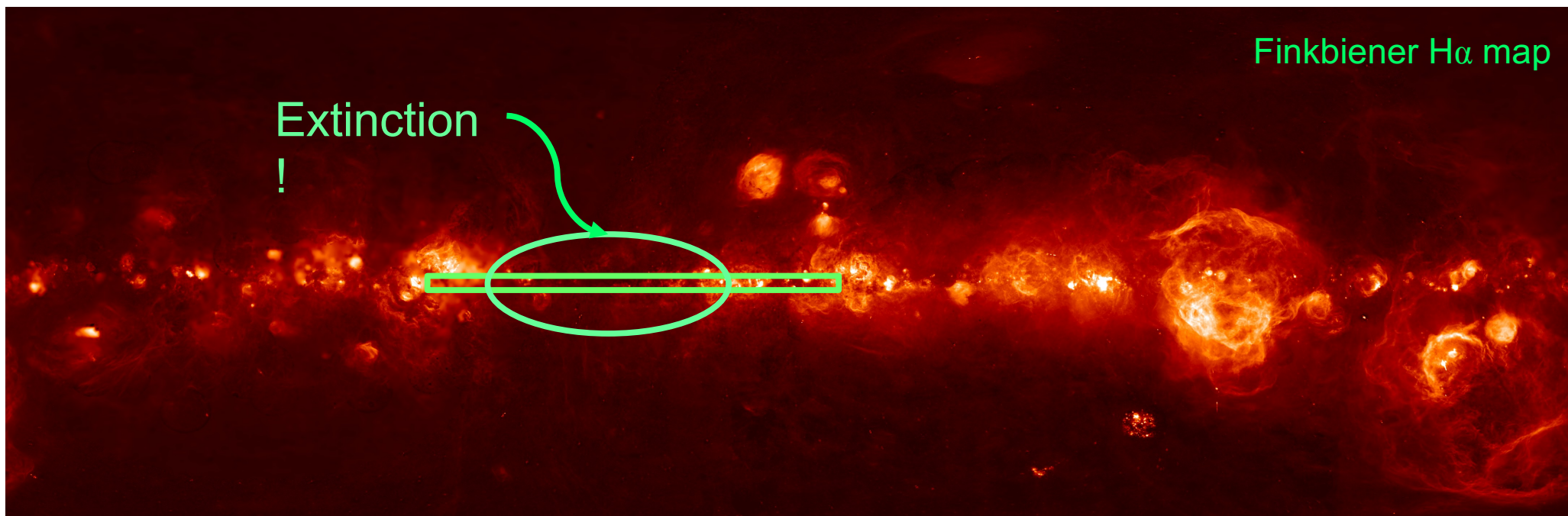


Motivation

Observations of RRLs are needed to map the WIM in the Galactic plane; and these observational data are currently lacking.

The Galactic plane WIM distribution is the connection between high mass star formation and the ISM.



GDIGS: The GBT Diffuse Ionized Gas Survey

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The Warm Ionized Medium (WIM)

The WIM is a low-density ($\sim 0.1 \text{ cm}^{-3}$), $\sim 10^4 \text{ K}$ plasma first proposed by Hoyle and Ellis (1963).

- It comprises $\sim 20\%$ of the total Milky Way gas mass and $\sim 90\%$ of its ionized gas (Reynolds, 1991), and is therefore a significant source of pressure at the midplane
- Can be traced using $\text{H}\alpha$ (for low-extinction lines of sight), or radio recombination lines (RRLs; for higher extinction lines of sight)

GDIGS: The GBT Diffuse Ionized Gas Survey

- Basic Parameters:
- C-band 4-8GHz
- 64 simultaneous tunings in two polarizations:
23 Hn α lines, 26 Hn β lines, 7 Hn γ lines,
Formaldehyde (H₂CO and H₂¹³CO) and methanol
(CH₃OH)
- Will cover the first Galactic quadrant $32^{\circ} > l > -2^{\circ}$,
 $|b| < 0.5^{\circ}$.
- Spatial resolution $\sim 1'$, beam size $\sim 3'$
- RRL sensitivity of ~ 2 mK (1mJy/beam)
- Awarded 368 hours in semesters 17B and 18A.

