CHIMPS2

The CO Heterodyne Inner Milky Way Plane Survey

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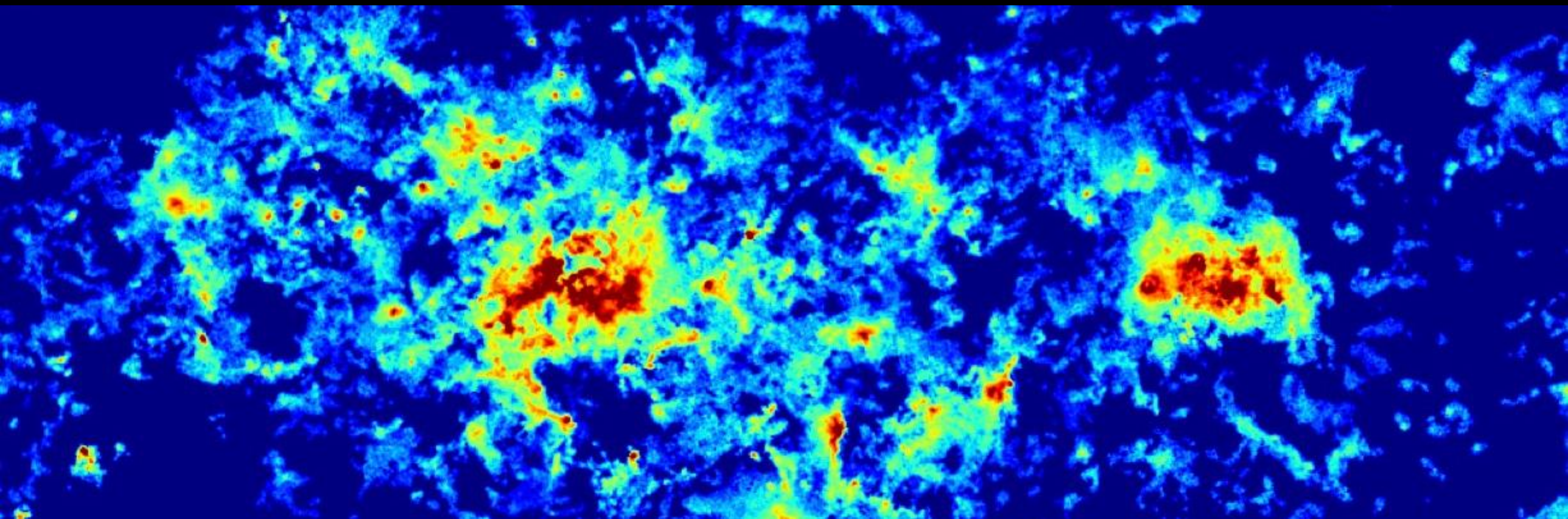
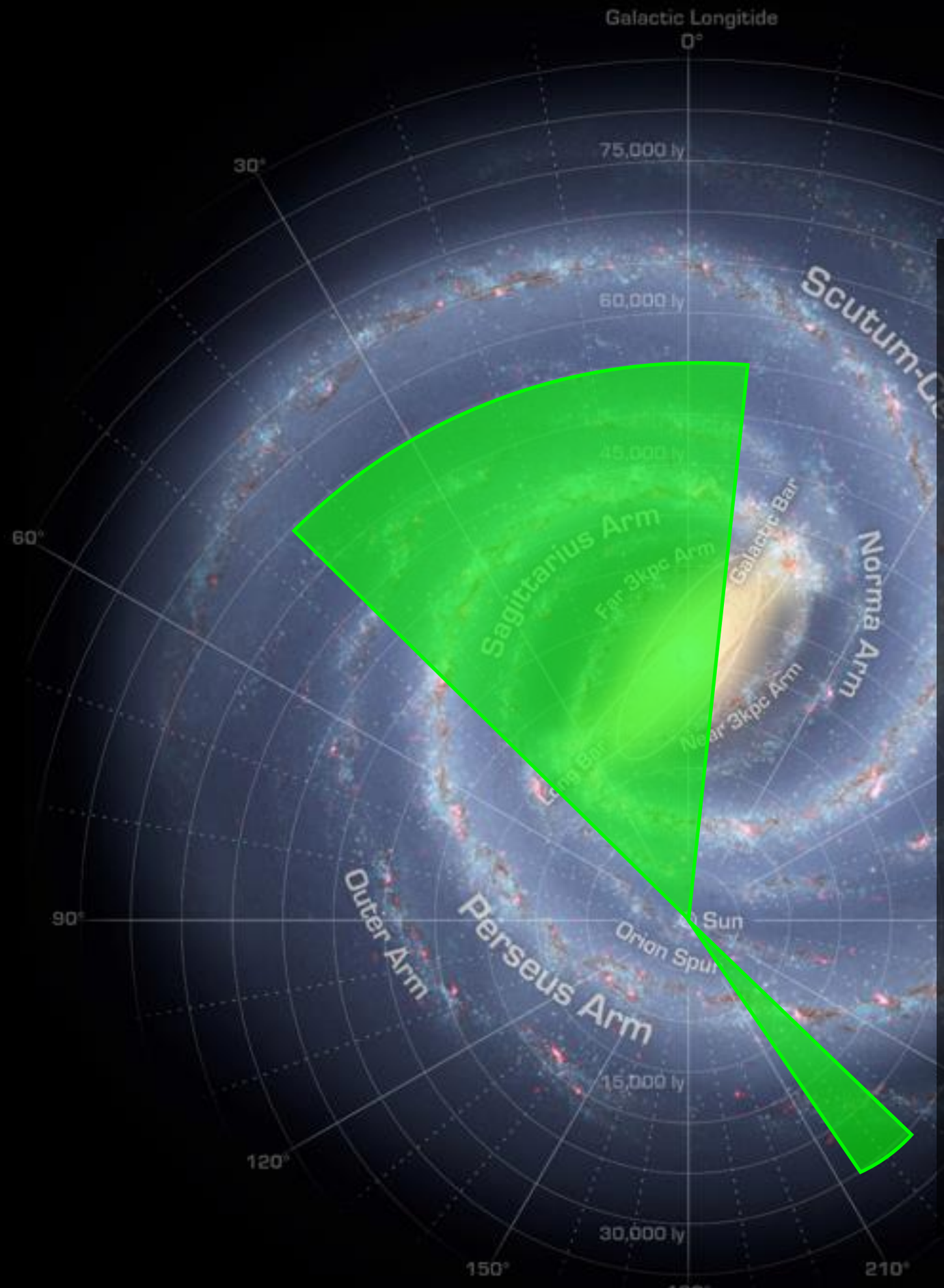
JCMT Users Meeting 2018

31st January 2018



CHIMPS

- JCMT (15m) with HARP
  - ^{13}CO (3–2) & C^{18}O (3–2)
  - Dense gas (n_{crit} ~ 10^4 cm^{-3})
  - High optical depth: cloud interiors
- 27.5° < l < 46.3° and |b| <0.5° (19 deg^2) spectral survey
- Spatial resolution ~ 15’’
- Velocity resolution 0.5 km/s (raw channel width 0.055 km/s)
- 200 km/s coverage ~ -50–150 km/s
- Sensitivity σ (T_{mb}) < 1 K per channel
  - T_A*~ 0.6 K/channel for ^{13}CO
  - T_A*~ 0.7 K/channel for C^{18}O



CHIMPS2

- Improve coverage in ^{12}CO, ^{13}CO and C^{18}O (3-2)
- Incorporate new COHRS ^{12}CO (3-2) line survey (Dempsey+13)
- Extend to Inner Galaxy and Central Molecular Zone, and a section in the Outer Galaxy.
  -5° ~ 46° & -0.5°~ 0.5°,
  215° ~ 225° & -1° ~ 0°
- Large overlap with FUGIN with 1-0 lines at matching resolution. cf) GRS
- Awarded 404 hours
  Observations are ongoing

CHIMPS2 Consortium

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* Jonny Henshaw
* Melvin Hoare
* Joe Mottram
* Jaime Pineda
* Alessio Traficante
* James Urquhart

