



SPLASH, GASKAP and Galactic OH

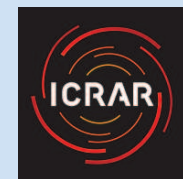
Joanne Dawson | Macquarie University / CASS

Andrew Walsh | Curtin University / ICRAR

And the SPLASH & GASKAP teams



MACQUARIE
University

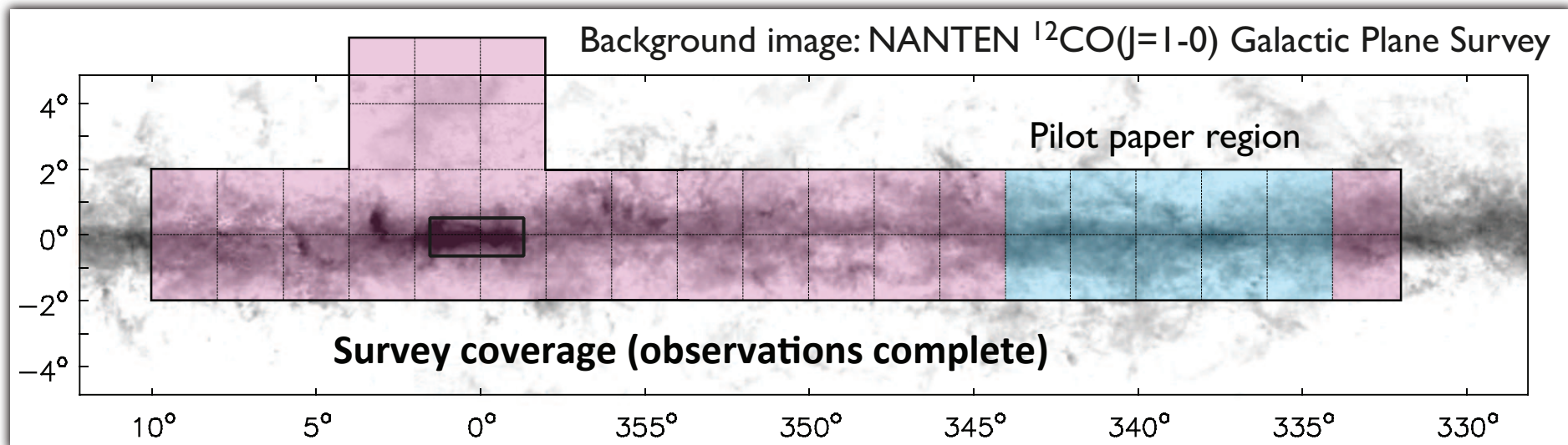
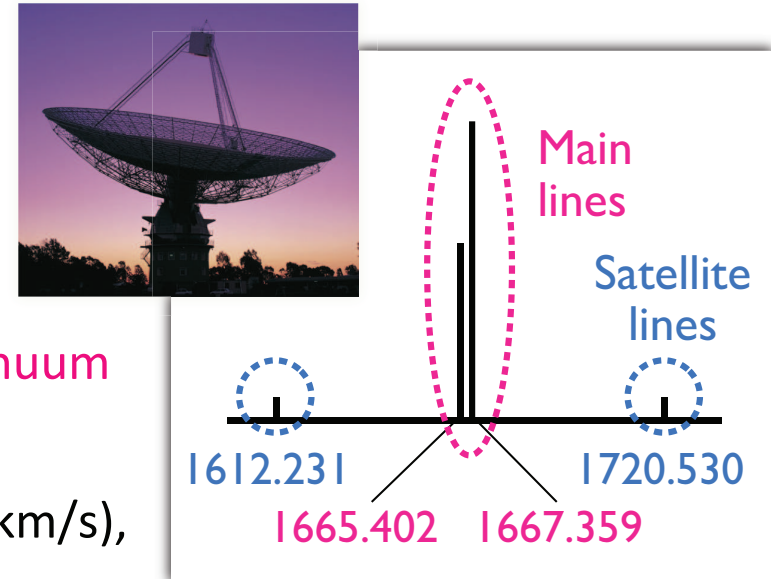


+ many more...

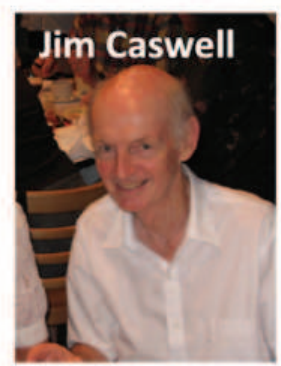
The SPLASH Survey



- Southern Parkes Large-Area Survey in Hydroxyl
- Unbiased, fully-sampled, large-scale OH survey of the Galactic Plane
- All four ground state transitions of OH
 - 1612, 1665, 1667, 1720 MHz + 1.6-1.7 GHz continuum
- Low resolution, high sensitivity:
 - Effective HPBW = 15', $\sigma = 15\text{-}20$ mK (for $\delta v = 0.7$ km/s), raw $\delta v = 0.18$ km/s



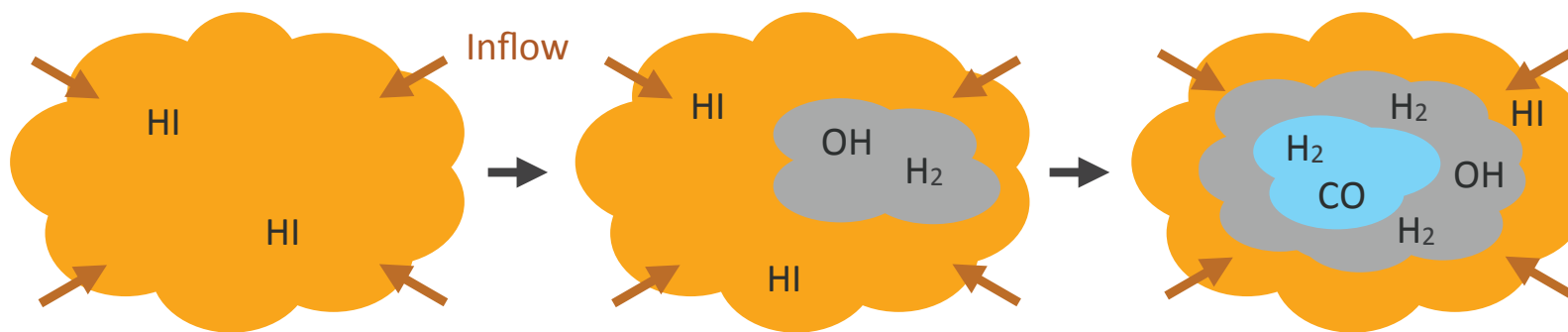
The SPLASH Team



GASKAP-ers

- **CO-dark H₂: the “dark” ISM**

- OH present where CO is not - recover the Milky Way’s hidden molecular gas



- **Environmental conditions in the OH-bright ISM**

- Excitation modeling gives local IR field, density, kinetic temperature...

