

CI in Vela and G333

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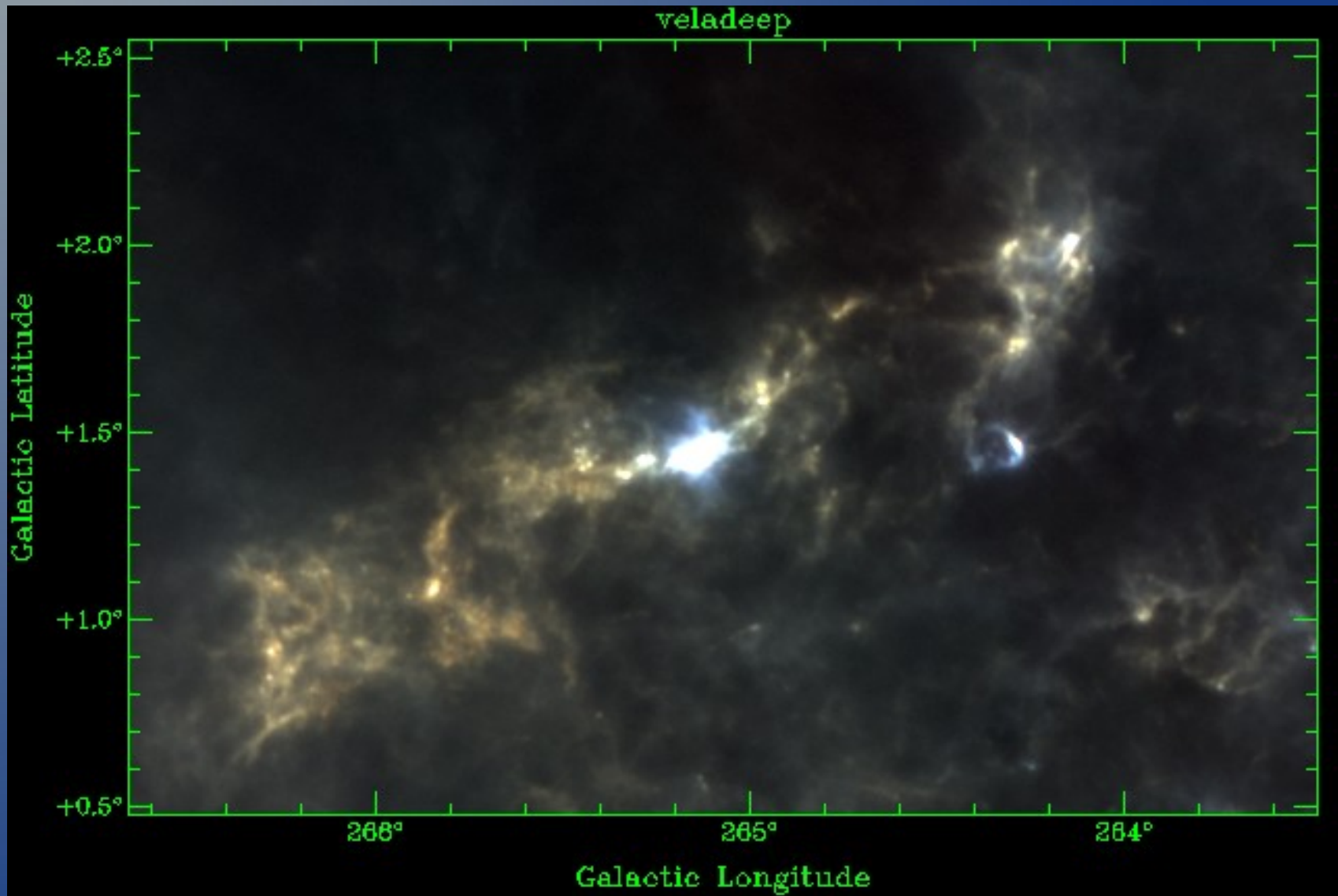
Part of NANTEN2 'High Mass Star Formation'
project