CHIMPS 2 Working Groups

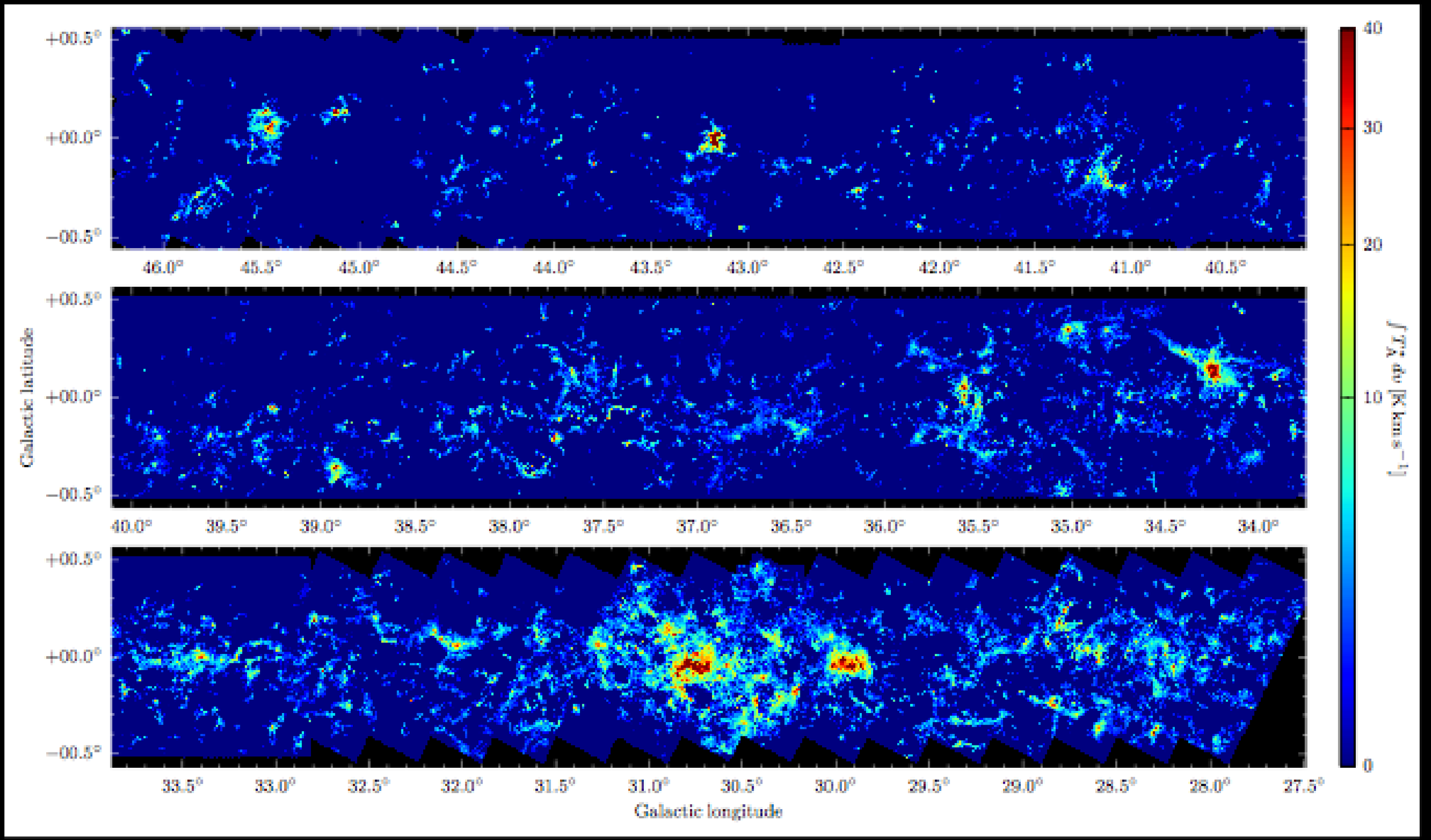
Science Working Groups

- CMZ
  - Dynamics within the CMZ
- Filaments
  - Kinematics of filaments
- Galactic Stucture
  - 3D map of the Galaxy
- HI Comparions
  - Conversion of HI to H_2
- Inner/Outer/CMZ Comparions
  - Temperatures and cloud conditions in each environment
- SFE/CFE Variations with environment
  - Variations as a function of large and local environment

Technical Working Groups

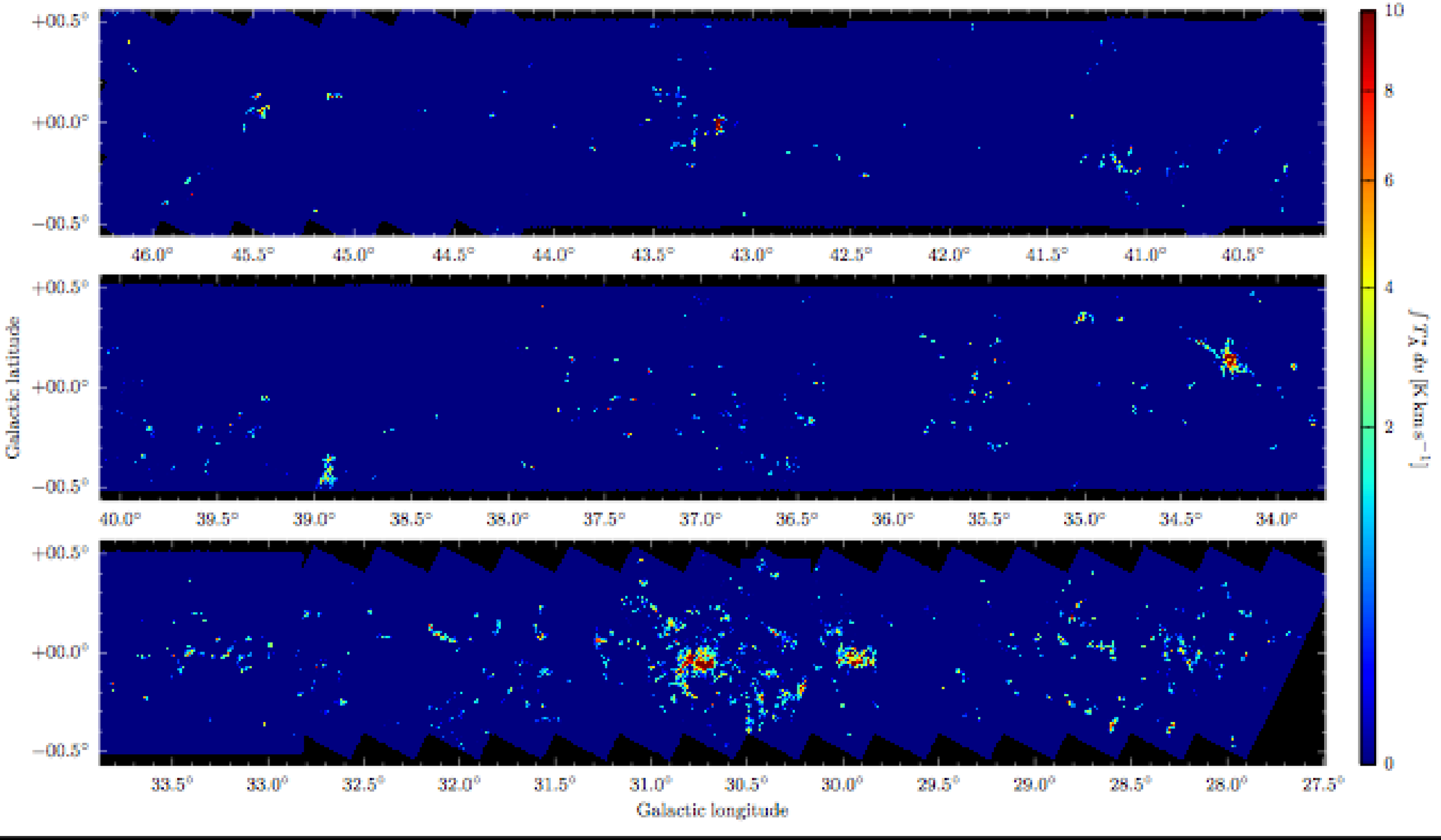
- Analysis
  - LTE analysis, combining with other surveys, such as FUGIN
- Data Reduction
- Source Extraction

^{13}CO (3–2)

