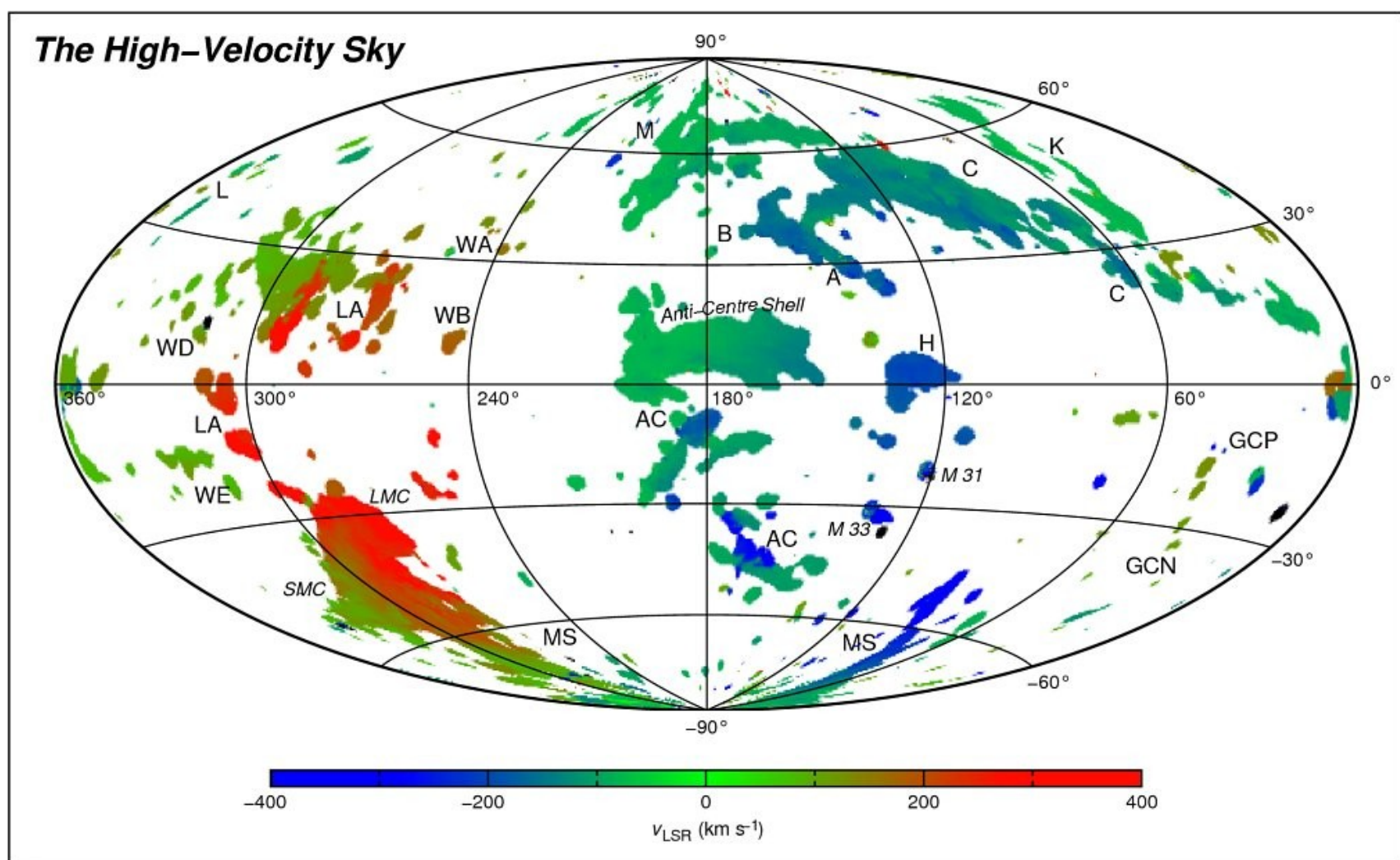


# Towards a revised picture of Compact High-Velocity Clouds:

New results from  
EBHIS and GASS

# High-Velocity Clouds (HVC)



**Tobias Westmeier, CSIRO Australia Telescope National Facility**

Based on the Leiden/Argentine/Bonn Survey (Kalberla et al. 2005, *A&A* 440, 775)  
and the Milky Way model of P. Kalberla (Kalberla et al. 2007, *A&A*, in press).