GDIGS: The GBT Diffuse Ionized Gas Survey

- Primary data products:
- Individual and average RRL maps of the 23 Hn α lines
- Individual and average Hn β and Hn γ RRL maps (26 and 7 lines, respectively)
- Continuum maps at \sim 60 frequencies from 4.3 to 7.5 GHz (some are compromised)
- Formaldehyde (H₂CO and H₂¹³CO) and methanol (CH₃OH) maps

Science Goals


- Determine the distribution of diffuse ionized gas in the Galactic plane, and its connection with high mass star formation
- Compare the dynamics of diffuse ionized gas with that of HI and CO
- Compare the properties of the WIM with those of discrete HII regions
- Produce unbiased maps of H_2CO and CH_3OH

Progress to Date

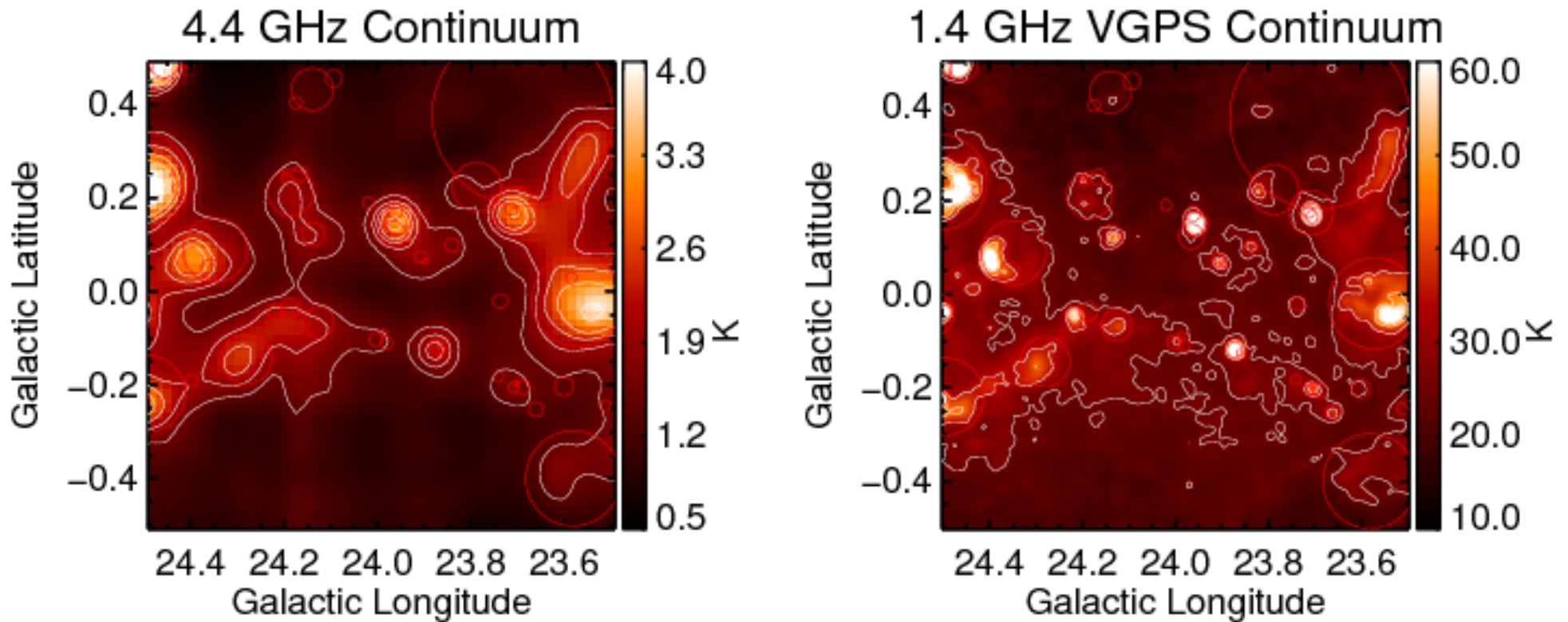
We have mapped the W43 region near $l=30^\circ$, the W31 region near $l=24^\circ$, the W24 region near $l=10^\circ$, and the Galactic center.

Extensions above and below the plane have not resulted in many detections.

Green and blue show regions already completed, red the planned observations.
Background is Planck 70 GHz.