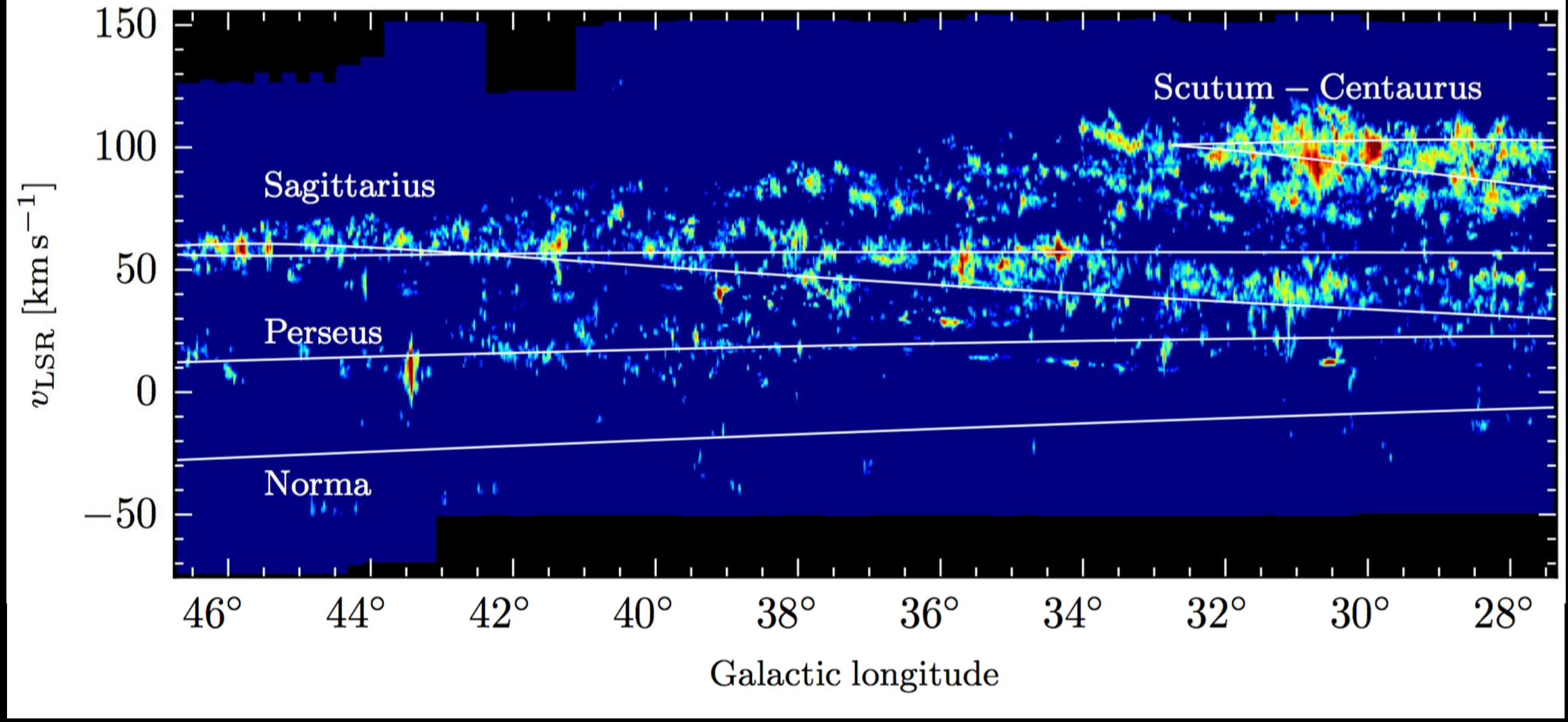


Rigby et al. (2016)

$C^{18}O$ (3–2)



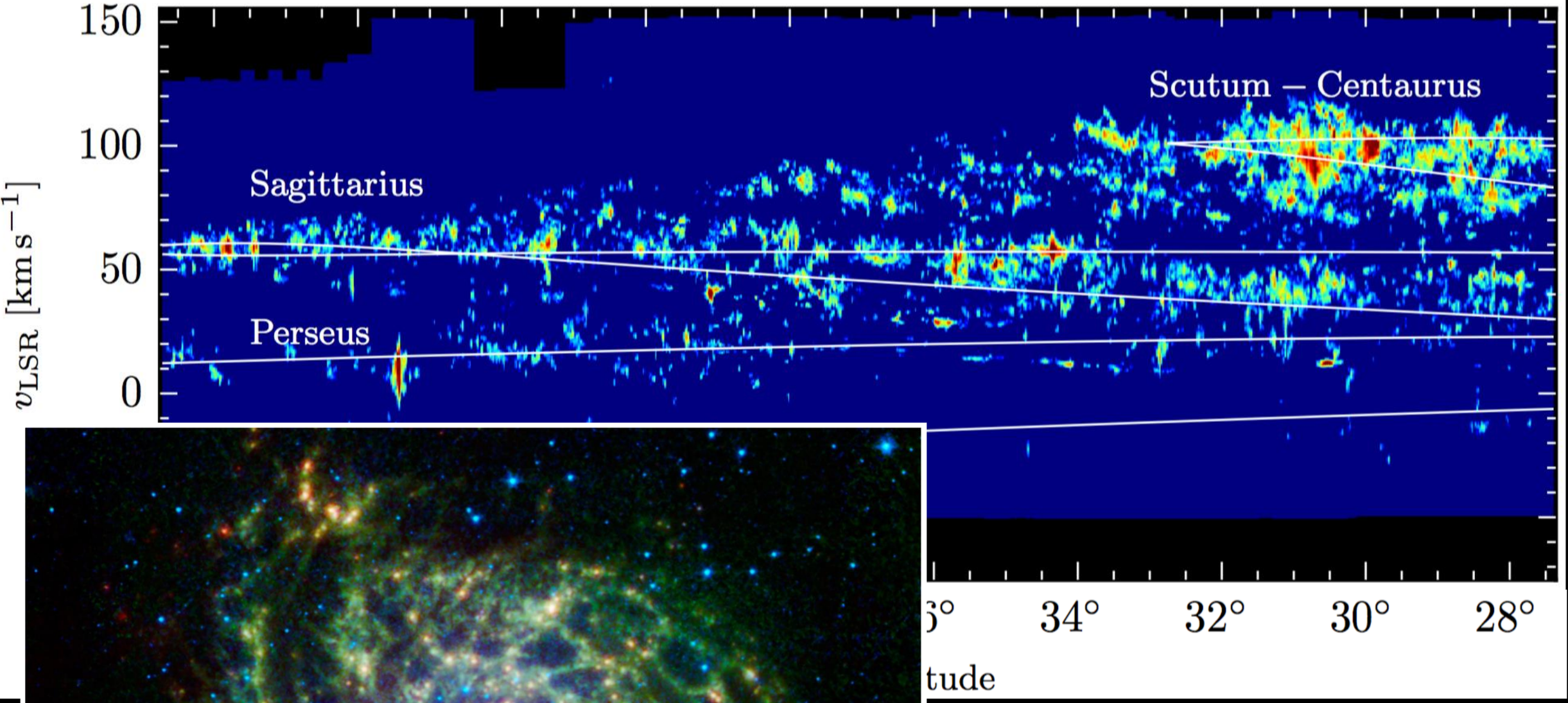
Rigby et al. (2016)



- Exceptional clarity of spiral structure

Rigby et al. (2016)

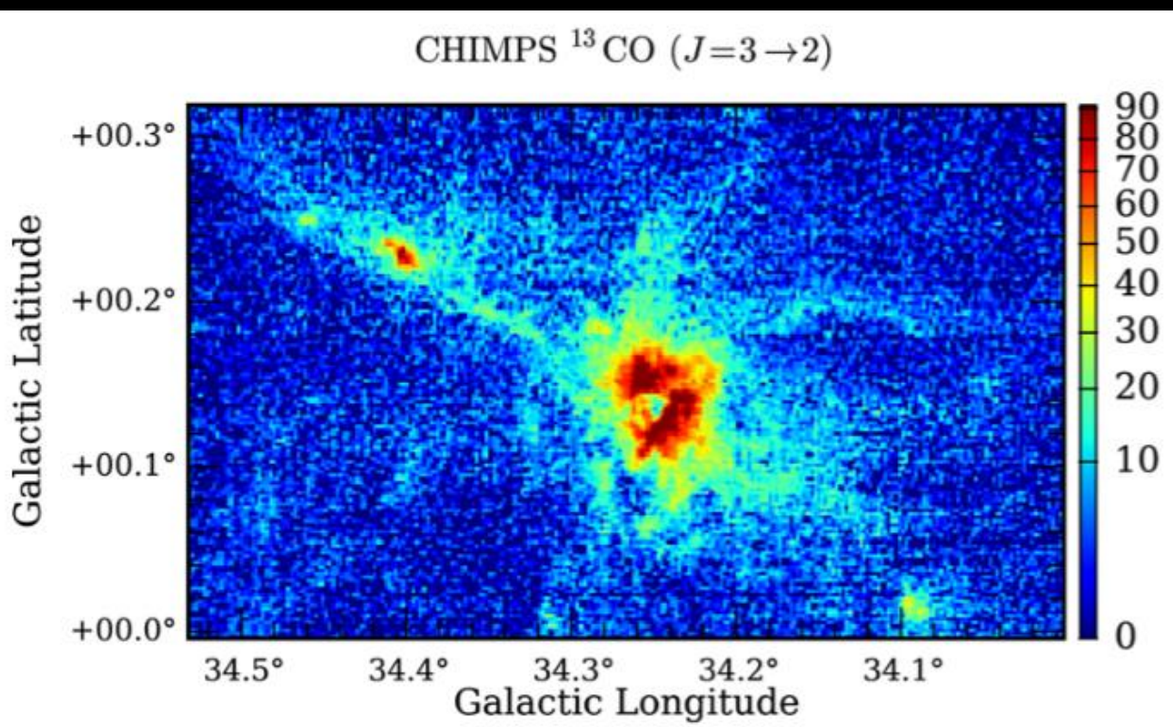
- Test of spiral models (Taylor+Cordes93, Cordes+04)
- Structure between Scutum and Sagittarius arms (e.g. Stark & Lee 06)
  - Armlet/ inter-arm filament/ filaments?
- More large-scale filaments (‘bones’)?
  - e.g. Abreu-Vicente+16, Ragan+14, Zucker+14, Li+13…