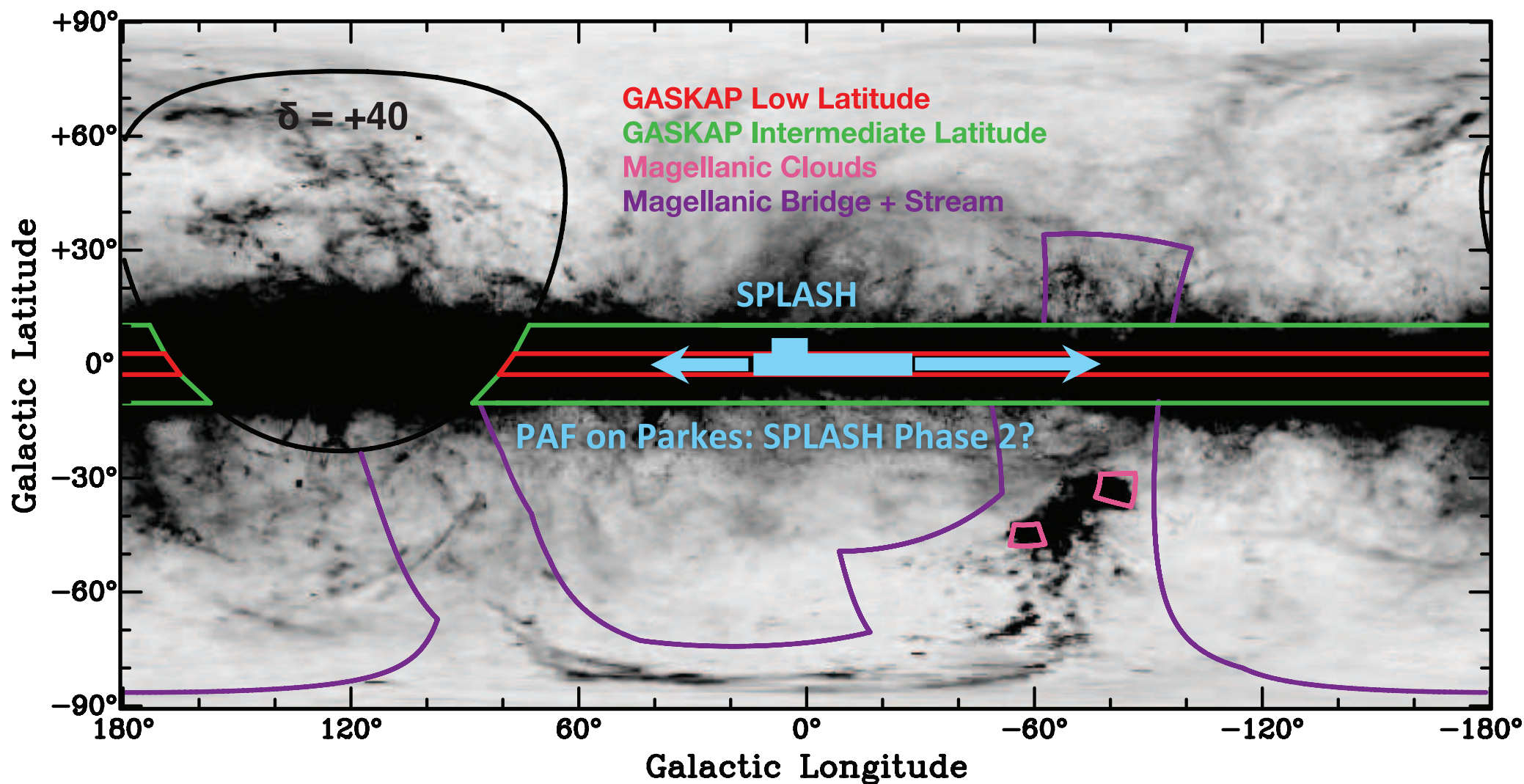
- **Probing Galactic structure**

- A new tool for disentangling blended structures along the line of sight

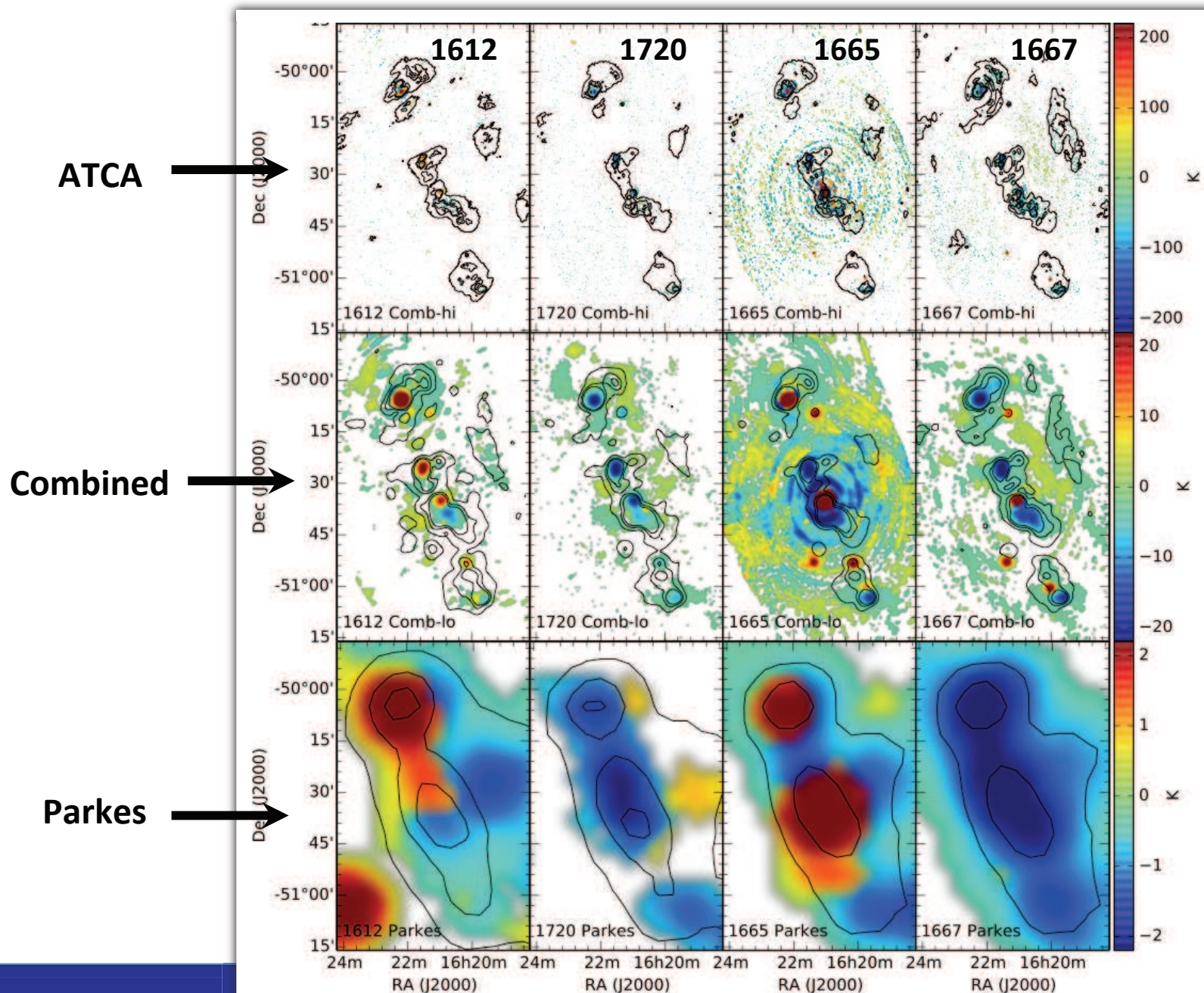
- **Deepest ever OH maser survey**

- Positions and polarisation properties (ATCA)
- Star formation studies, magnetic field studies...

