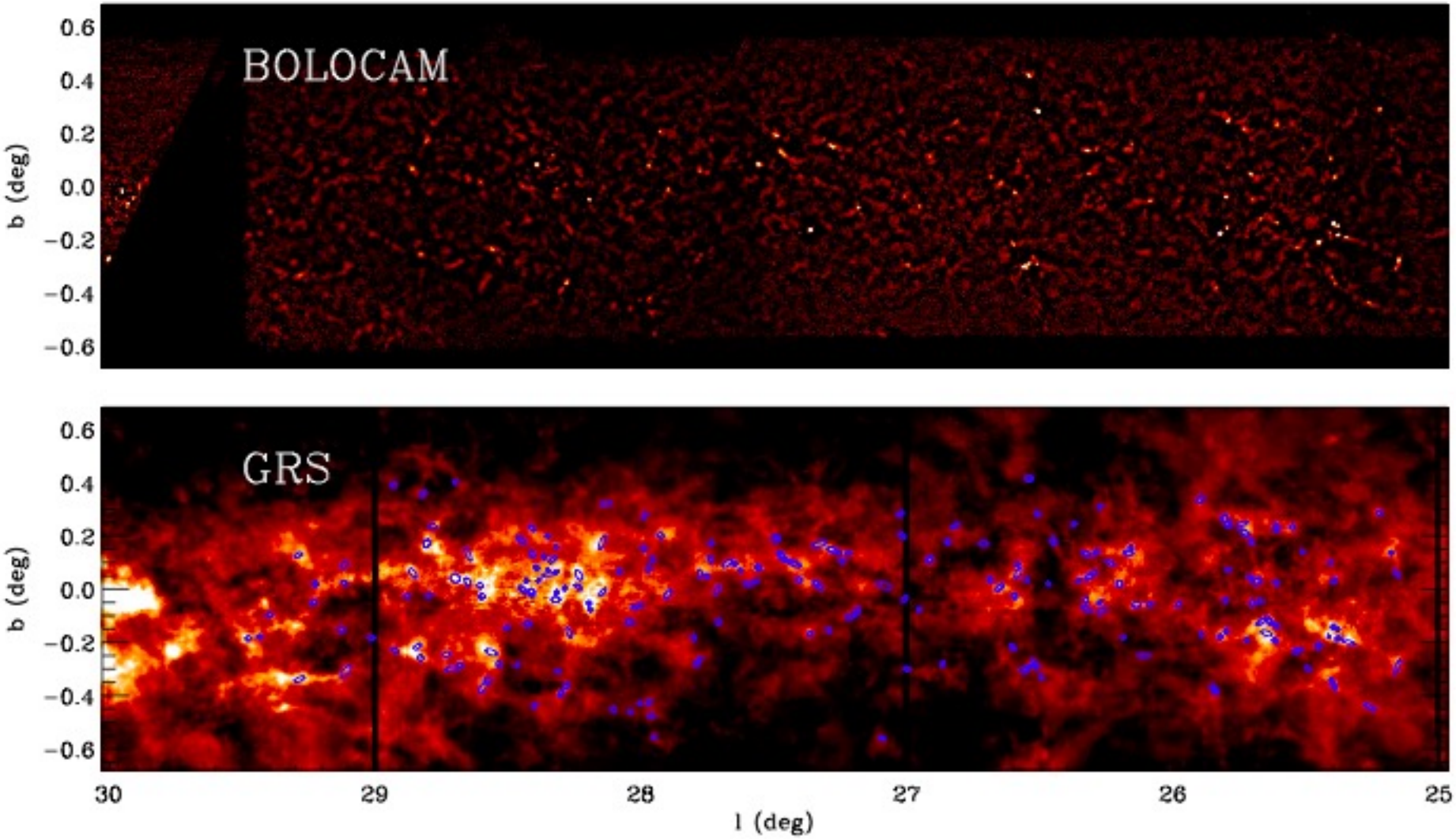
Bolocam 1.1 mm



Bolocam 1.1 mm is best tracer of: pre-stellar cores, cluster-forming cores, and hot dust associated with hot cores, hypercompact & compact HII regions.