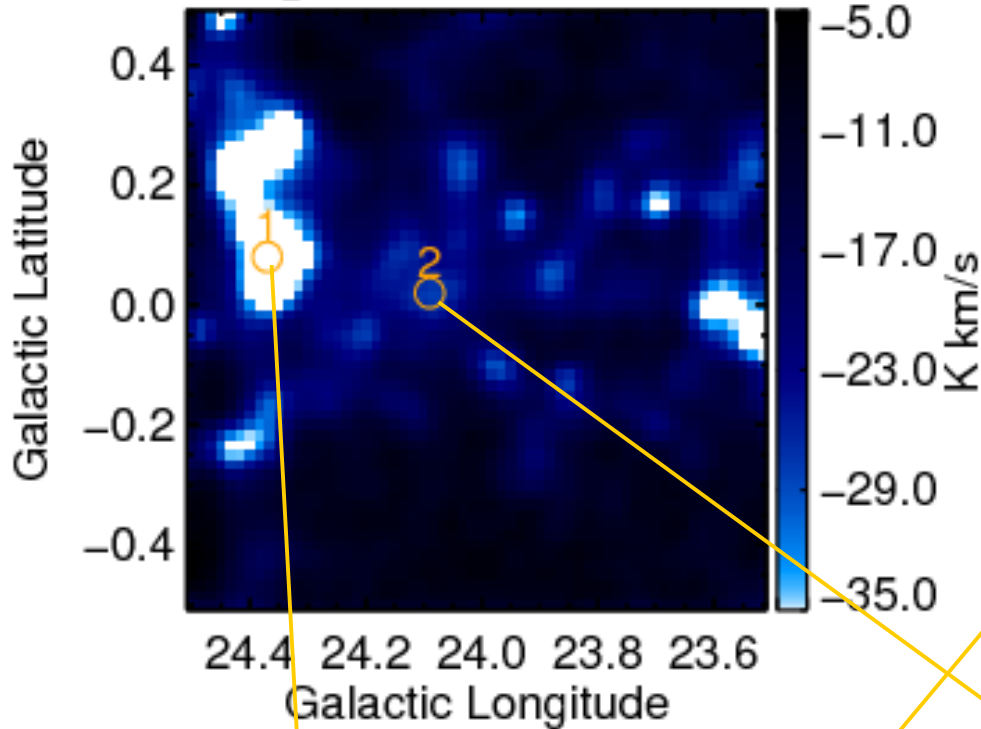
Continuum



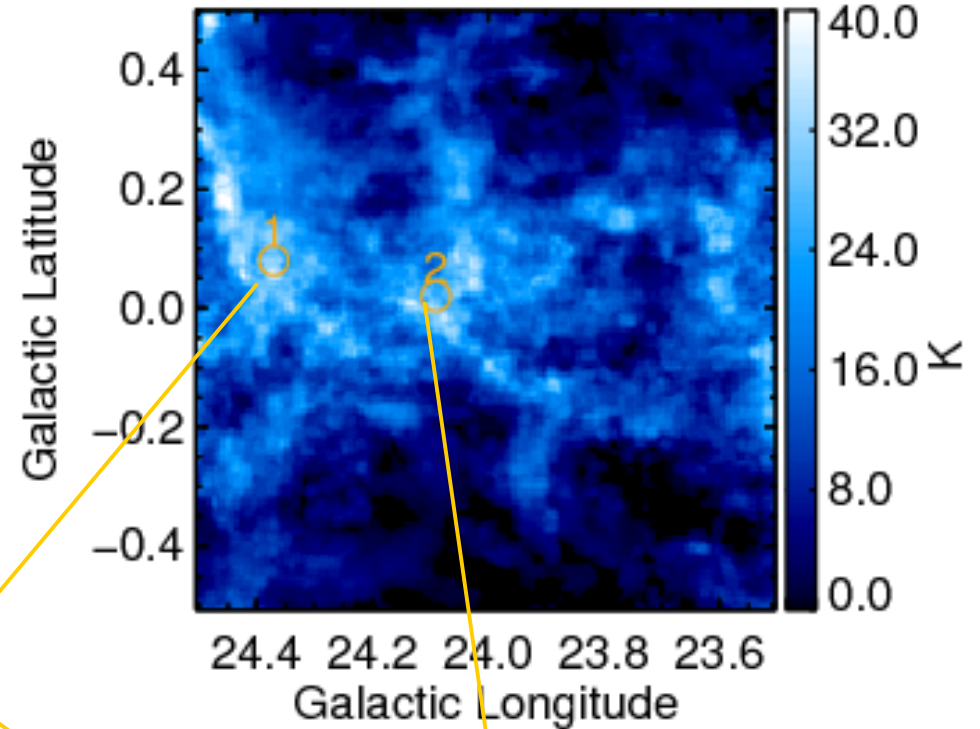
Continuum fidelity is surprisingly good; most of the 64 IFs have good continuum