Zero Spacings Data for GASKAP



Zero Spacings Data for GASKAP

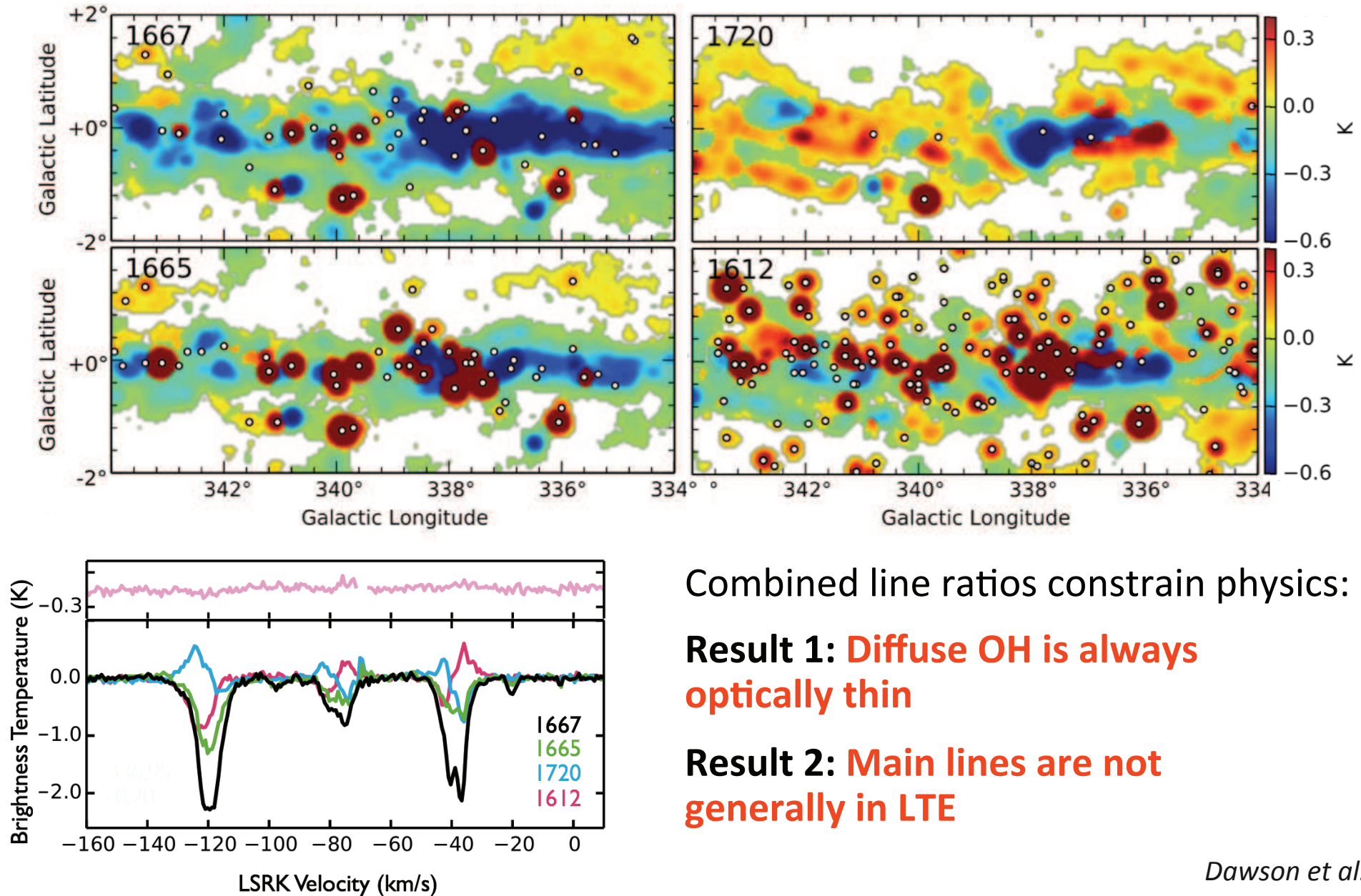


Preliminary tests
with Parkes and
ATCA OH data

GASKAP + SPLASH:
refine combination
strategy

Peltzer, Cunningham,
Jones et al. (in prep)

Early Analysis: Laying the Groundwork



Combined line ratios constrain physics:

Result 1: Diffuse OH is always optically thin

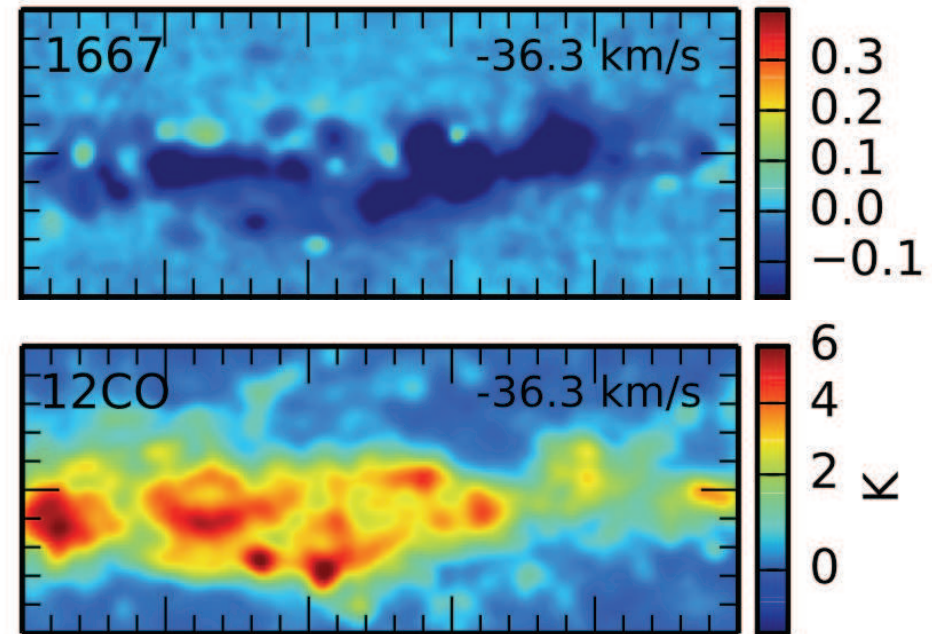
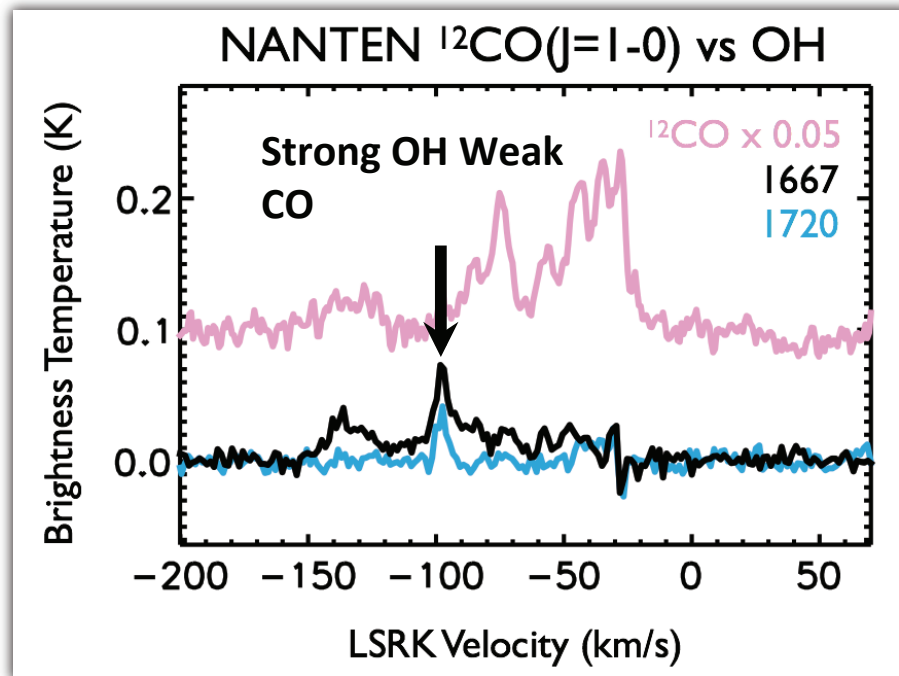
Result 2: Main lines are not generally in LTE