Incl. Robert Simon (Univ. Koeln), Leonardo
Bronfman (Univ. Chile) etc

Vela

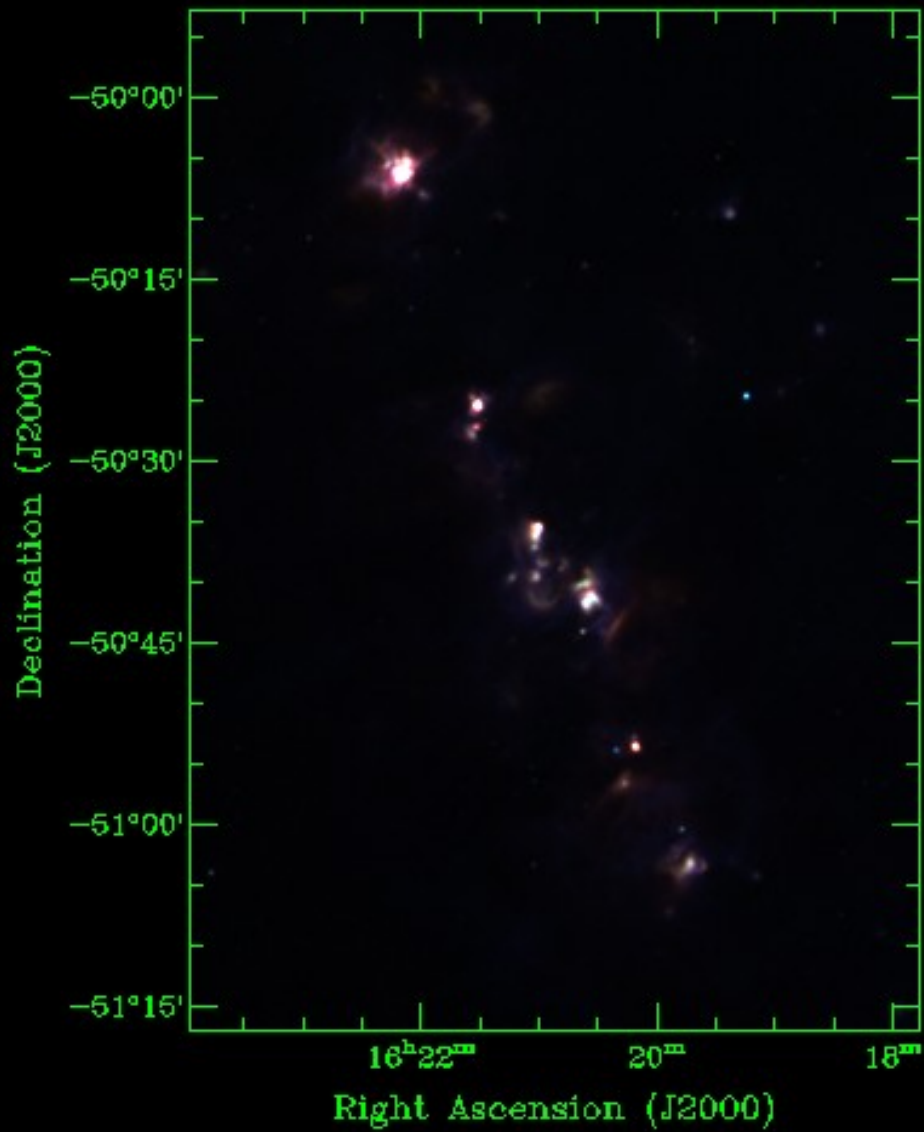
- Vela Molecular Ridge, Vela C
- Distance 700 pc, early stages of star formation ($< 10^6$ yr) with high, intermediate and low mass stars
- Mopra observations 3-mm, 7-mm and 12-mm, M401, PI Vicki Lowe, and fast CO mapping, M635, PI Laura Fissel
- Also BLAST-Pol, Herschel HOBYS target

Vela - BLAST 250, 350, 500 micron



G333

- Giant Molecular Cloud complex, distance 3.6 kpc, with high mass star formation
- Well studied with Mopra 3-mm mapping (M156, PI Maria Cunningham), plus ATCA and Parkes followups (continuum at cm and mm, OH etc)



G333 —

MSX bands
C, D and E

G333

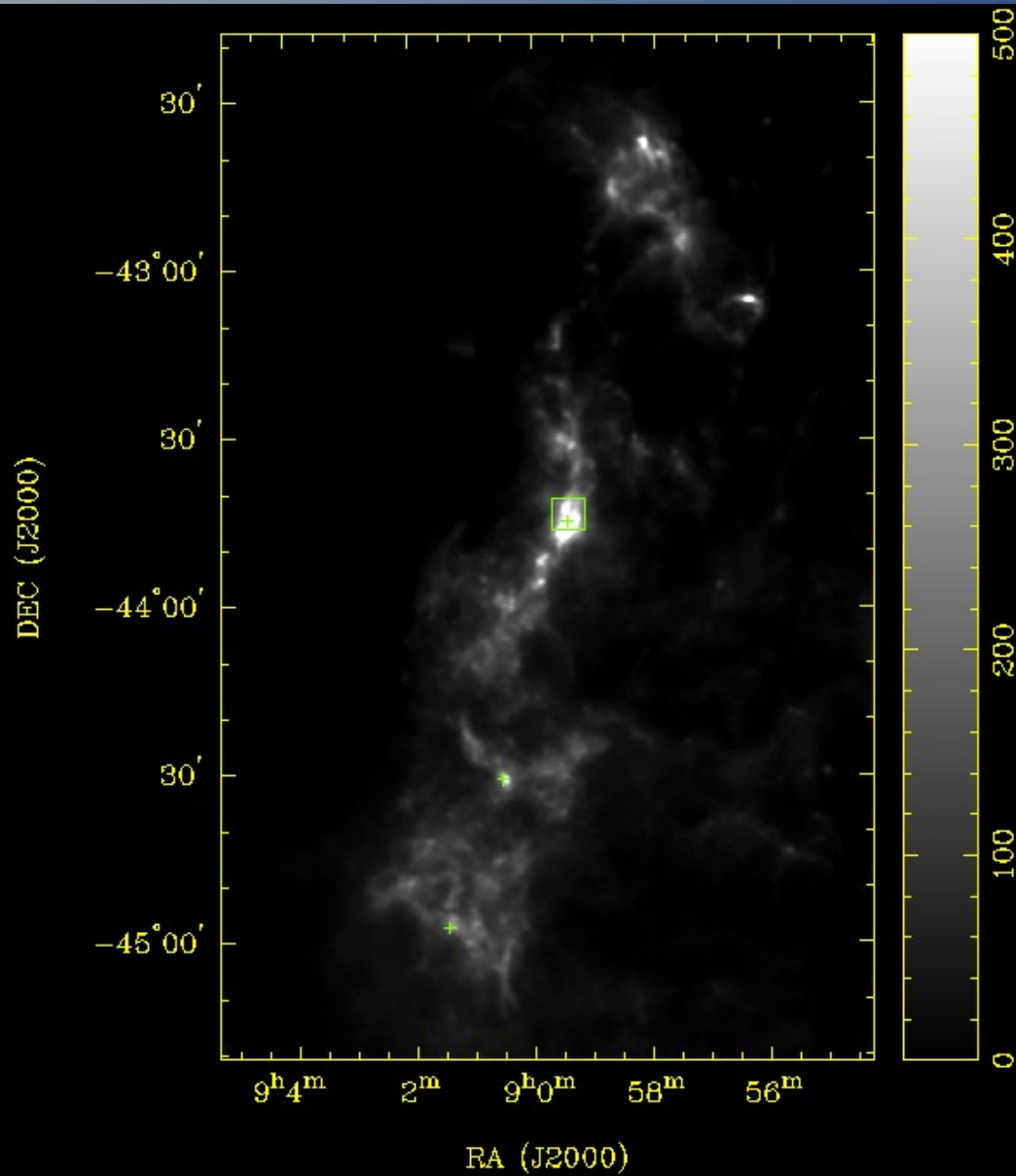
- Bains I., Wong T., Cunningham M., et al., 2006, 'Molecular Line Mapping of the Giant Molecular Cloud Associated with RCW 106 - I: ^{13}CO ', MNRAS, 367, 1609 - 1628
- Breen S.L., Ellingsen S.P., Johnston-Hollitt, M., et al., 2007, 'A search for 22-GHz water masers within the giant molecular cloud associated with RCW 106', MNRAS, 377, 491 - 506
- Lo N., Cunningham M., Bains I., et al., 2007, 'Detection of SiO emission from a massive dense cold core', MNRAS, 381, L30 - L34
- Wong T., Ladd E.F., Brisbin D., et al., 2008, 'Molecular line mapping of the giant molecular cloud associated with RCW 106 – II. Column density and dynamical state of the clumps', MNRAS, 386, 1069 - 1084