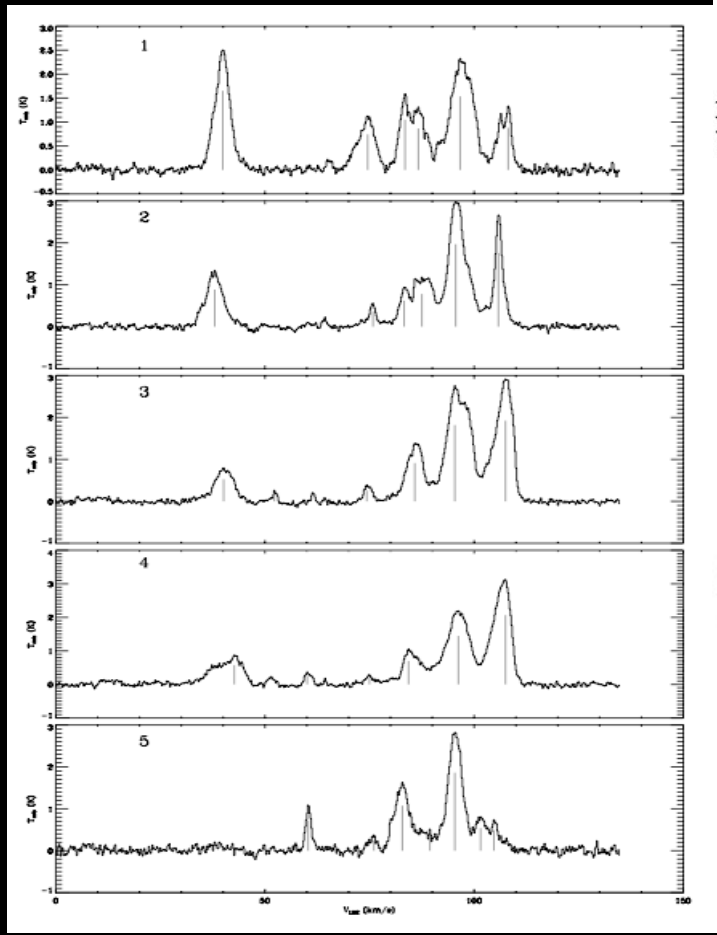
1.1 mm vs. ^{13}CO

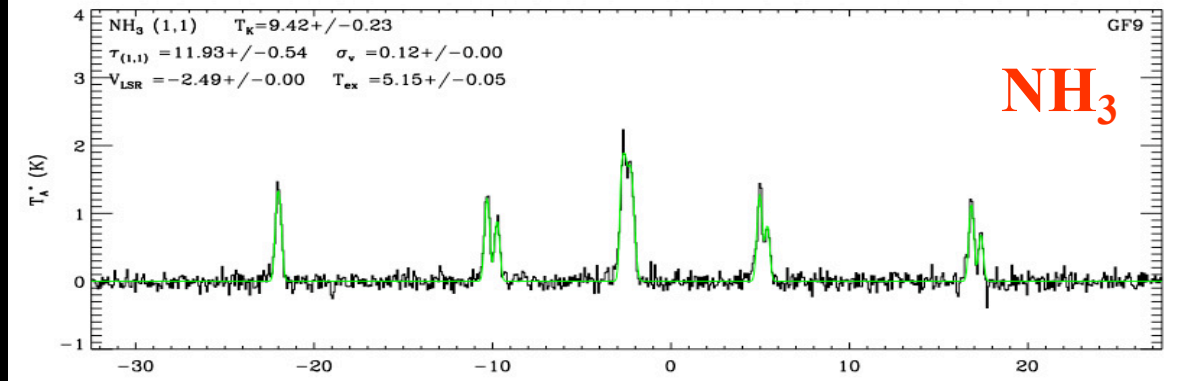
BGPS: 3 component PCA but NOT iteratively mapped