# Origins of HVCs

remnants of galaxy merging

tidal stripping



ANDROMEDA GALAXY

TRIANGULUM GALAXY

THE LOCAL GROUP

MILKY WAY GALAXY

MILKY WAY GALAXY

<http://chandra.harvard.edu>

galactic fountain



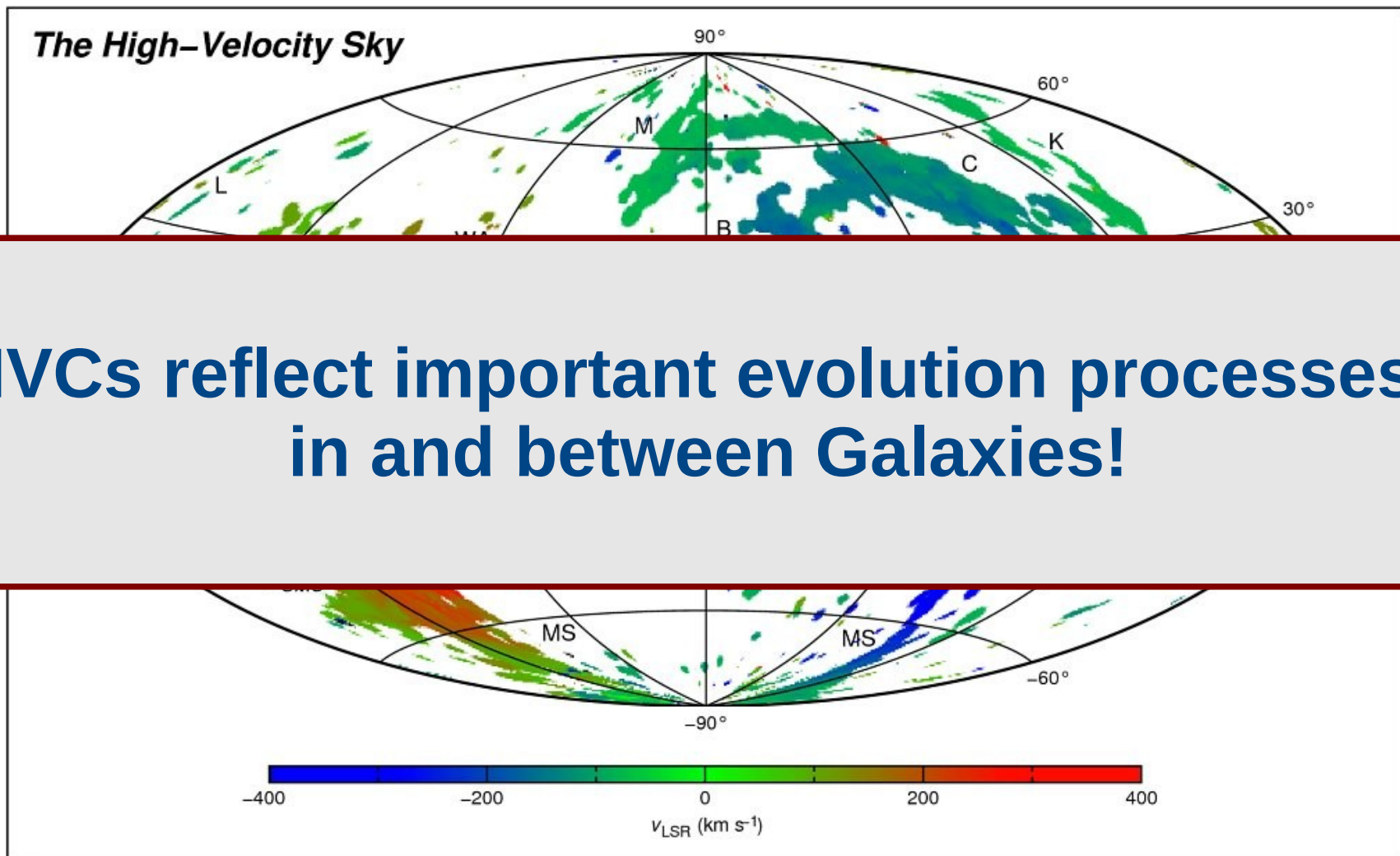
<http://sci.esa.int>

primordial gas



[www.threadless.com](http://www.threadless.com)