G333

- Lo N., Cunningham M.R., Jones P.A., et al., 2009, 'Molecular line mapping of the giant molecular cloud associated with RCW 106 - III. Multi-molecular line mapping', MNRAS, 395, 1021 - 1042
- Lo N., Redman M.P., Jones P.A., et al., 2011, 'Observations and radiative transfer modelling of a massive dense cold core in G333', MNRAS, 415, 525 - 533
- Lo N., Wiles B., Redman M.P., et al., 2014, 'High velocity infall, outflow, and turbulence in massive star forming regions: a scaled-up version of the low-mass case', MNRAS, submitted

NANTEN2 CI observations

- CI at 492 GHz, with KOSMA SMART
- Some data for G333 in 2012 (but not much good data obtained) see Lo N., 2013, 'An atomic carbon view of massive star formation', Protostars and Planets VI, Heidelberg, July 15-20, 2013. Poster #1B062
- DID get some good data in 2013 season with SMART and new XFETS
- NOT yet all reduced (last part on Koeln website 2014 Jan) so preliminary reduction for about half data observed up to 2013 early Nov

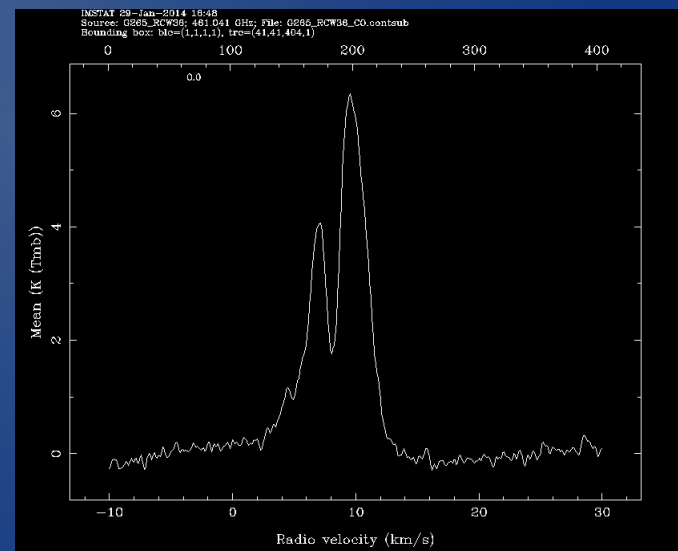
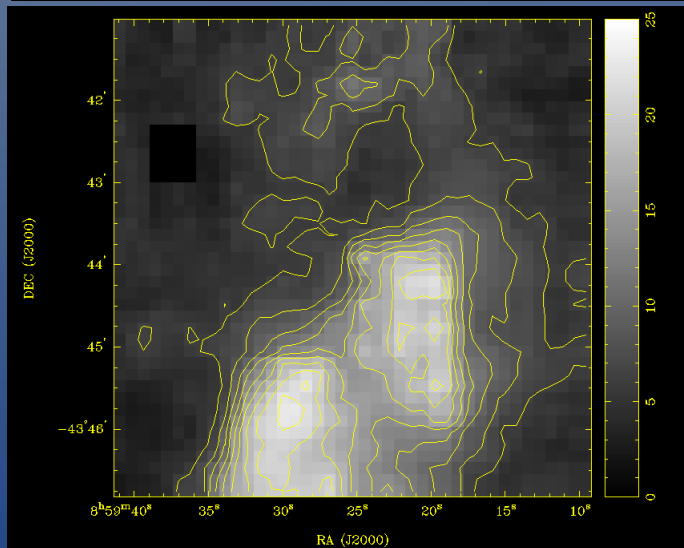
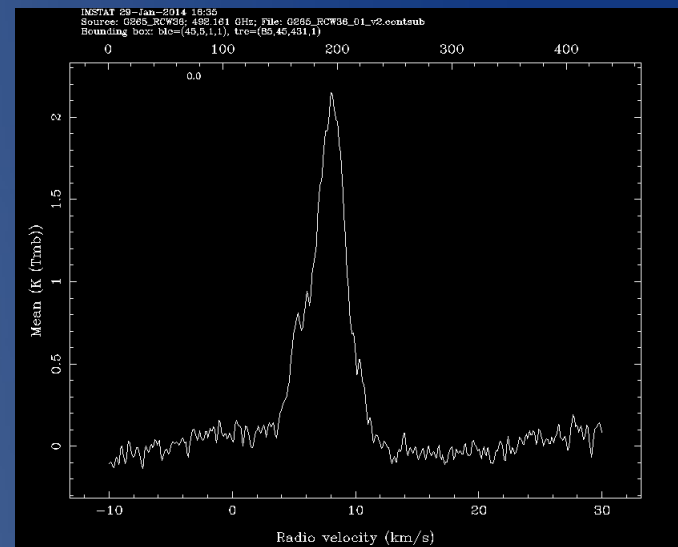
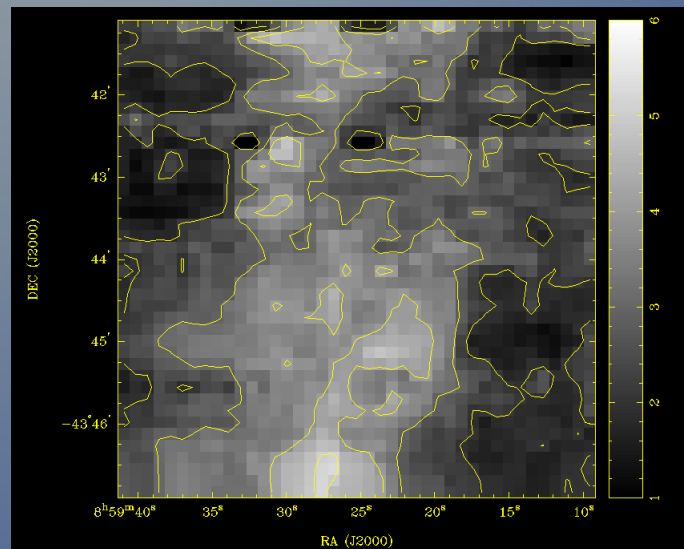