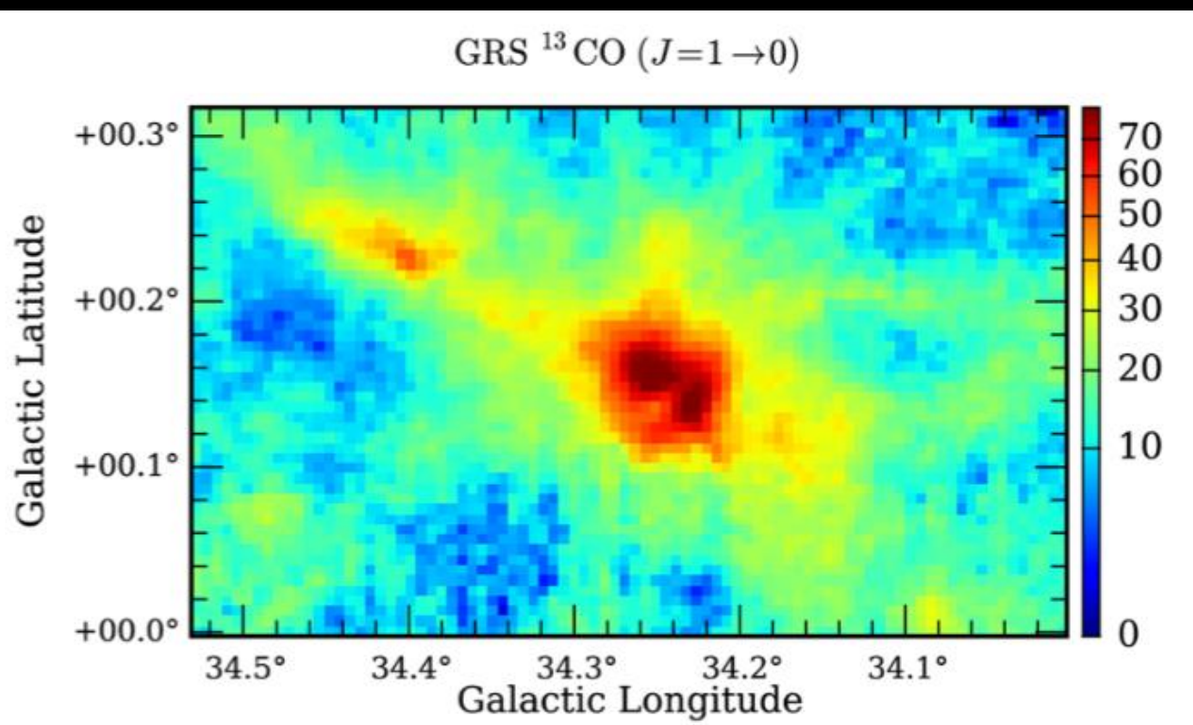


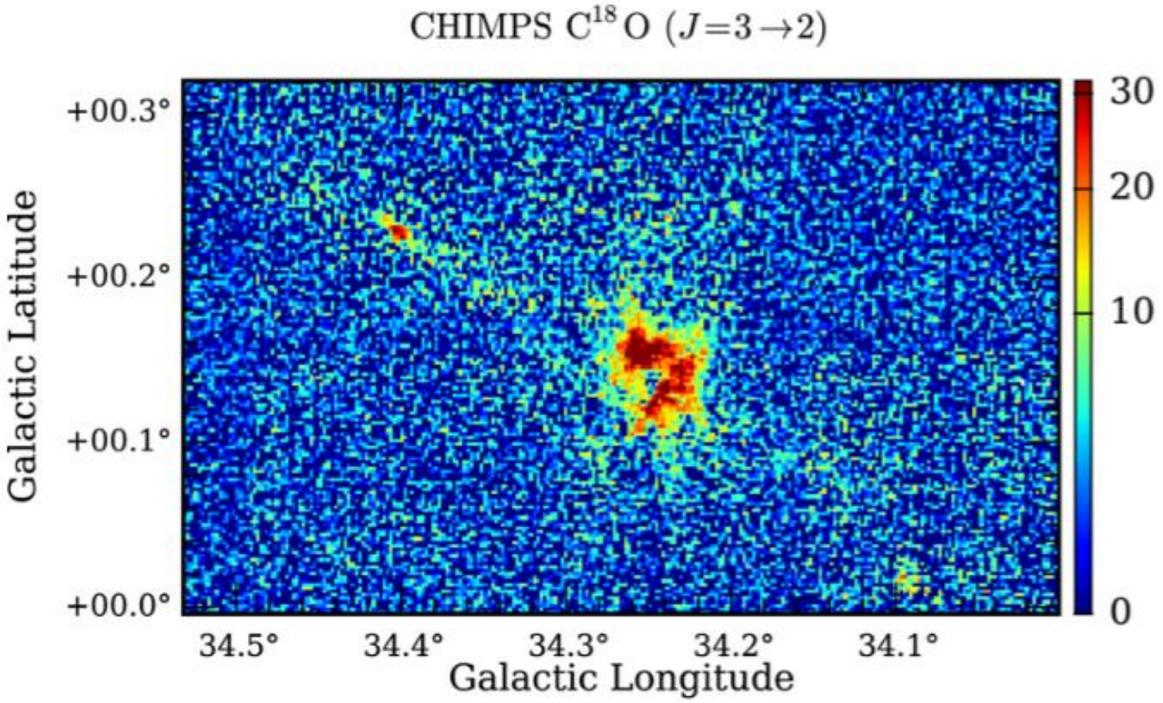
Rigby et al. (2016)

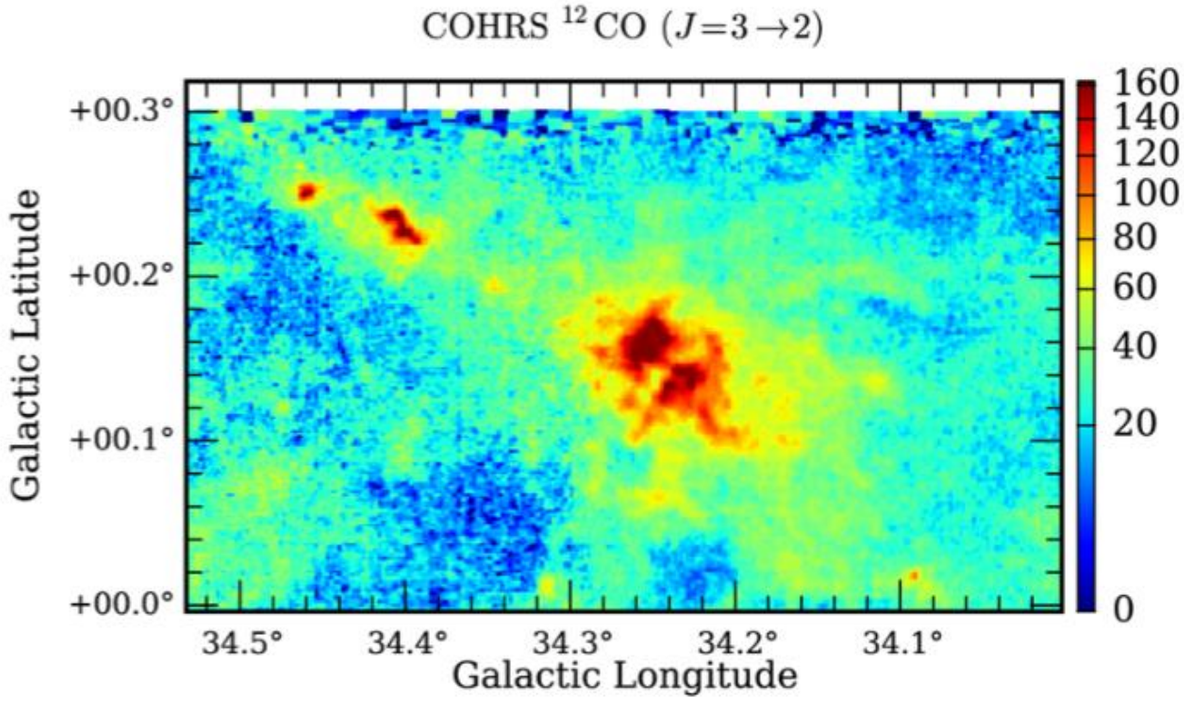
- es+04)
- ns (e.g. Stark & Lee 06)
- -14, Li+13…