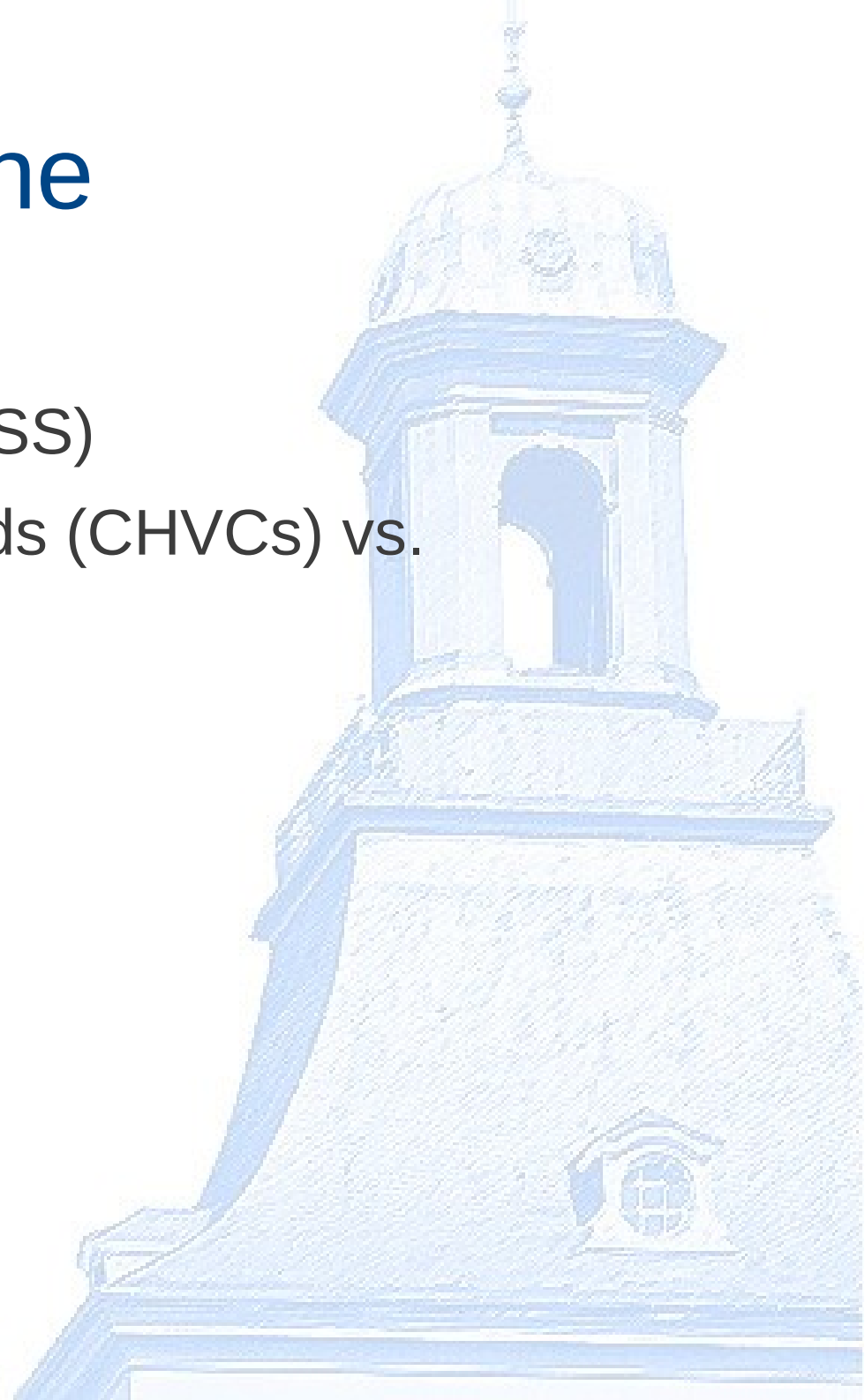
# High-Velocity Clouds (HVC)