Vela - areas

1 out 3 reduced
(part coverage)
on BLAST 500
micron peak

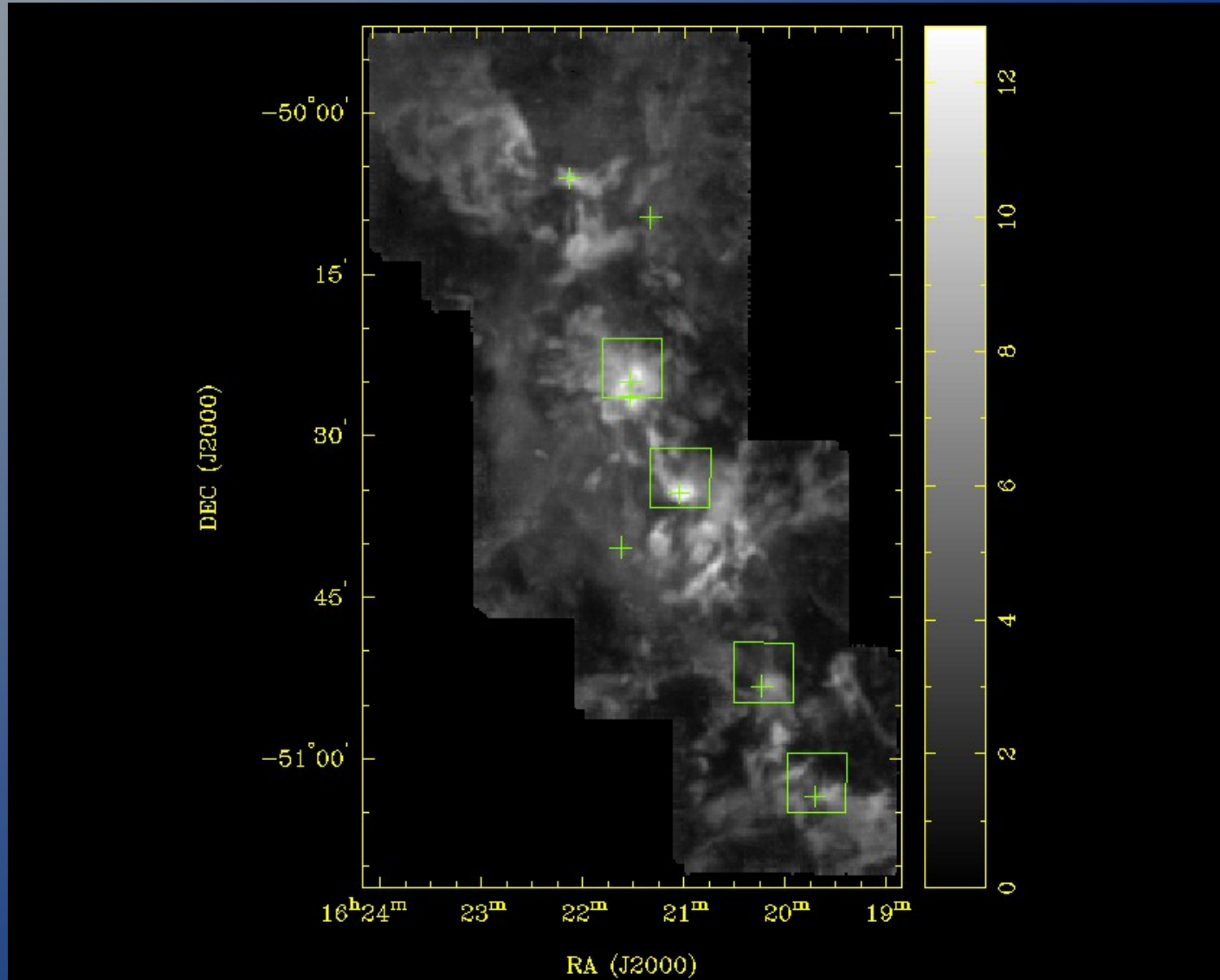
Vela – area RCW 36