Dawson et al. (2014)

CO-dark H₂: SPLASH

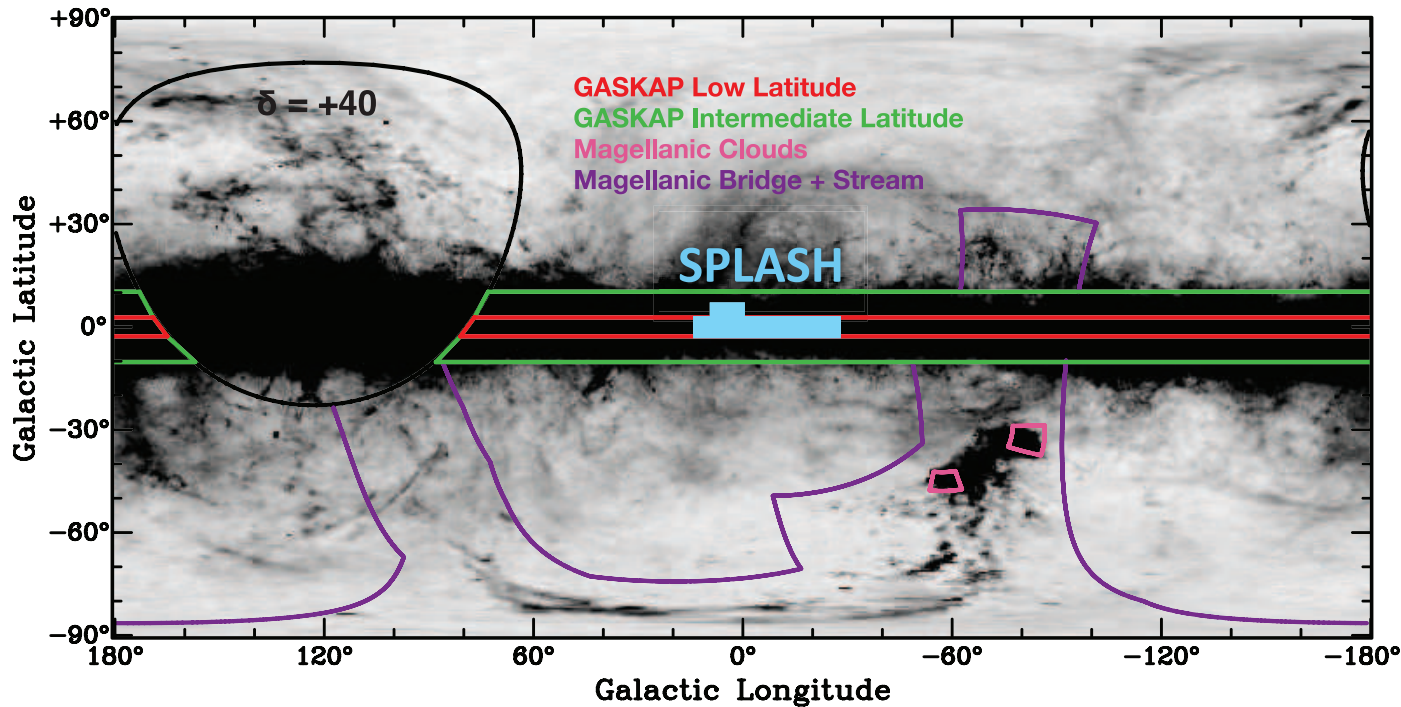


- Pilot region: **OH and CO well-mixed** on scales of Parkes beam (5~50 pc)
- **Spatially extended CO-dark layers not seen** - unlike Outer Galaxy & local clouds



- Is the Inner Galaxy different? Thin envelopes? Embedded pockets?
- Focus on high-contrast midplane ($T_c \gg T_{ex}$)
- Compare CO- and OH-derived columns to recover CO-dark H₂