Formaldehyde

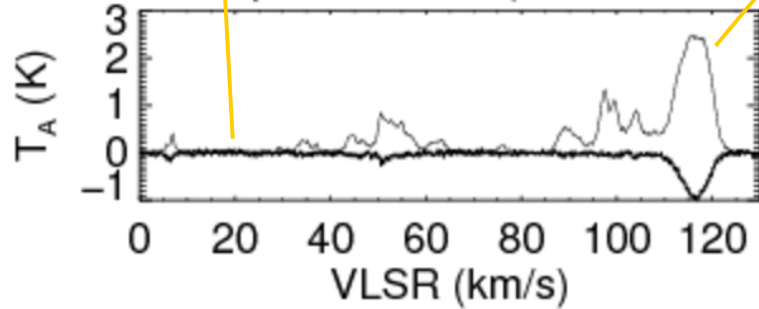
H₂CO – Moment 0



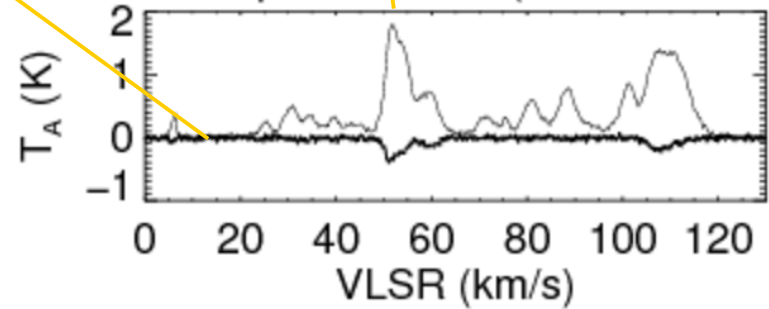
GRS ¹³CO – Moment 0



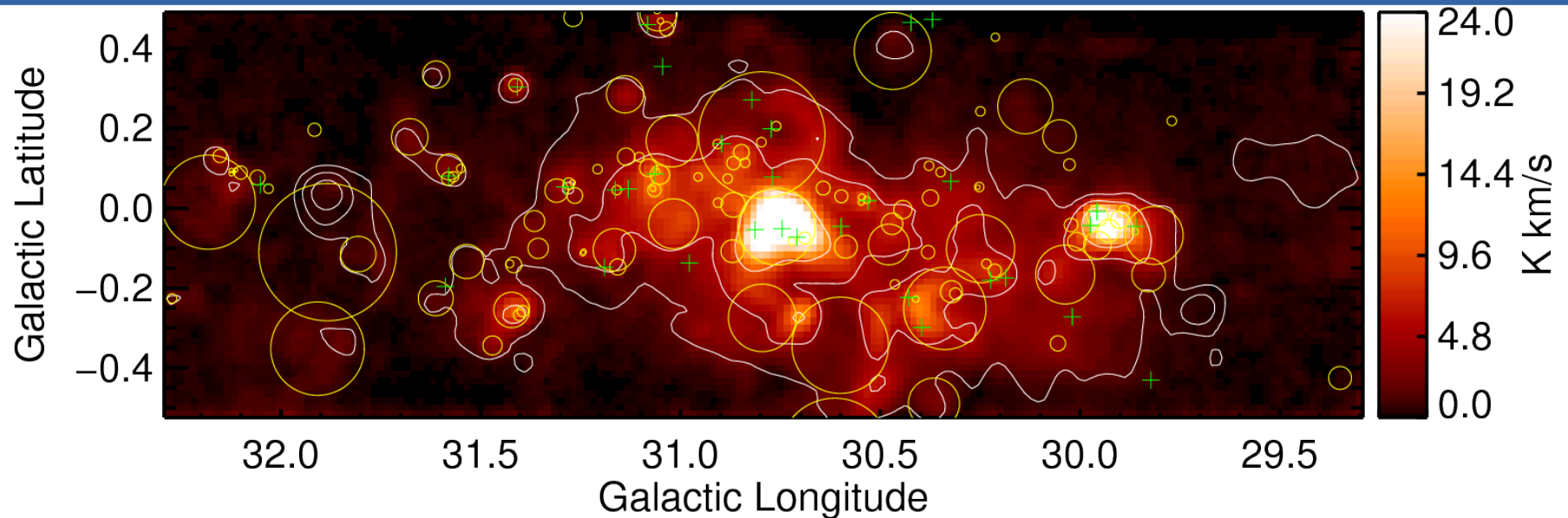
Mol. Spectrum 1 (24.37, 0.08)