CI top, ^{12}CO 4-3 bottom



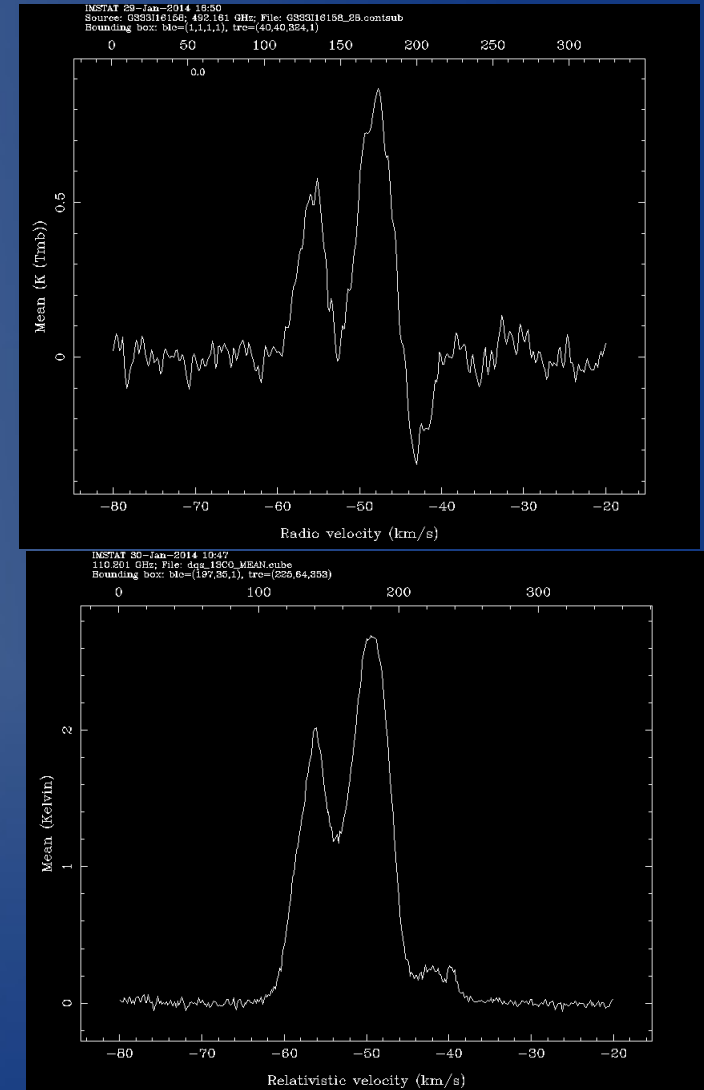
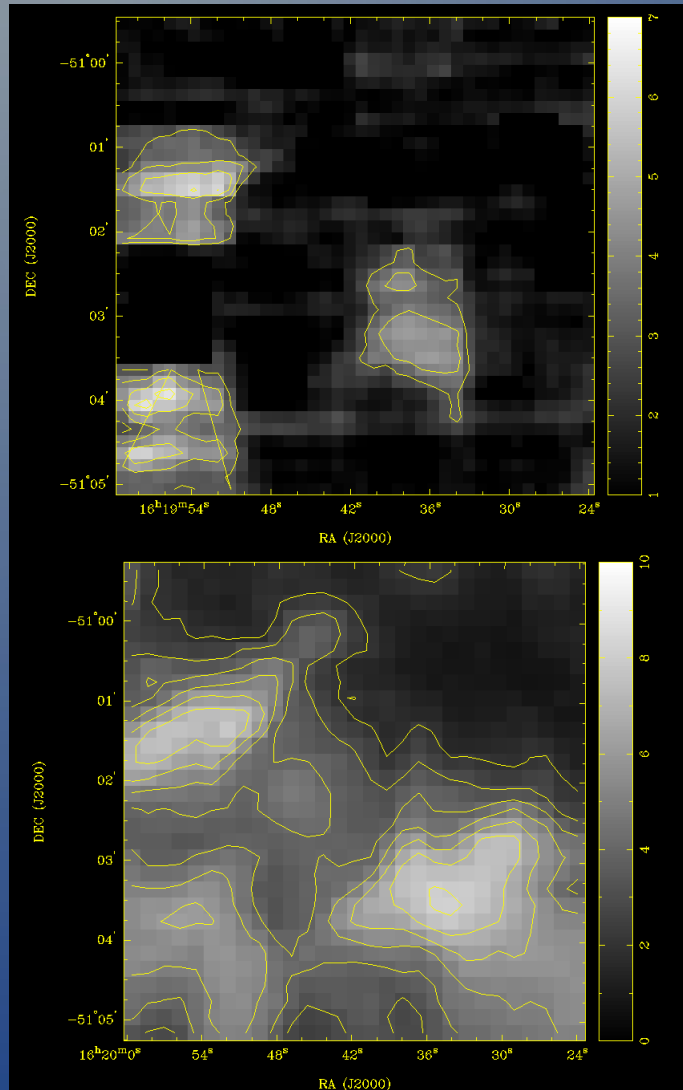
G333 areas