CO-dark H₂: GASKAP



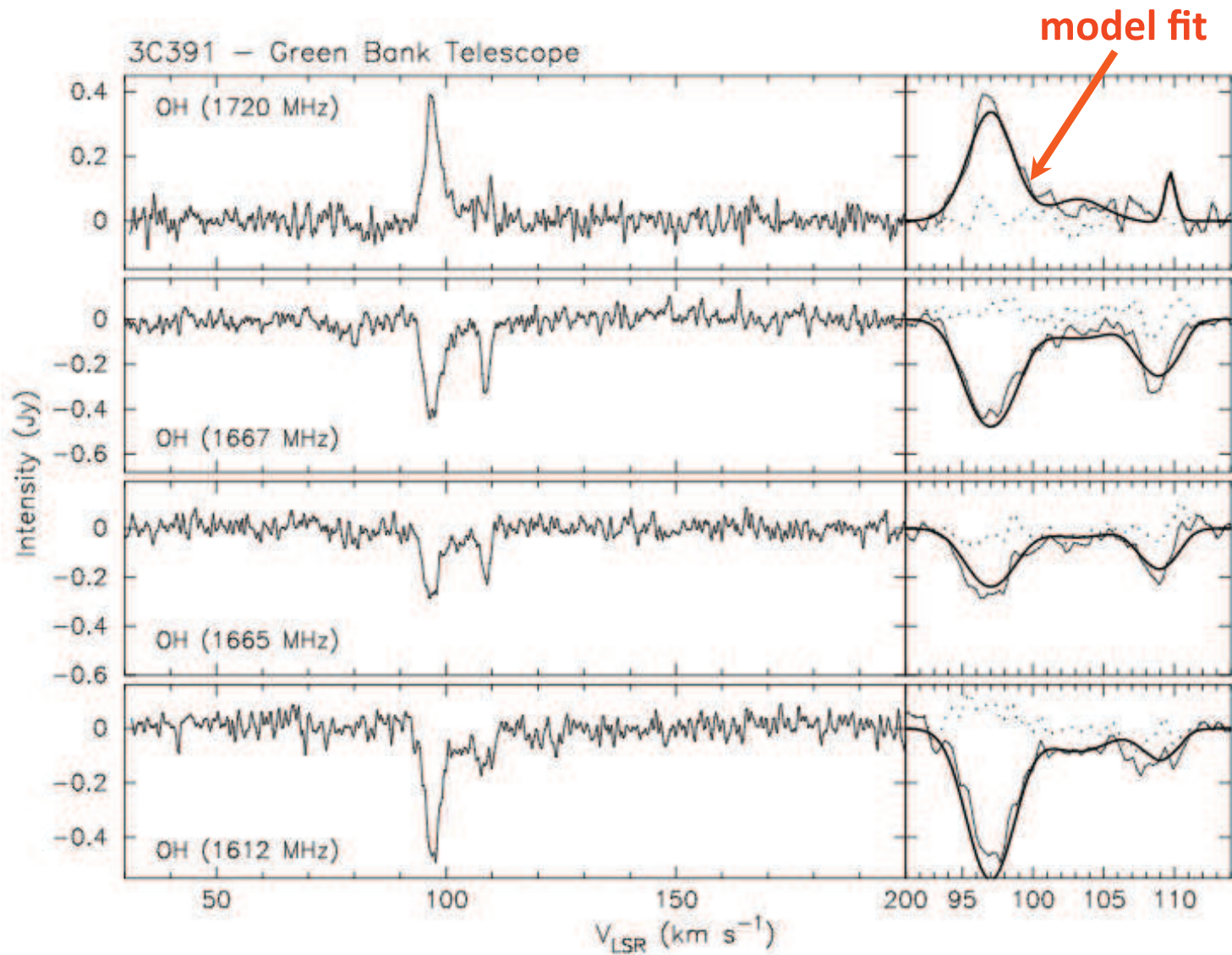
- Small beam: absorption against bright continuum sources
- Detect CO-dark OH components to far better sensitivity than SPLASH
- 2000 extragalactic sources ($T_b > 500\text{K}$) in full GASKAP survey!

• Combined SPLASH + GASKAP data: off-source emission spectra \rightarrow derive T_{ex} and τ

- **Accurate OH column densities!**

- Lock in T_{ex} and τ at sample of ~ 100 positions in SPLASH region \rightarrow **calibrate full SPLASH survey**

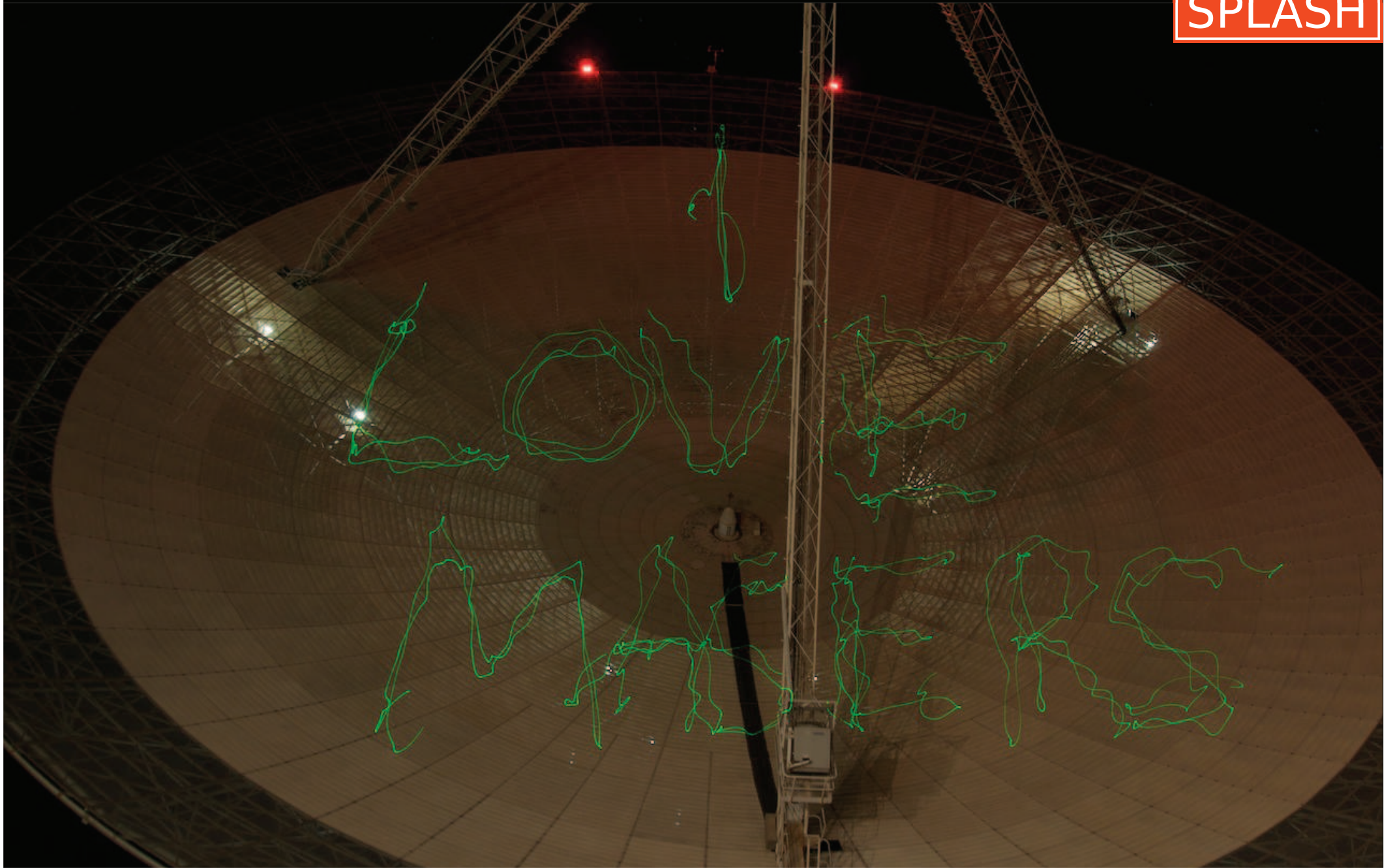
OH Excitation Modelling



- **Full set of all four OH lines** has immense potential
- Translate to measurable physics via **excitation / radiative transfer models**
- T_{ex} , T_{k} , IR field, $n(\text{H}_2)$, τ ...
- **Probe physical state of the CO-dark H_2 !** (And all OH-bright gas)