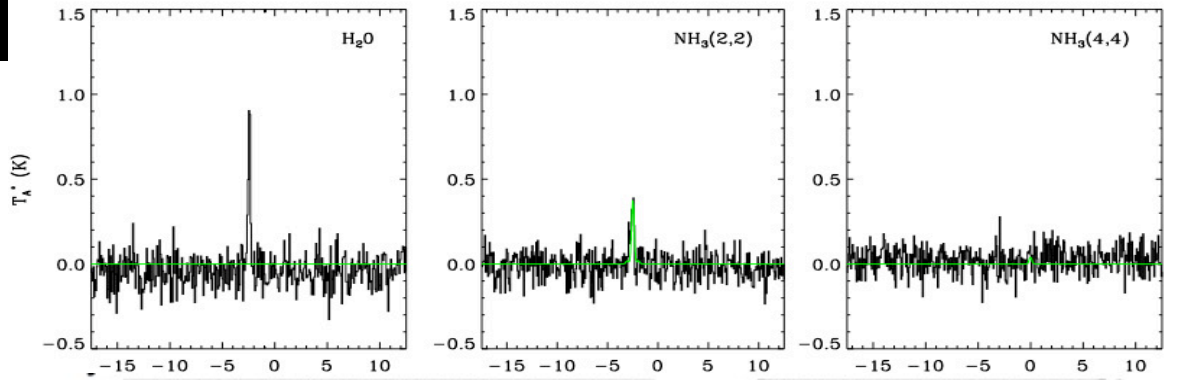


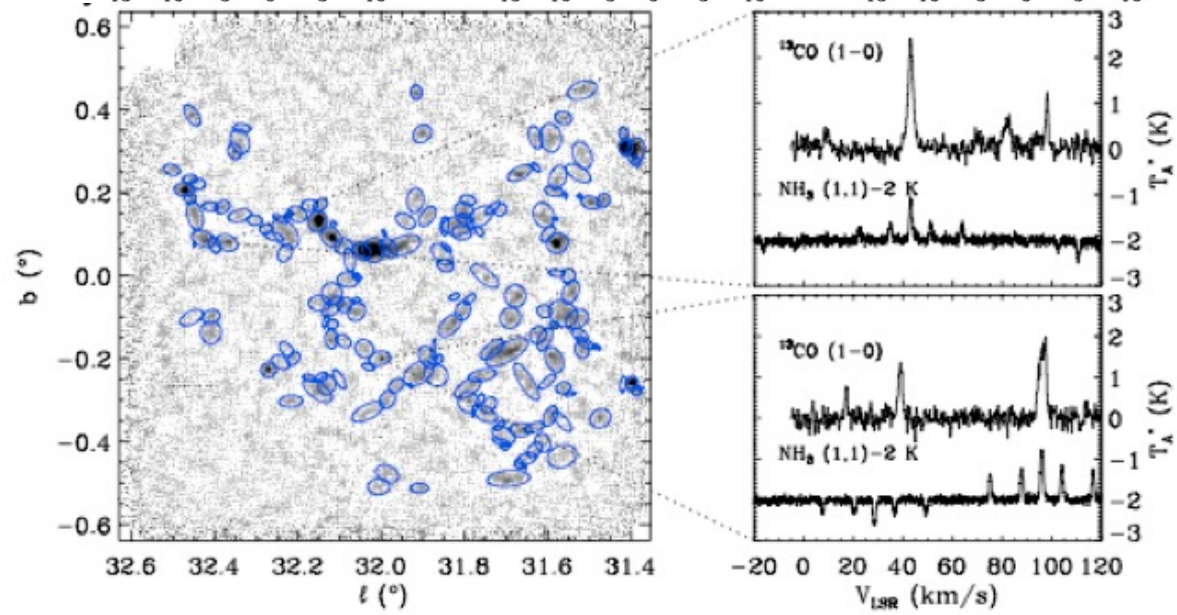
Heterodyne spectra:

^{13}CO 1-0





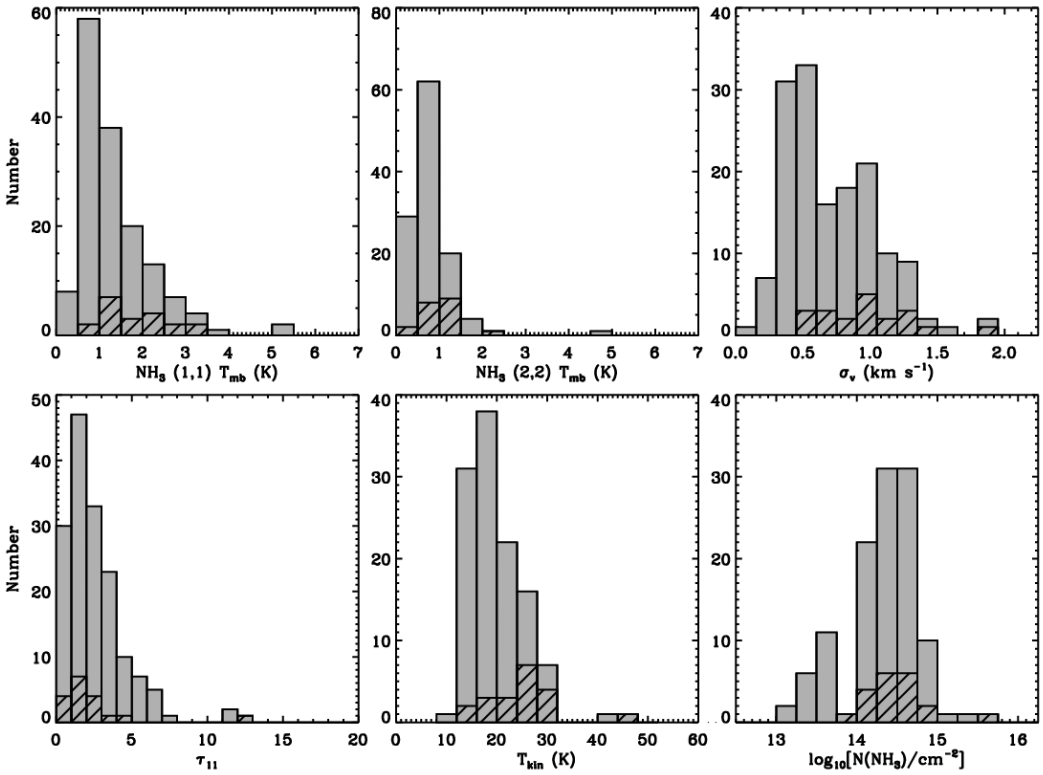


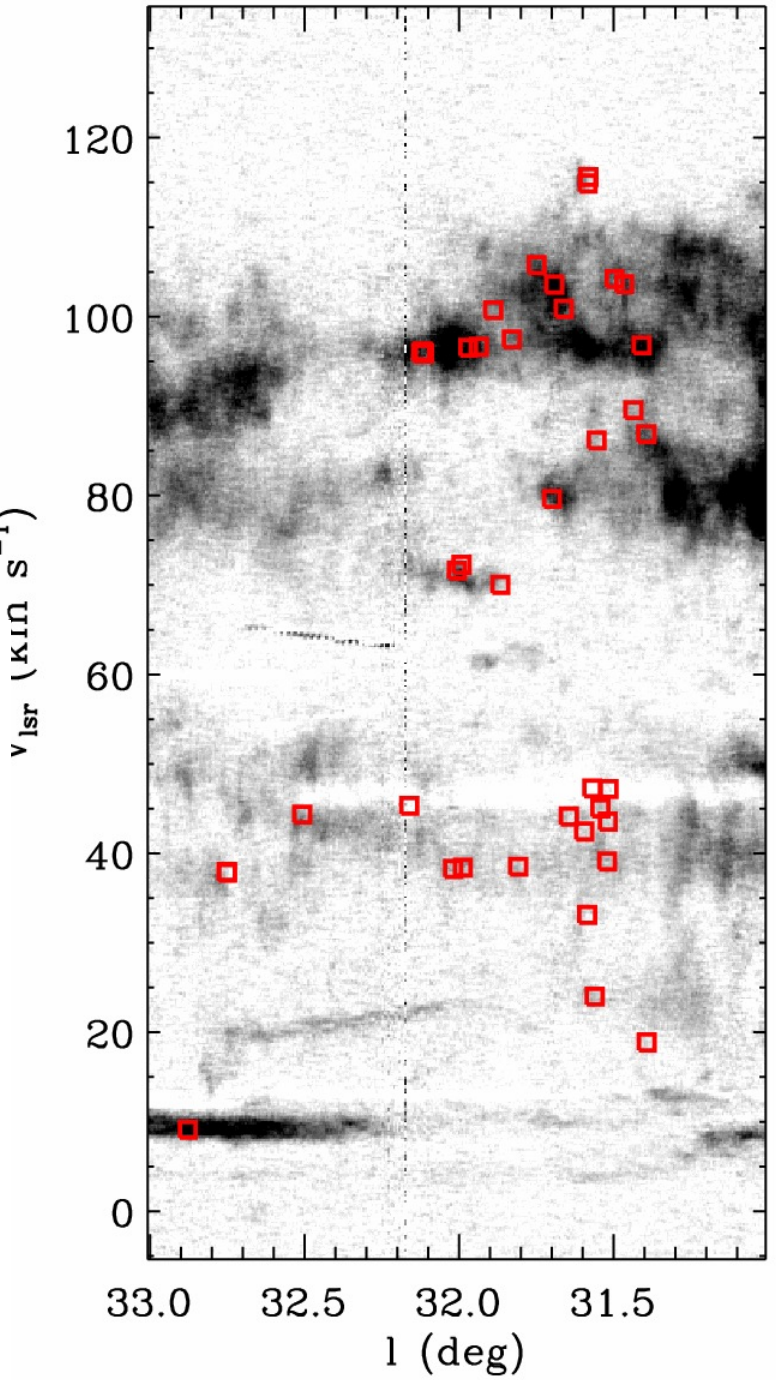


NH_3 Heterodyne spectra:

V_R on ^{13}CO FCRAO survey

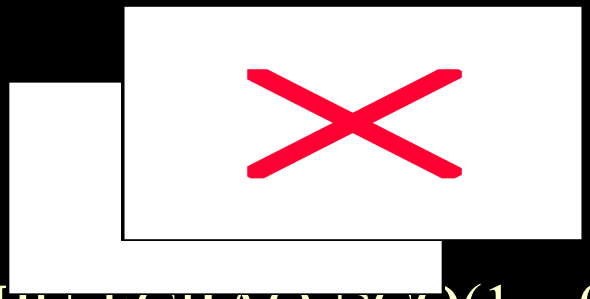
Statistics of ~ 200 cores



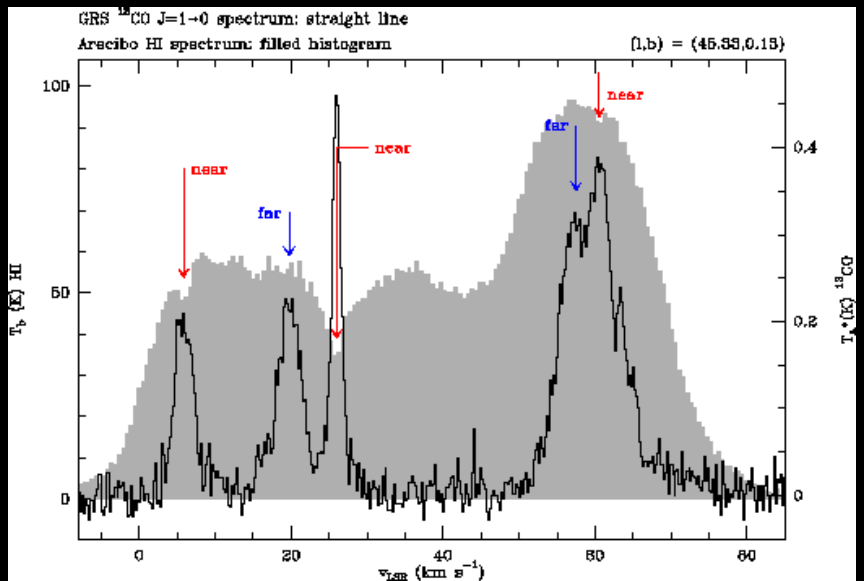


Finding Distances (and Masses)

- For optically thin dust, the mass is extremely sensitive to the assumed distance:



- For $15 < l < 56$, the BU-FCRAO ^{13}CO(1→0) Survey provides a way of obtaining velocities, provided: freeze out is not too extreme, and the CO morphology traces the dust



- HI self-absorption (HISA) can be used to resolve the distance ambiguity in the inner Galaxy; data available from the VGPS

http://www.ras.ucalgary.ca/VGPS/VGPS.html

BGPS Activities, Analyses, & Processes

- **Ancillary data gathering: (GBT, CSO, JCMT, HHT)**
- **Modeling:** Automated structure extraction,

  Identify Best Galaxy model: (l,b,V) => Distance
- **Pipeline development & data reduction:**

  BGPS V2 pipeline: AdamGinsburg
- **Public data release through IPAC:** FITS images, Bolocat, ancillary data (spectra), documentation: Fall 2008 or following verification
- **Exploitation:** First papers in draft. Sub-groups based on "work"

  Open to collaborative use of data
- **Associations:** Visual, 2MASS, Spitzer, MSX, VLA, …
- **Funding:** NRAO, NSF, NASA (Astrobiology, Hi-GAL) - insufficient!

Herschel Hi-GAL (PI. Sergio Molinari, Rome)

- **Image Galactic Plane:** $l = +/-60^{o}$, $b = +/- 1^{o}$

  60 - 500 μm (SPIRE, PACS)

- **Distribution of ISM Temperature and the ISRF:**

  Characterize the diffuse ISM

- **Dust in the Galaxy:** **Formation, Evolution, Destruction of Molecular Clouds**

- **The Formation Time-line for Massive Stars:**

  Evolution from IRDCs to clsuters

- **Bridging the Gap Between Global and Local Star Formation:**

  Link resolved clouds and star formation in the Galaxy to distant galaxies

Hi-GAL Activities, Analyses, & Processes

- **Ancillary data gathering: (BGPS, mm & sub-mm heterodyne)**
- **Modeling:**

  Cloud formation models (spiral arm, thermal-I, converging flows)

  Automated structure extraction, SED generation

  Identify Best Galaxy model: (l,b,V) => Distance
- **Pipeline development & data reduction (Rome / Frascati)**
- **SWGs:** models; ancillary data; diffuse ISM; clouds, star formation; post-MS (2 co-chairs each)
- **Exploitation:** SWGs => analysis => publications. External collaborations with approval of Steering Group

Data released - "eventually"