4 out of 7 reduced (part coverage) on ^{13}CO 1-0 peak



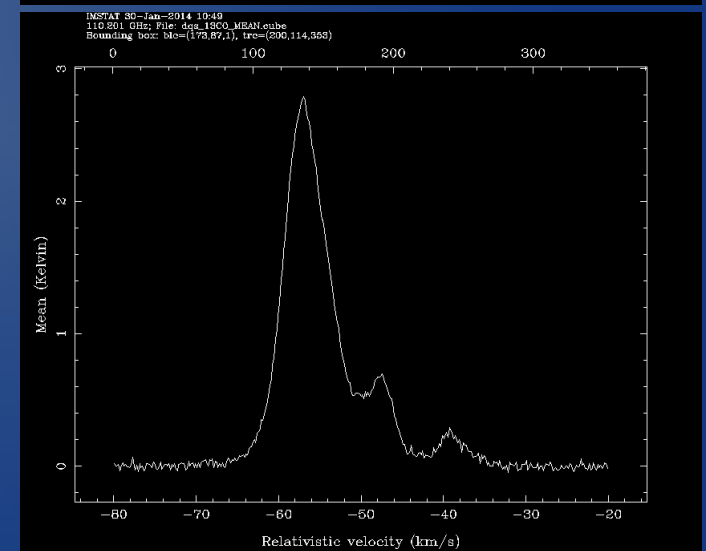
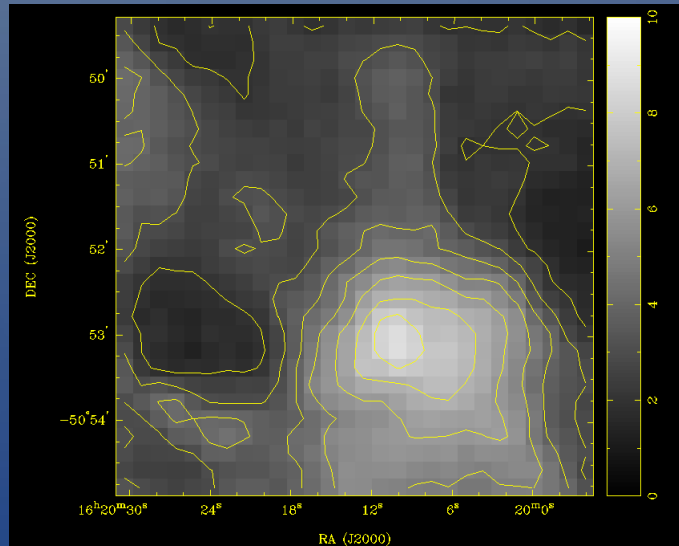
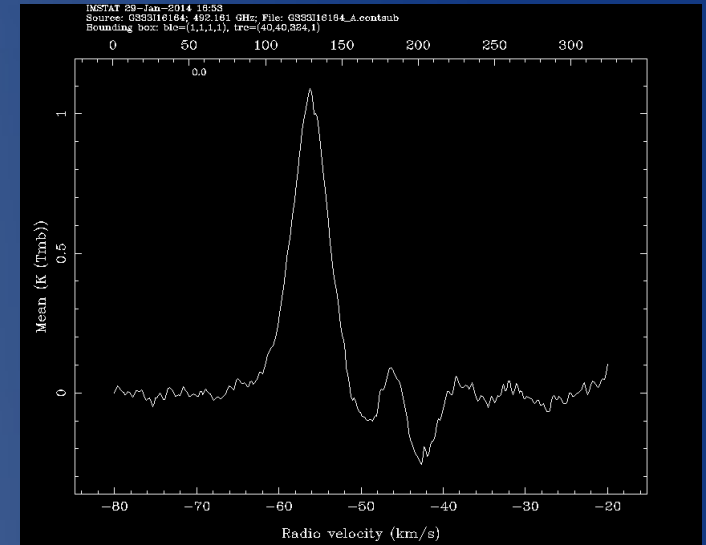
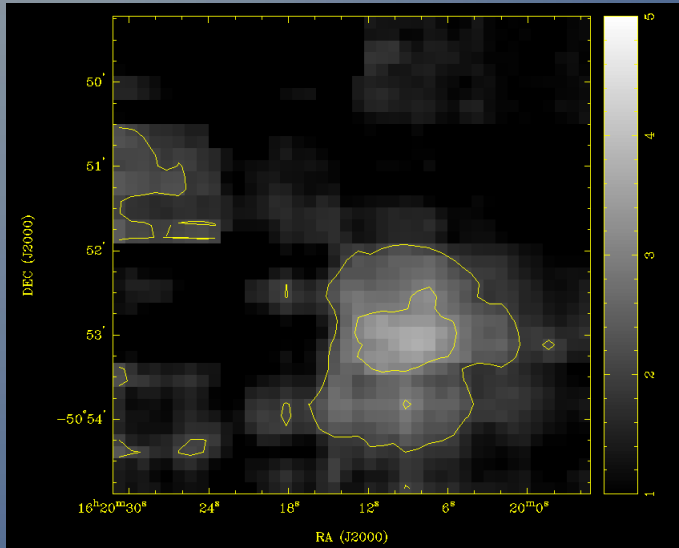
G333 – area IRAS 16158