SPLASH Project status, masers and the Galactic Centre

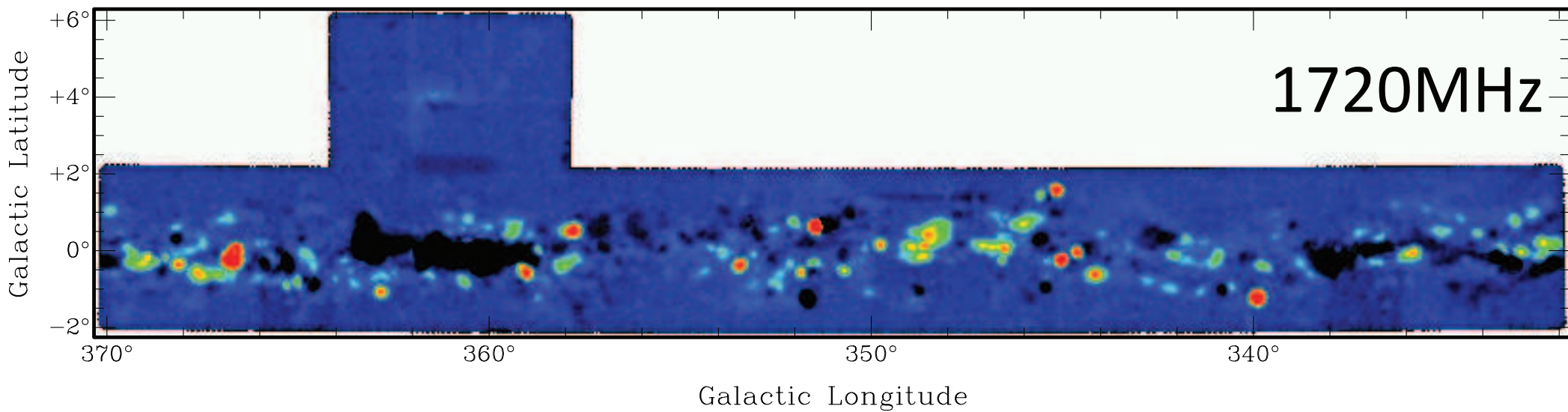
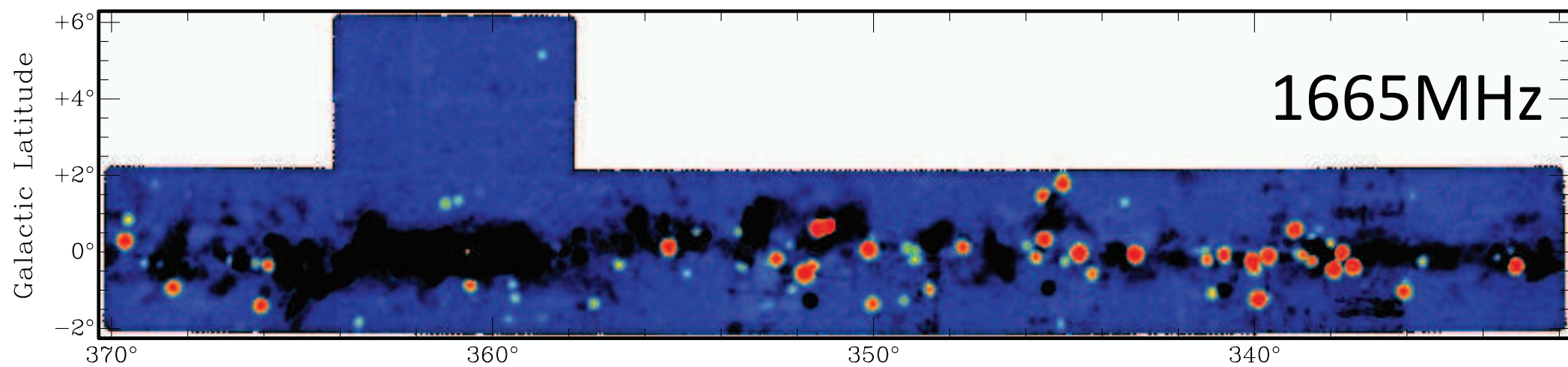
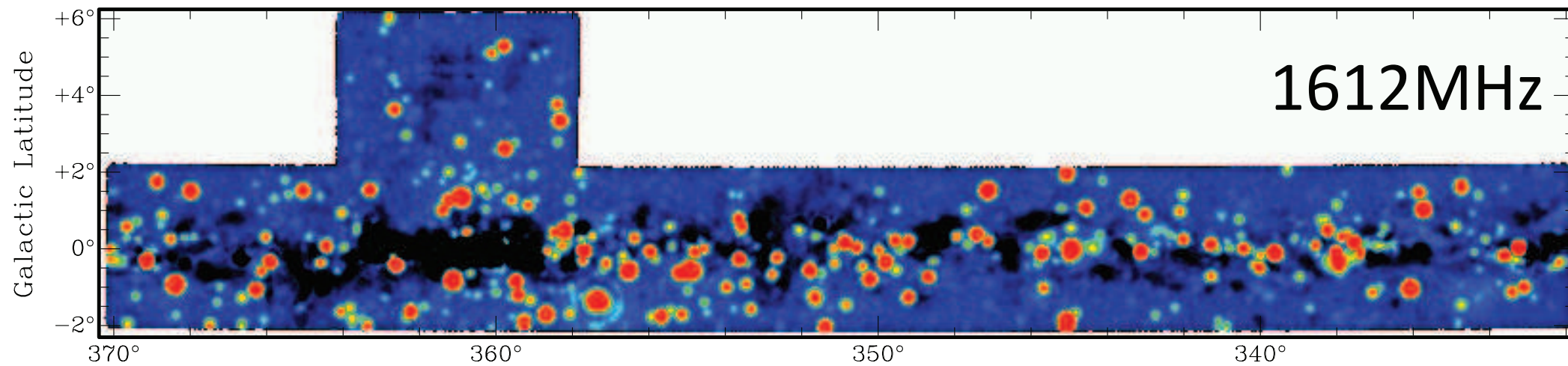