CHIMPS, COHRS, GRS



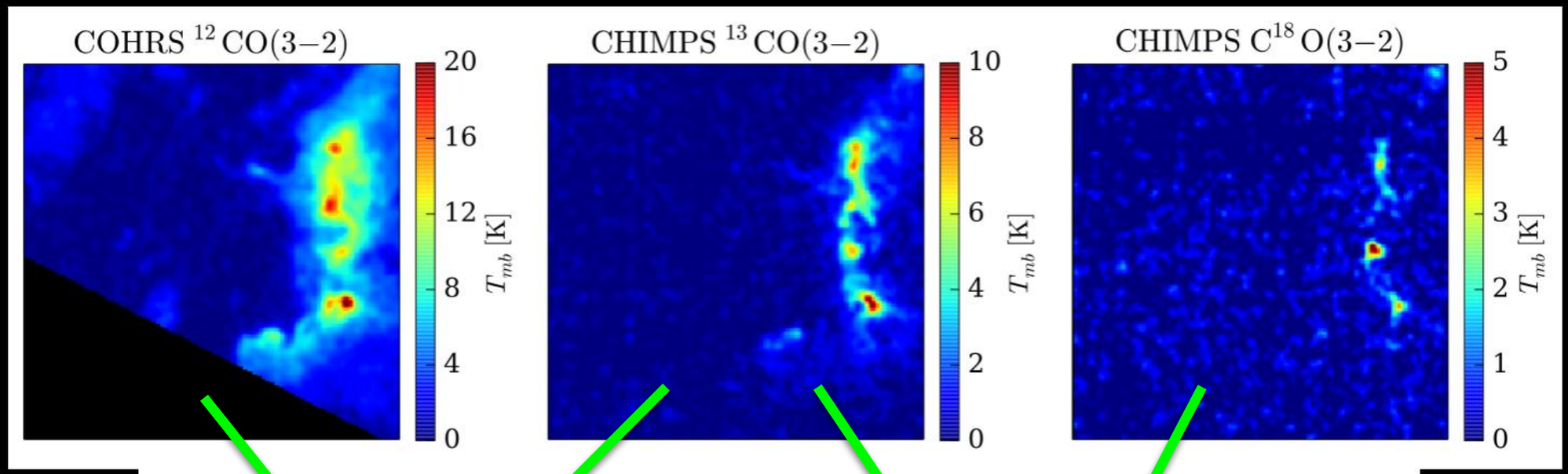






Rigby et al. (2016)

Optical depth

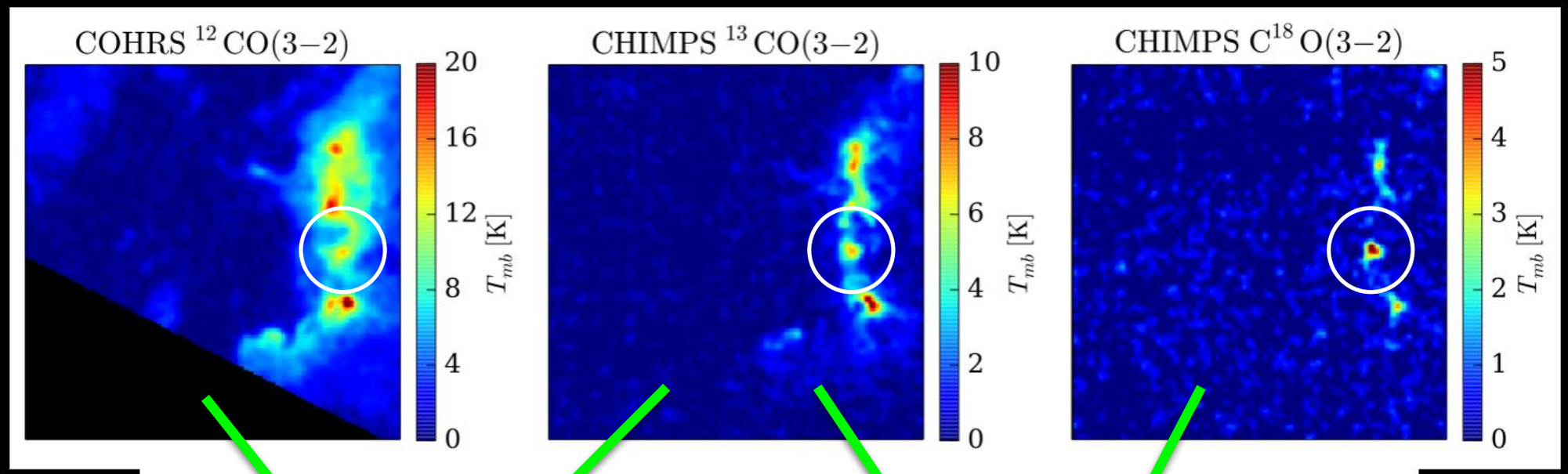


l = 32.15°
b = 0°
95.5 km/s

- Not quite a full complement of isotoplogue tracers

Rigby et al. (in prep)