Cl top, Mopra ^{13}CO 1-0 bottom



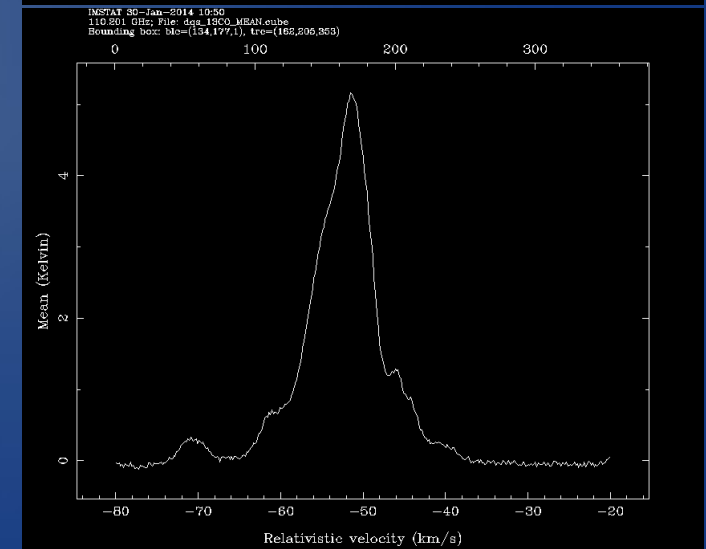
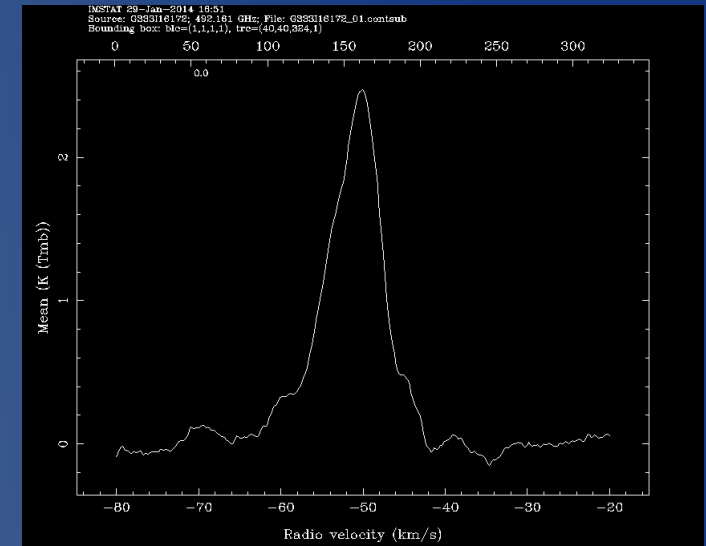
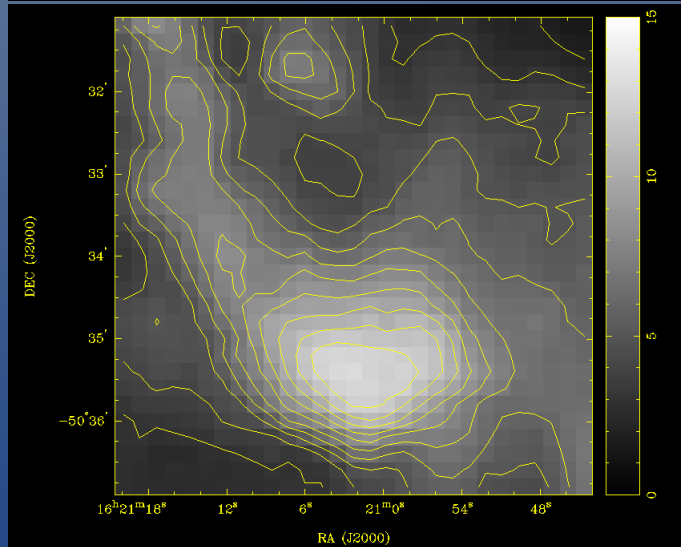
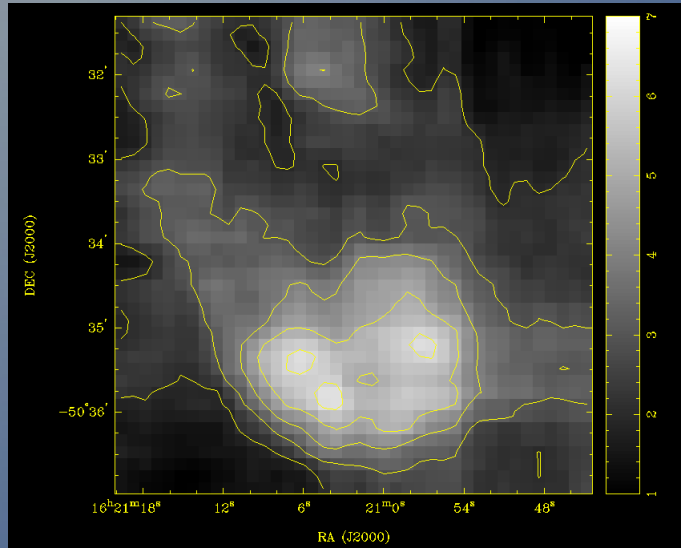
G333 – area IRAS 16164