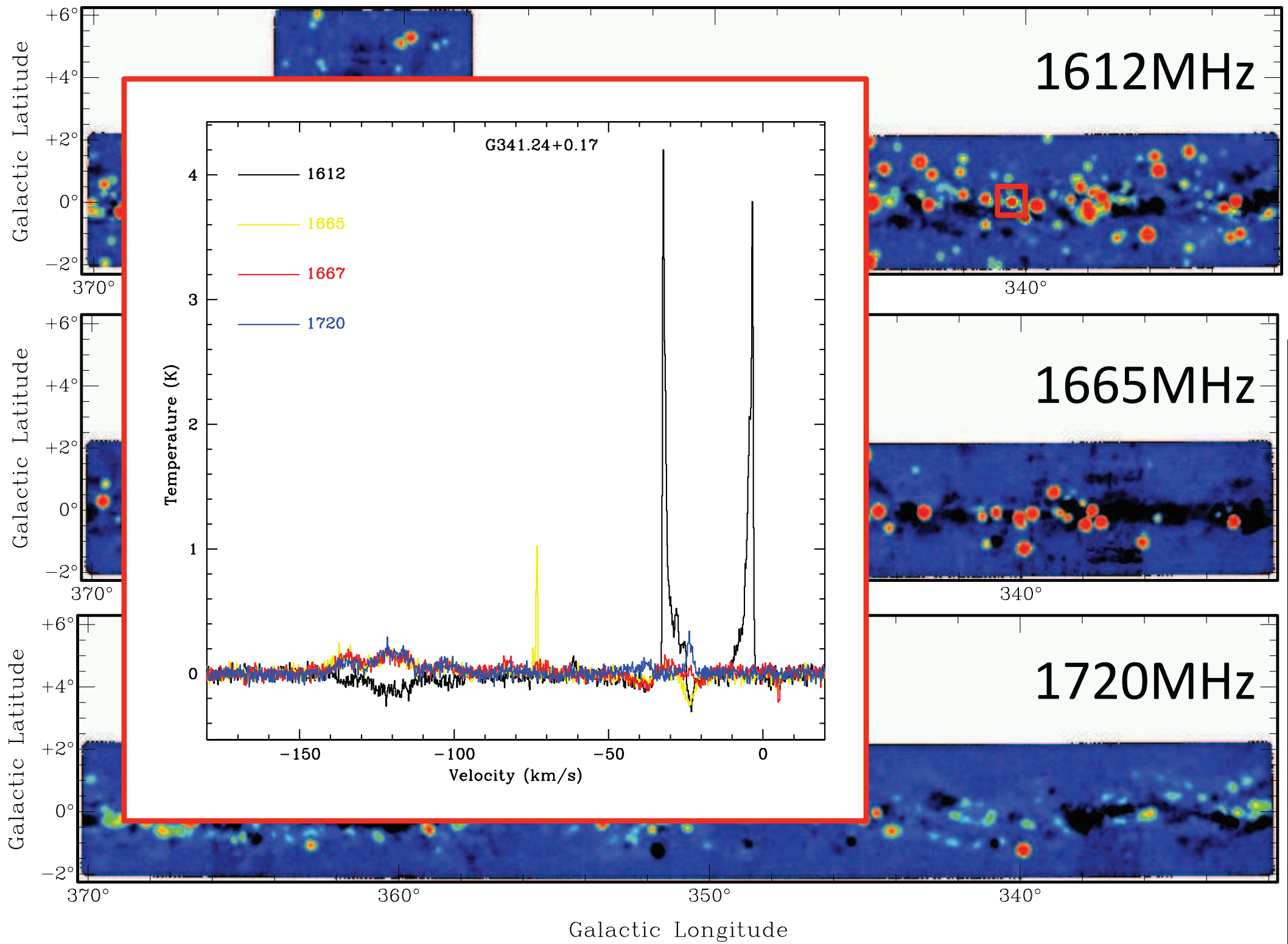


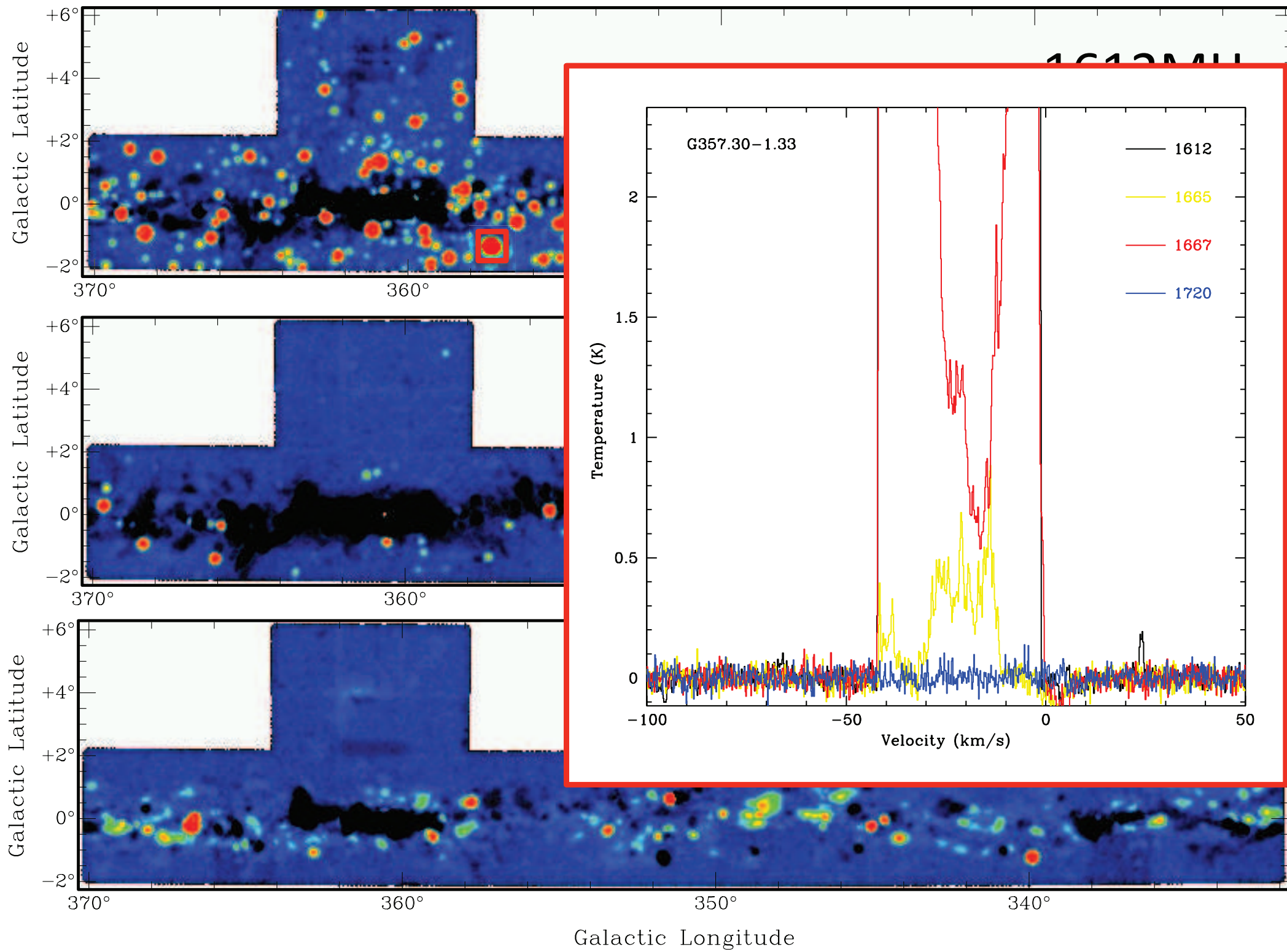
SPLASH: Project Status

- Parkes observations complete
- Data reduction pipeline close to complete
 - Calibration complete
 - Severe RFI removal complete
 - Bandpass removal complete
 - Excision of subtle RFI still underway
 - Characterisation of data underway