Optical depth

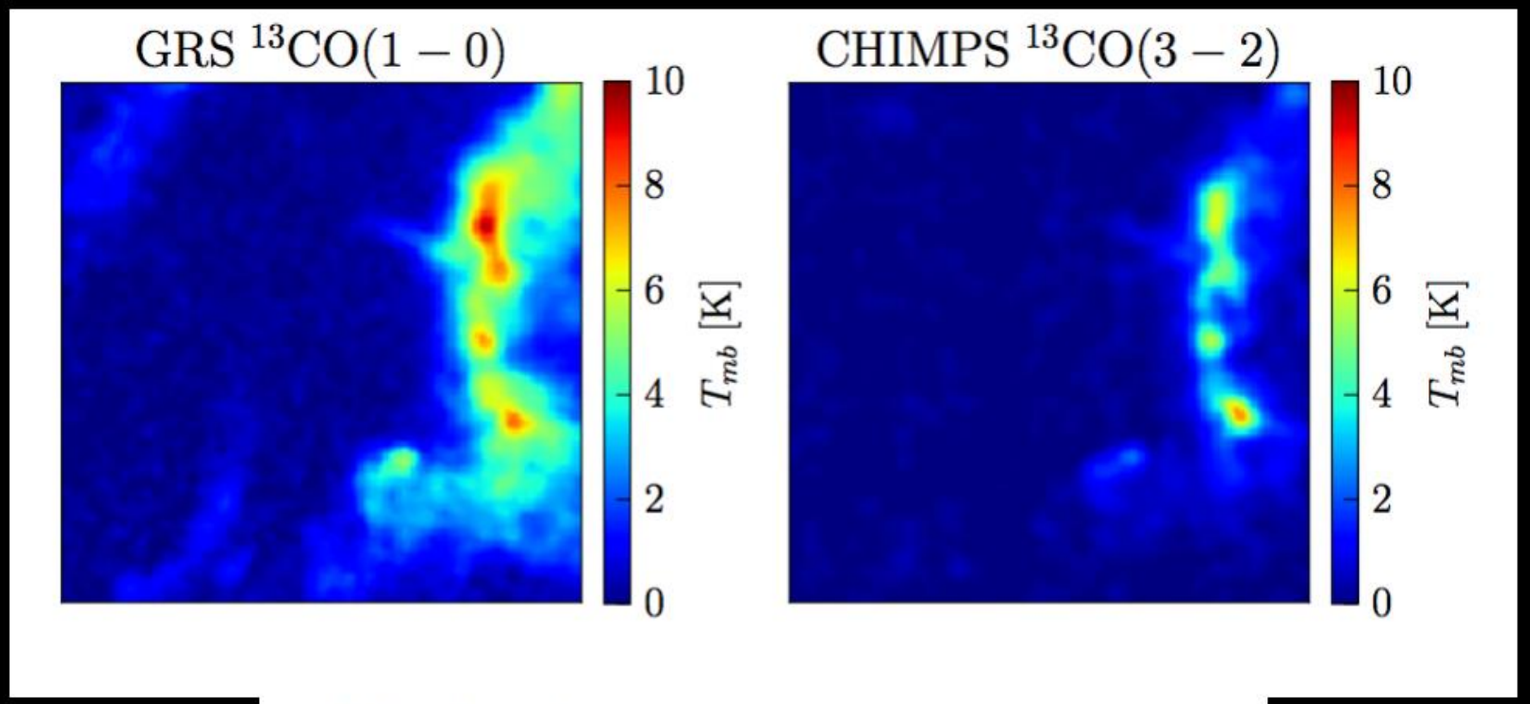


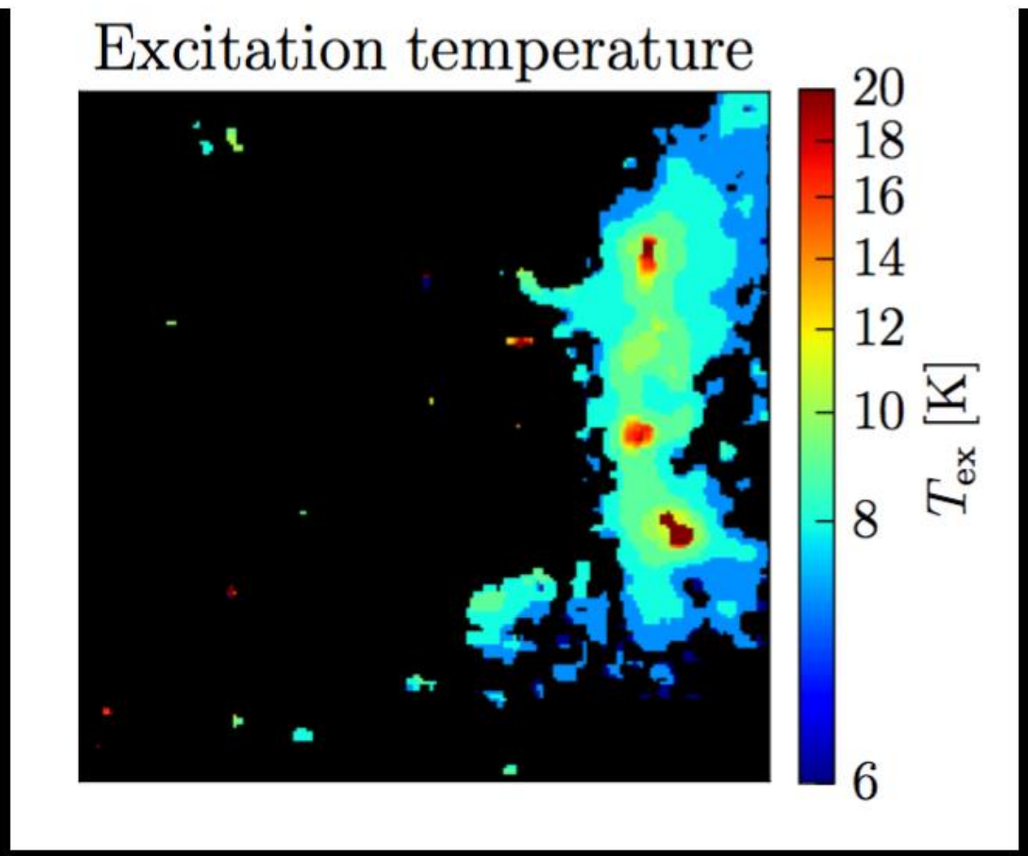
l = 32.15°
b = 0°
95.5 km/s

- Not quite a full complement of isotopologue tracers

Rigby et al. (in prep)

Excitation temperature





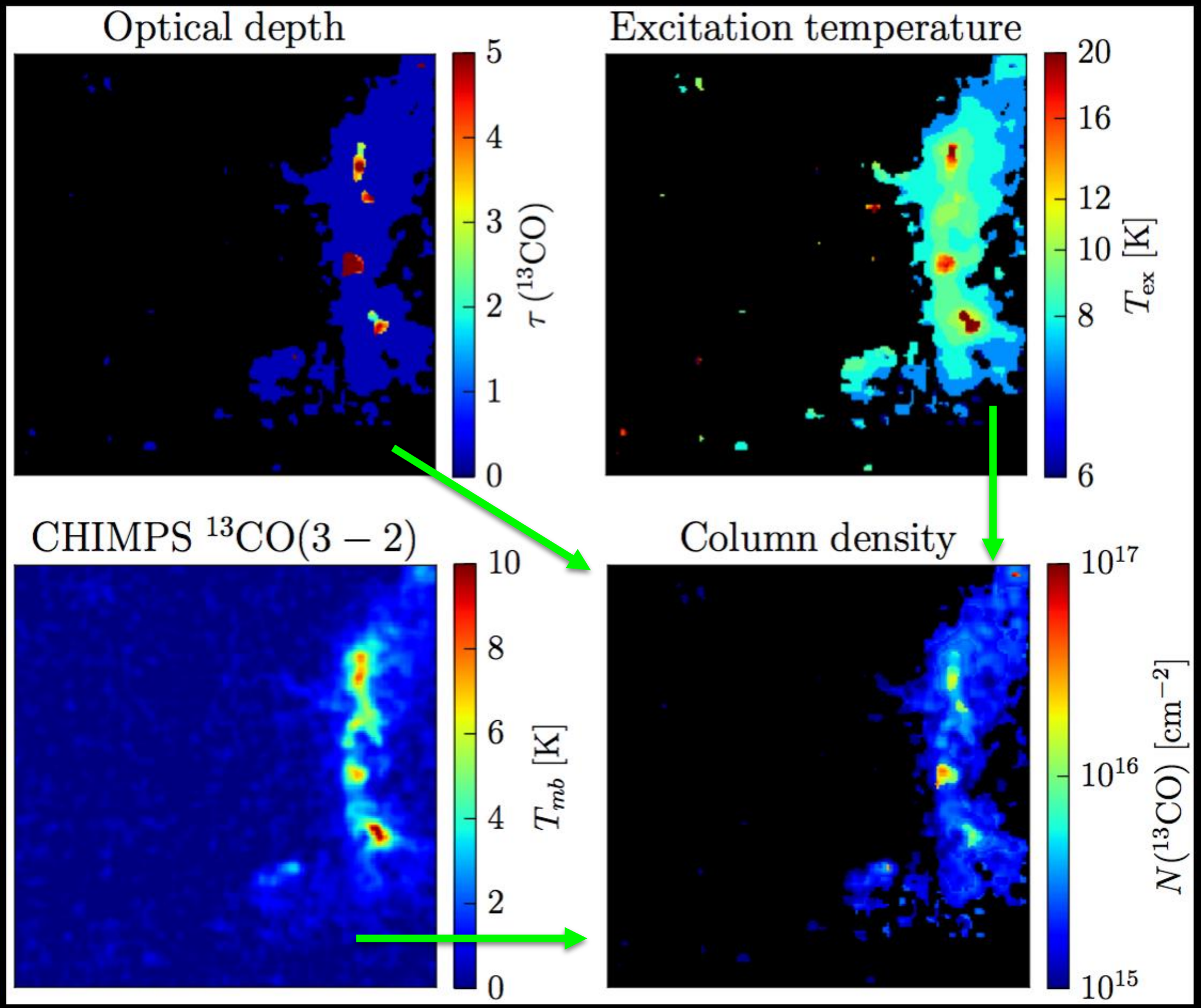
l = 32.15°
b = 0°
95.5 km/s

- 46” resolution, interpolated to 27.4”
  ⇒ ±30% in N

Approximated in an optically thin and optically thick case due to lack of $C^{18}O$ (1–0)

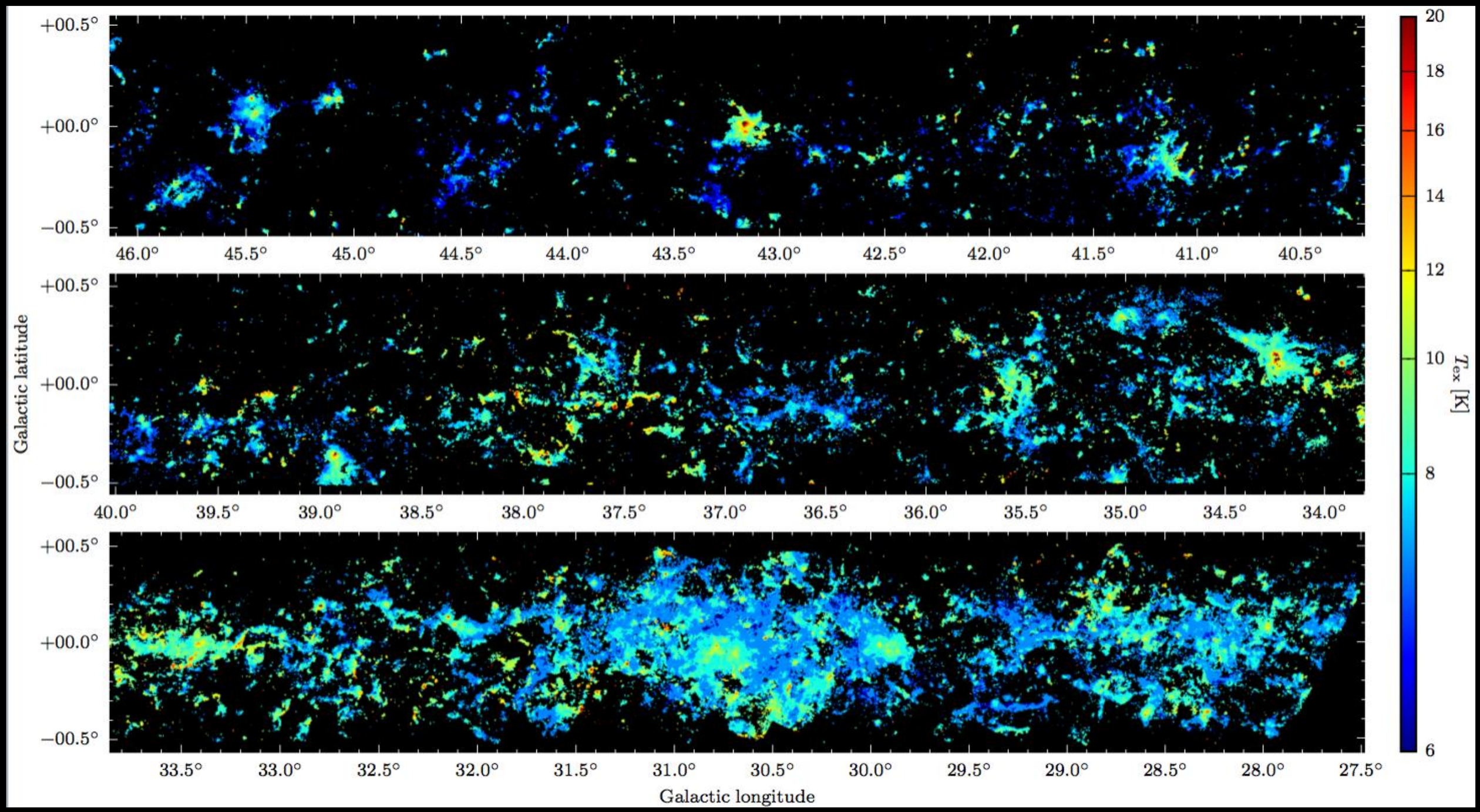
Rigby et al. (in prep)

l = 32.15°
b = 0°
95.5 km/s



Rigby et al. (in prep)