CI top, Mopra ^{13}CO 1-0 bottom



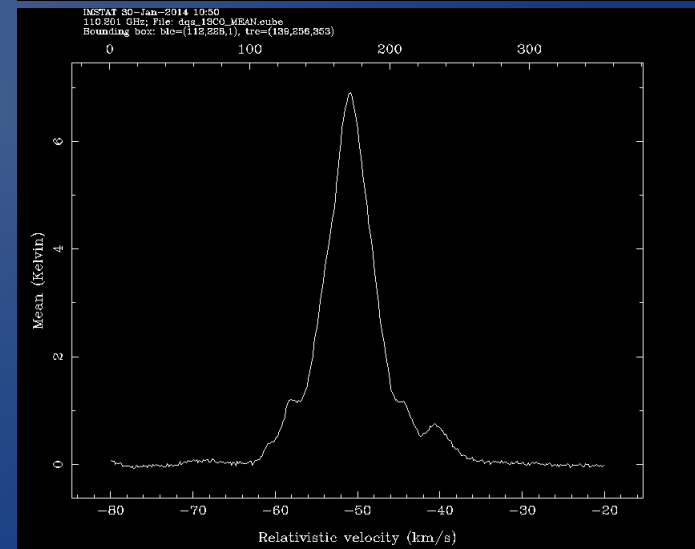
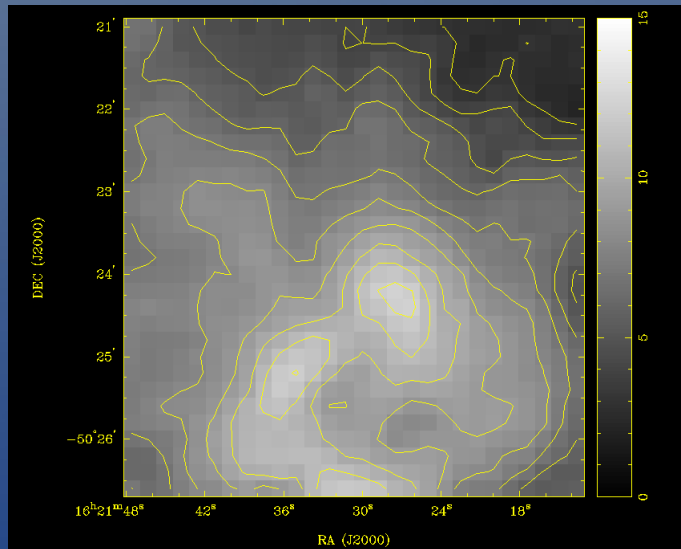
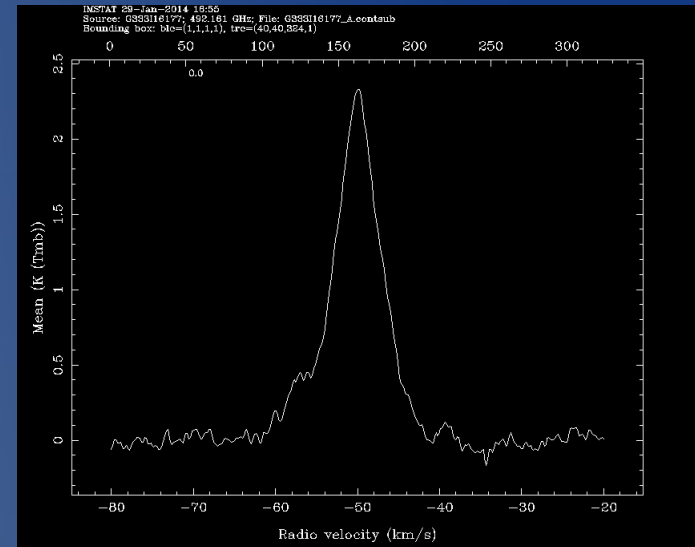
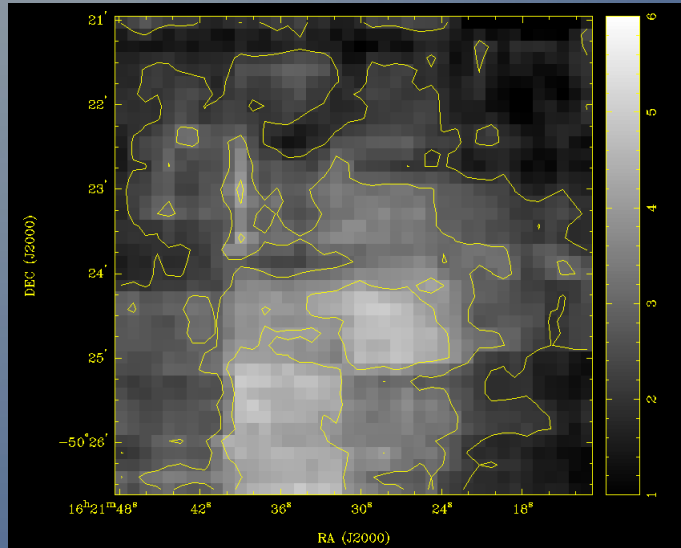
G333 – area IRAS 16172

CI top, Mopra ^{13}CO 1-0 bottom



G333 – area IRAS 16177

CI top, Mopra ^{13}CO 1-0 bottom



Comments – preliminary results

- Do detect good CI with 2013 data
- Spatial structure in CI and CO peaks are qualitatively similar, but need more quantitative analysis
- CI can be seen in absorption – may be expected with sub-mm bright cores
- CI spectra otherwise similar to ^{13}CO (but ^{12}CO has high optical depth)
- Need to finish reduction to add later data and more cores