1612 data complete. 1665/1667/1720 still need fine tuning

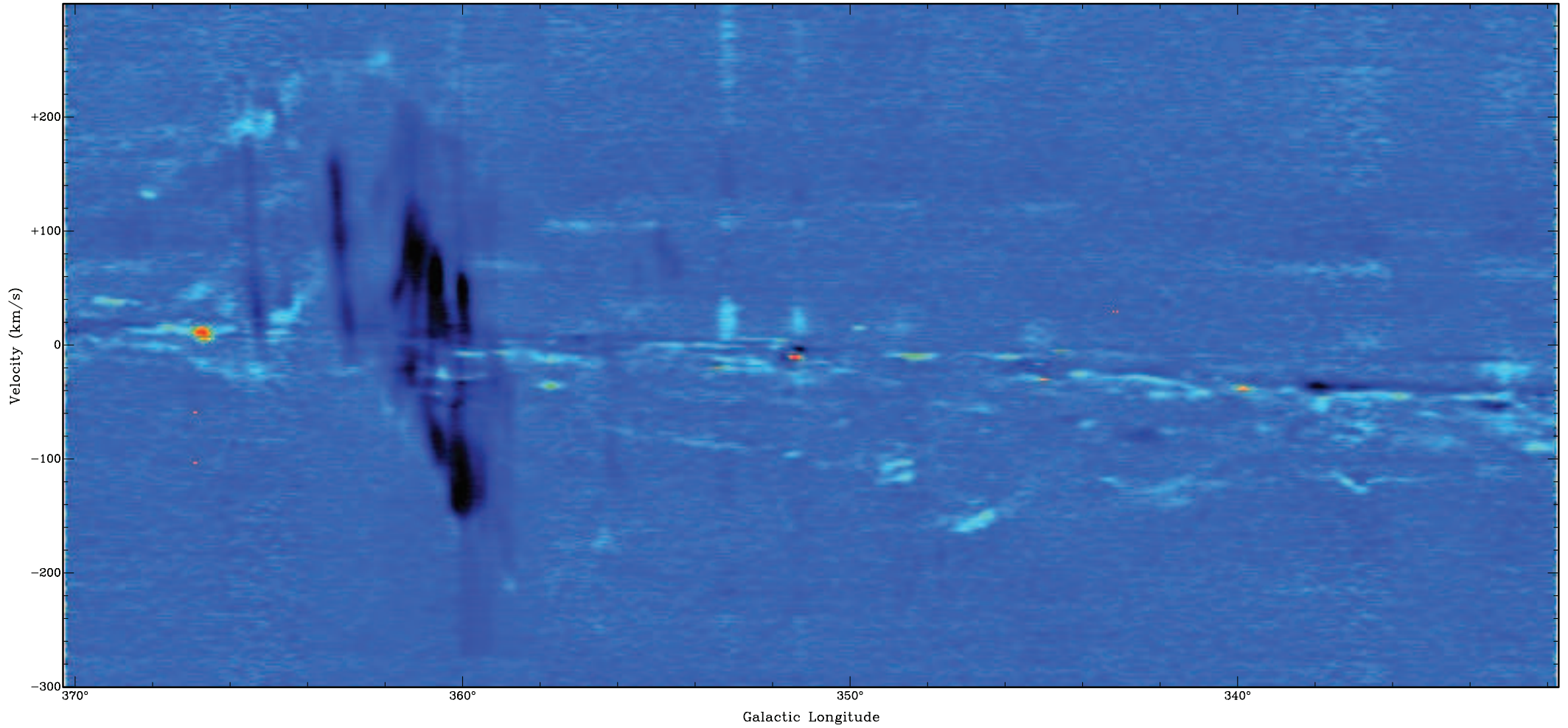




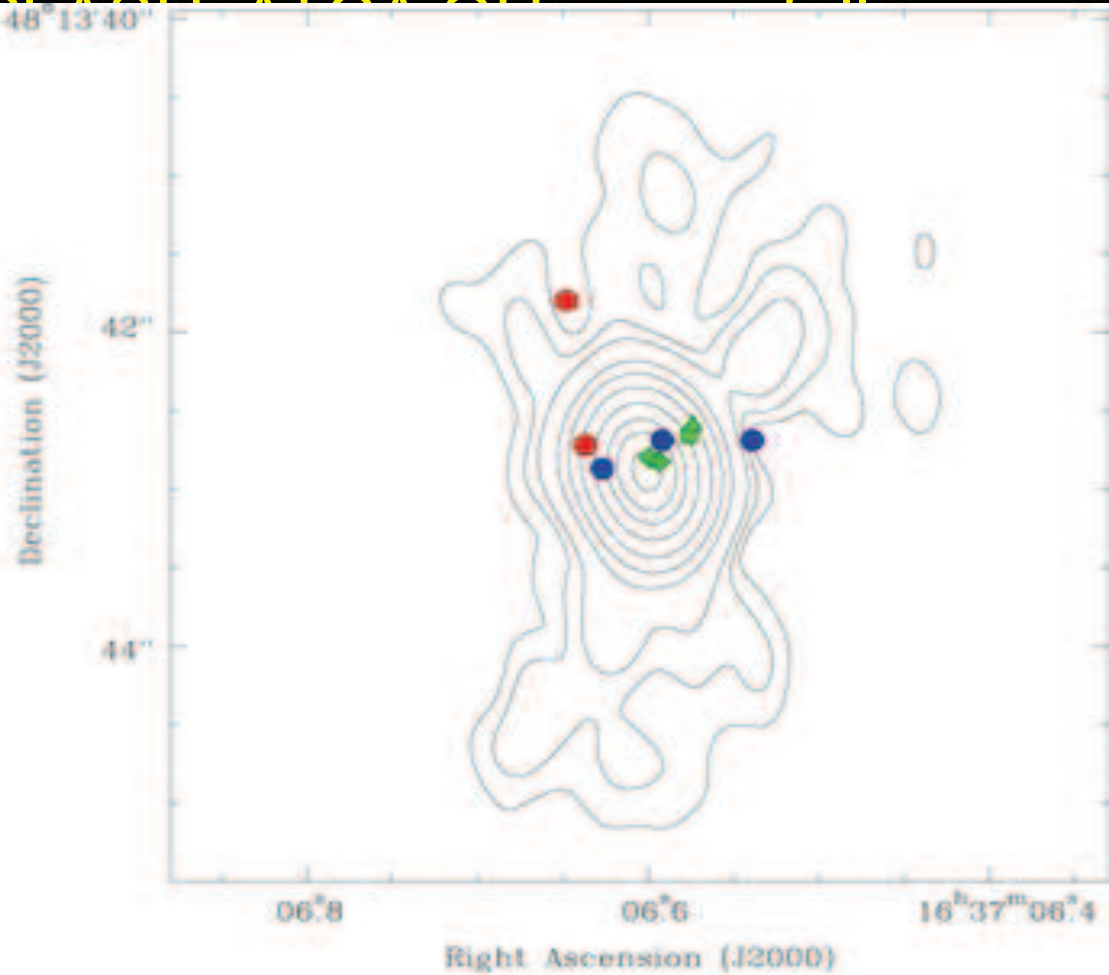




The Galactic Centre



- Use the ATCA
- Observations
- Paper on OH
- Data reduction



Submission

Figure 4 from Unusual Shock-excited OH Maser Emission in a Young Planetary Nebula
 Hai-Hua Qiao et al. 2016 ApJ 817 37 doi:10.3847/0004-637X/817/1/37



SPLASH + GASKAP

- Many more masers!
 - SPLASH + ATCA followup ~ 1,000 masers
 - GASKAP ~ 15,000 masers
- Trace Galactic Structure
- Compare to other maser species
- Time variability of masers



Summary

- SPLASH data products close to release
- Early science is now out – more to come
- Ready to combine SPLASH+GASKAP data