Median excitation temperature /spectrum ~ 8 – 10 K

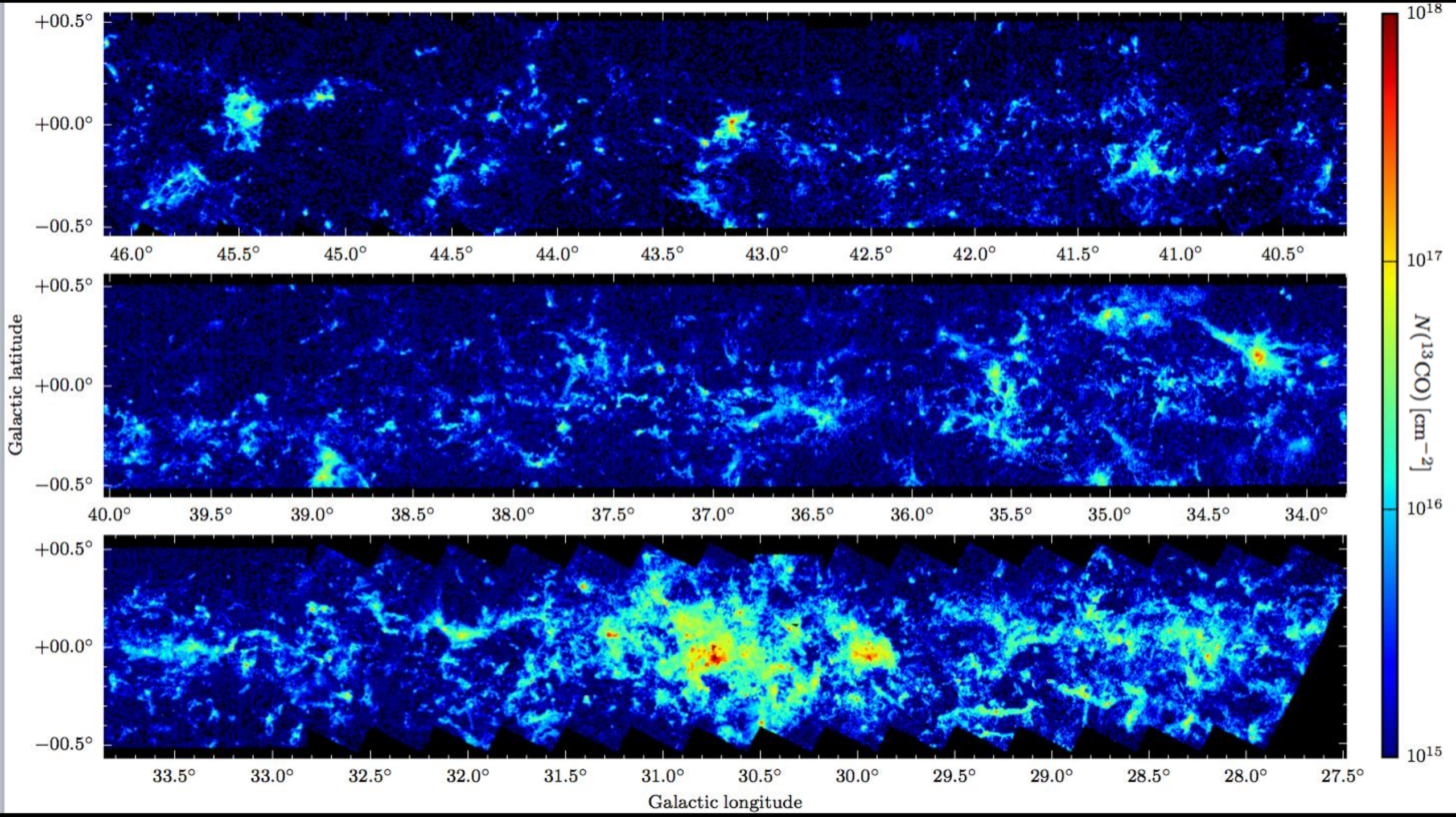


46” resolution

Rigby et al. (in prep)

^{13}CO (3 – 2) column density

$N(H_2) \sim 10^{24}$ cm^{-2}



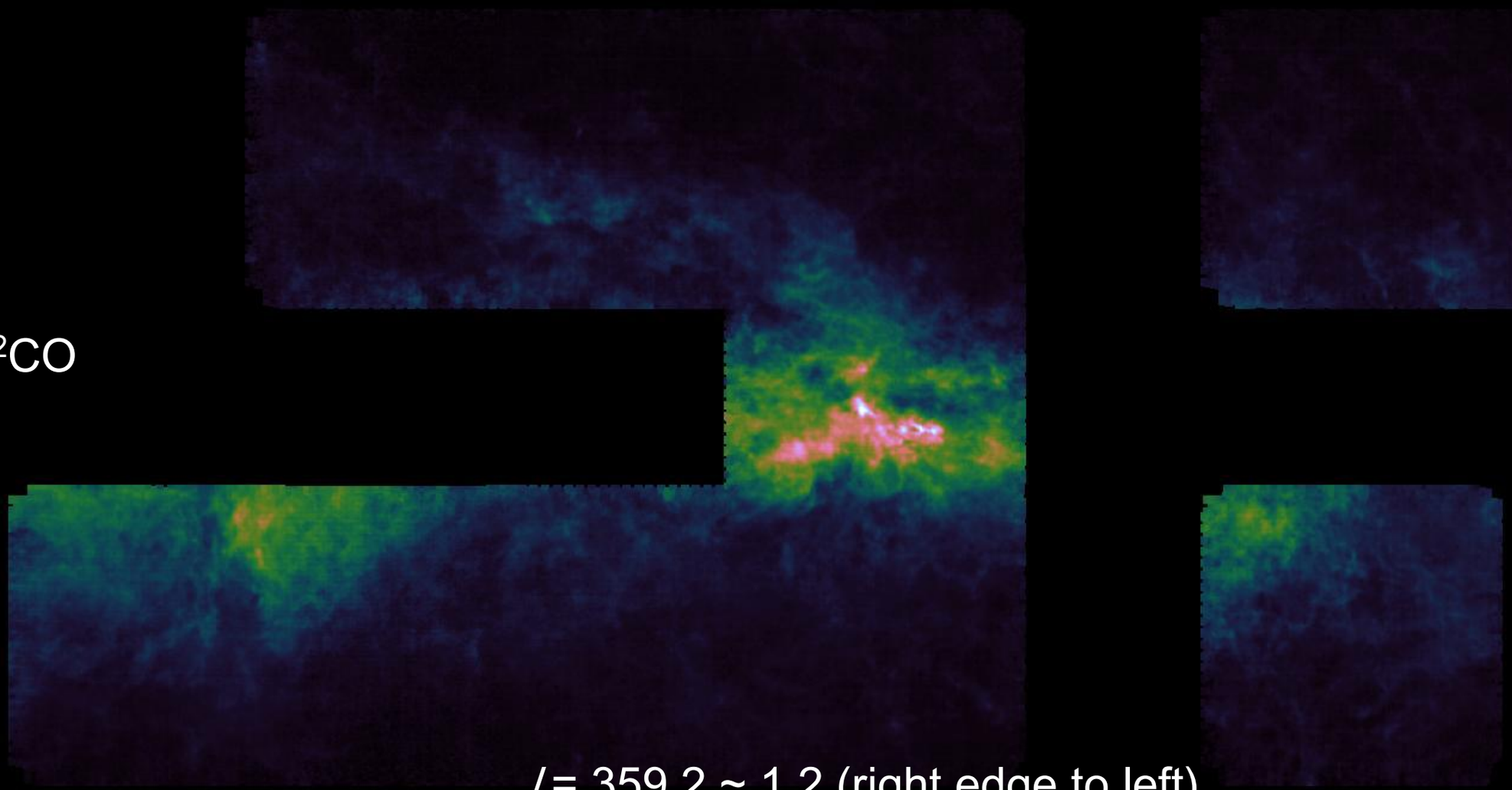
27.4” resolution

$N(H_2) \sim 10^{21}$ cm^{-2}

Rigby et al. (in prep)