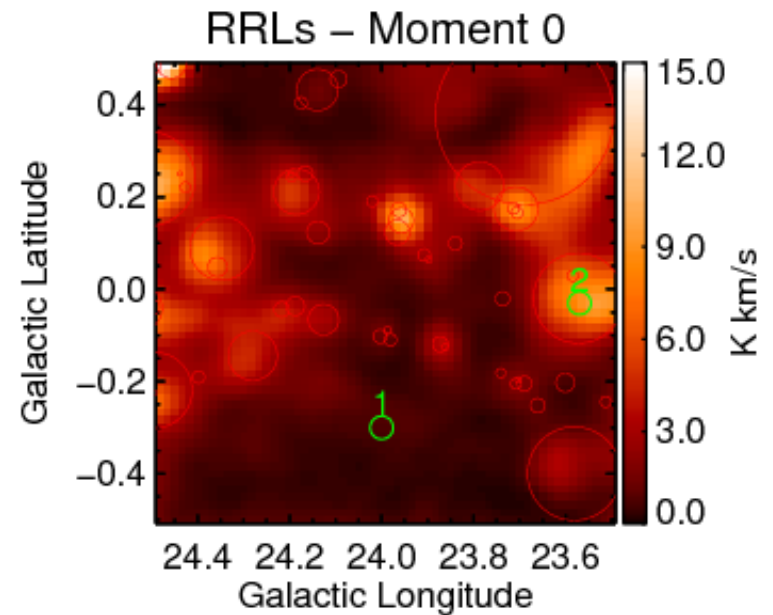
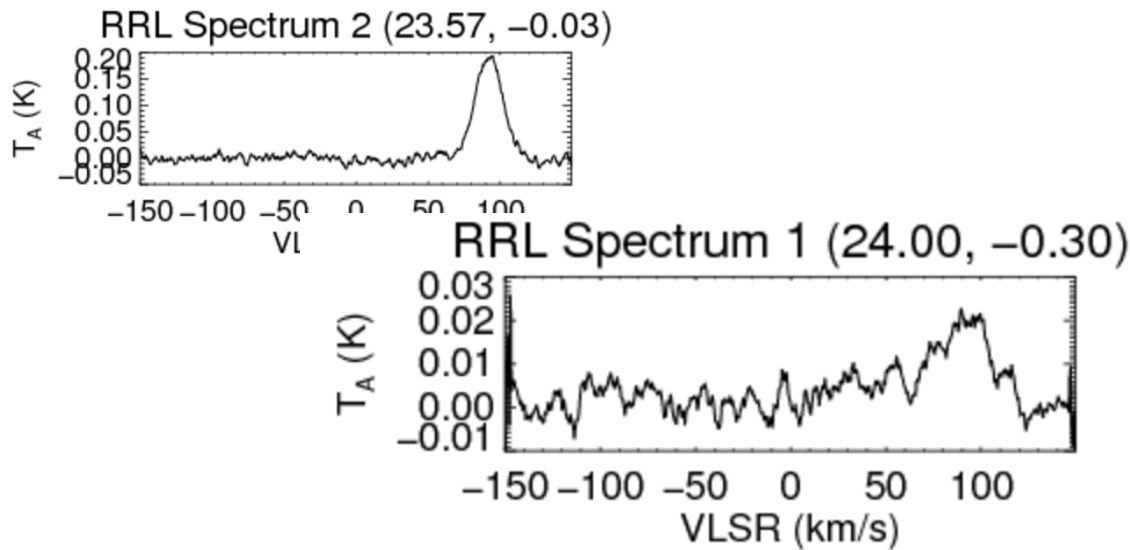
Mol. Spectrum 2 (24.09, 0.02)



H α Average RRLs



Moment 0 map. Yellow circles are discrete HII regions, green crosses are locations of methanol masers detected in our data.



Summary

GDIGS is an ongoing, sensitive, C-band survey of the Galactic plane in RRL, formaldehyde, and methanol emission.

Data collection is ongoing, and will (hopefully!) complete in the 2018A semester.

Stacking of RRLs is a very powerful technique that makes use of wide bandwidths; multi-pixel cameras would further increase the efficiency.

This work can only be done with single-dish radio telescopes!