CHIMPS2 Progress

CMZ

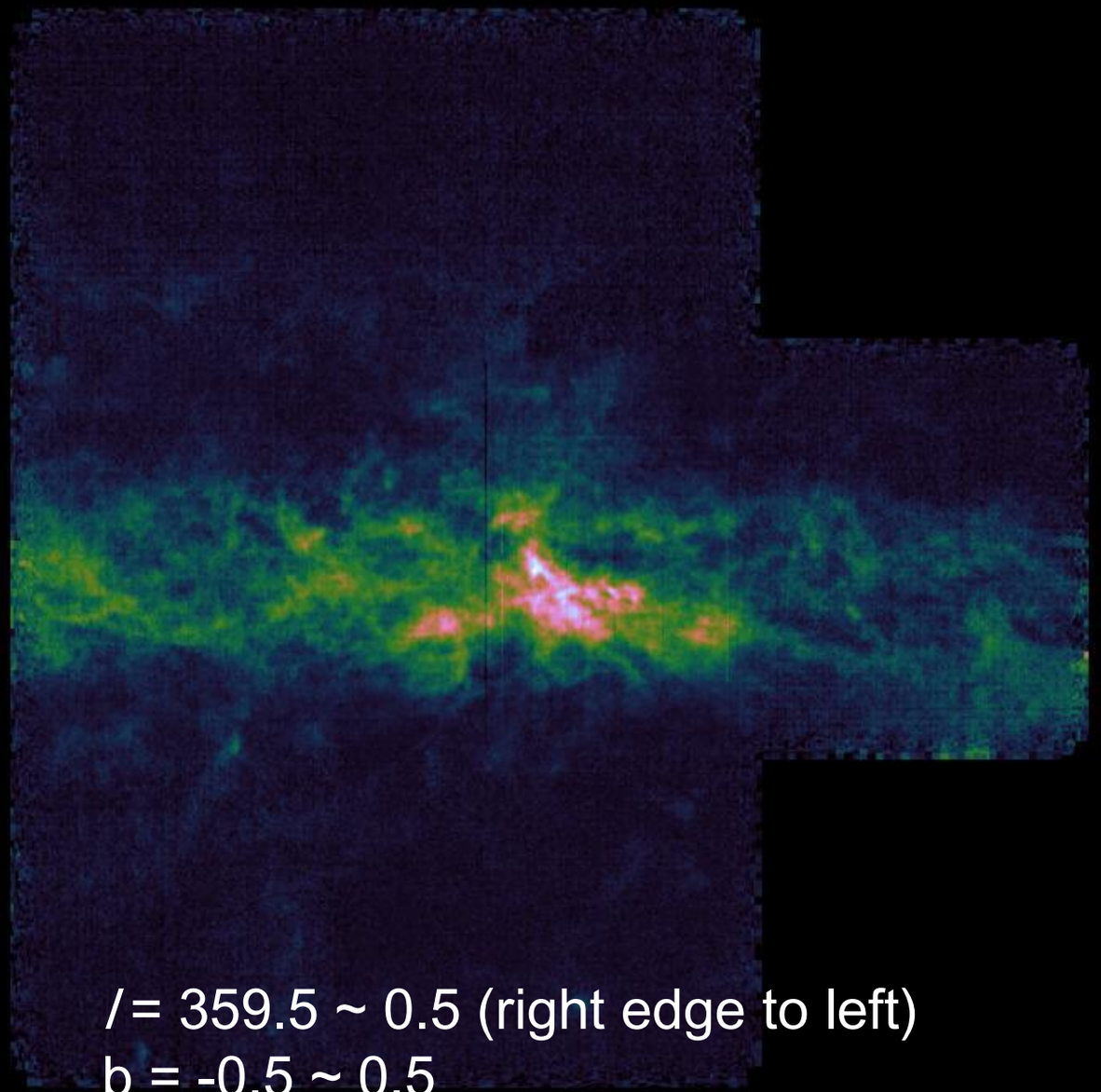


/ = 359.2 ~ 1.2 (right edge to left)
b = -0.5 ~ 0.5
v = -150 ~ +150 km/s

CHIMPS2 Progress

CMZ

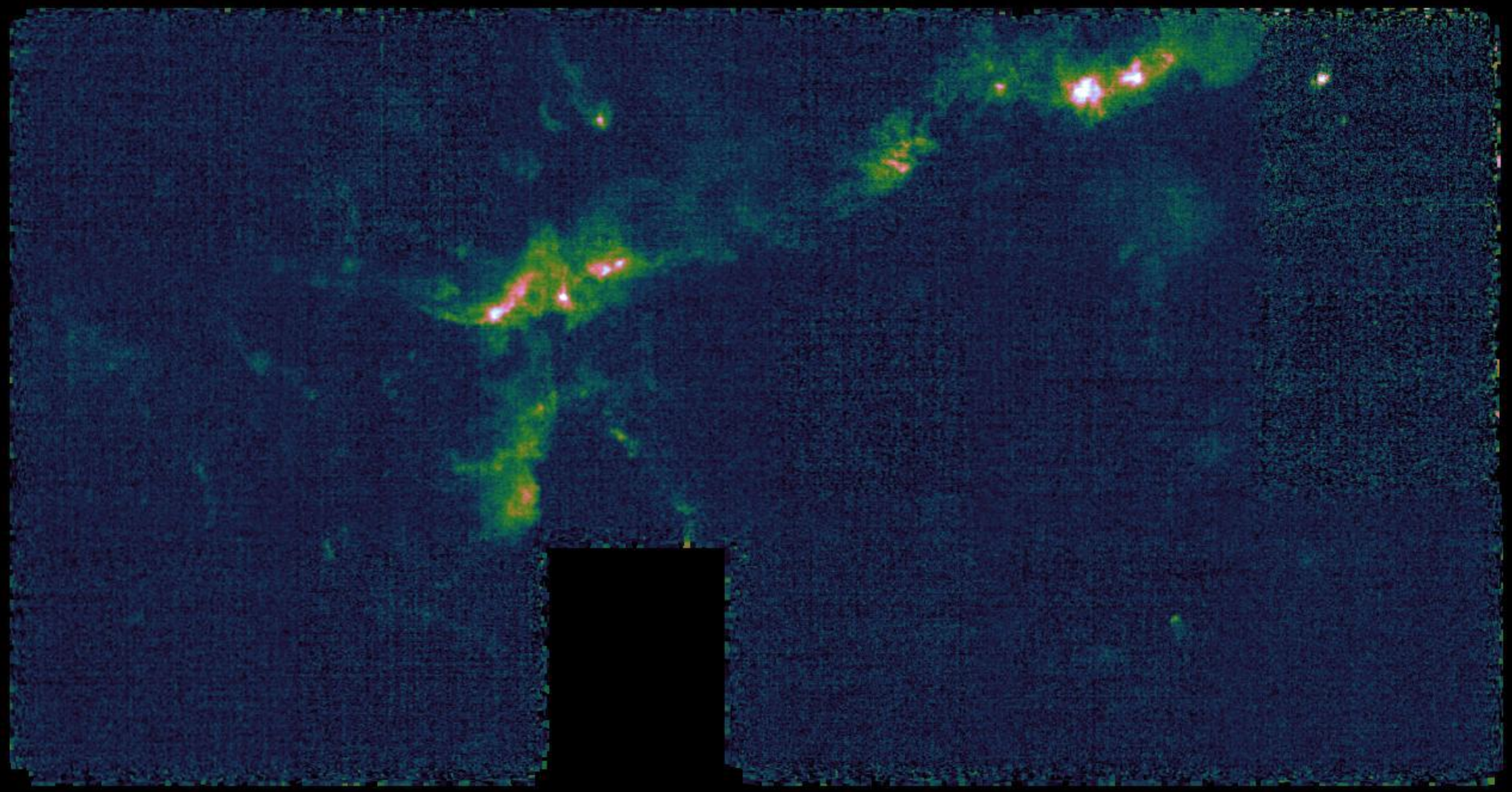
^{13}CO



/ = 359.5 ~ 0.5 (right edge to left)
b = -0.5 ~ 0.5
v = -150 ~ +150 km/s

CHIMPS2 Progress

Outer Galaxy



^{12}CO

/ = 216.8 - 218.9 (right edge to left)
b = -1 ~ 0
v = +10 - + 65 km/s

Summary

- A full description of CHIMPS can be found in Rigby et al. (2016).
- High resolution temperature, optical depth and column density maps will be available soon.
- New survey - CHIMPS 2- is taking data looking to map a large portion of the Galactic Plane