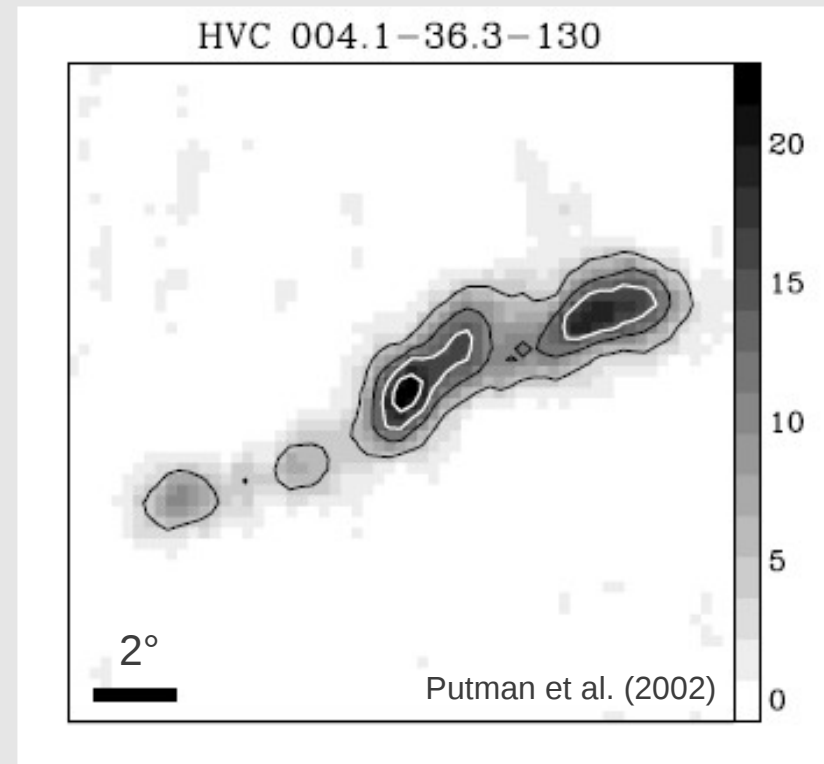
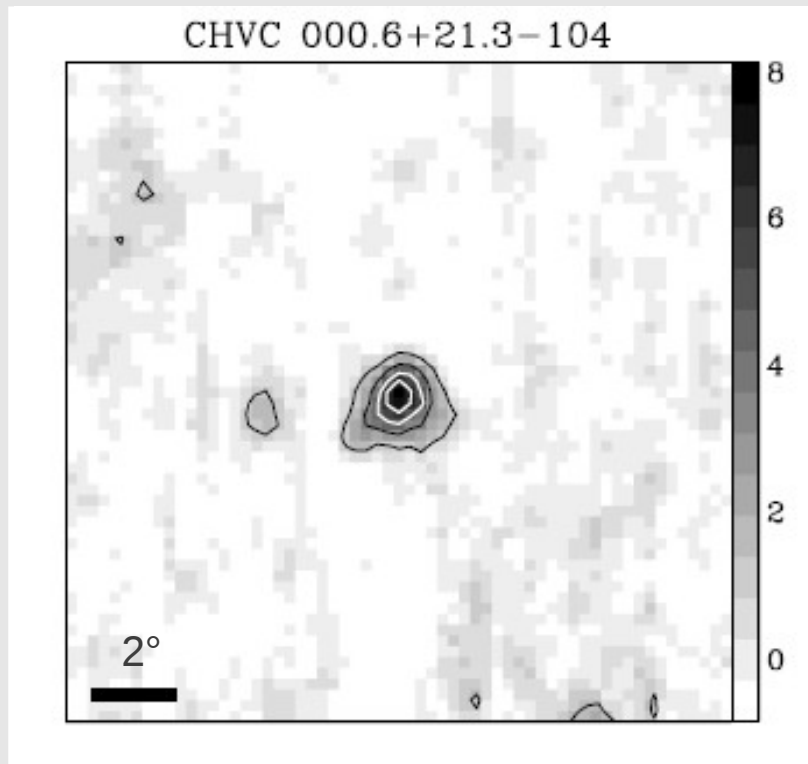


# Outline

- Introduction
- New HI Surveys (EBHIS, GASS)
- Compact High-Velocity Clouds (CHVCs) vs. High-Velocity Clouds
  - Edge of complexes
  - CHVC selection criteria
  - First results
- Summary
- Outlook



# Compact High-Velocity Clouds



- Separated from complexes and Milky Way HI emission
- Angular sizes  $< 2^\circ$

# Previous Compact Isolated HVC All-Sky Catalogue

- Braun and Burton (1999)
  - northern hemisphere ( $\delta > -30^\circ$ )
  - Leiden/Dwingeloo Survey (Hartmann and Burton, 1997)
  - 66 Clouds
- Putman et al. (2002)
  - southern hemisphere ( $\delta < 2^\circ$ )
  - HI Parkes All-Sky Survey (HIPASS; Barnes et al. 2002)
  - 179 Clouds
- De Heij et al. (2002) combined both catalogues
  - 216 CHVCs

# Surveys



# Galactic All Sky Survey (GASS)

(McClure-Griffiths et al., 2009; Kalberla et al., 2010)

- 13 beam multi array
- Fully sampled
- Corrected for stray radiation

Sky coverage :  $\delta < 1^\circ$   
Angular resolution: 15.'6  
 $v_{\text{LSR}}$  range [km/s] :  $-468 < v < +468$

Channel width : 1.0 km/s  
 $1\sigma T_{\text{B}}$  noise : 57 mK



# Effelsberg–Bonn HI Survey (EBHIS)

(Winkel et al., 2010; Kerp et al., 2011)



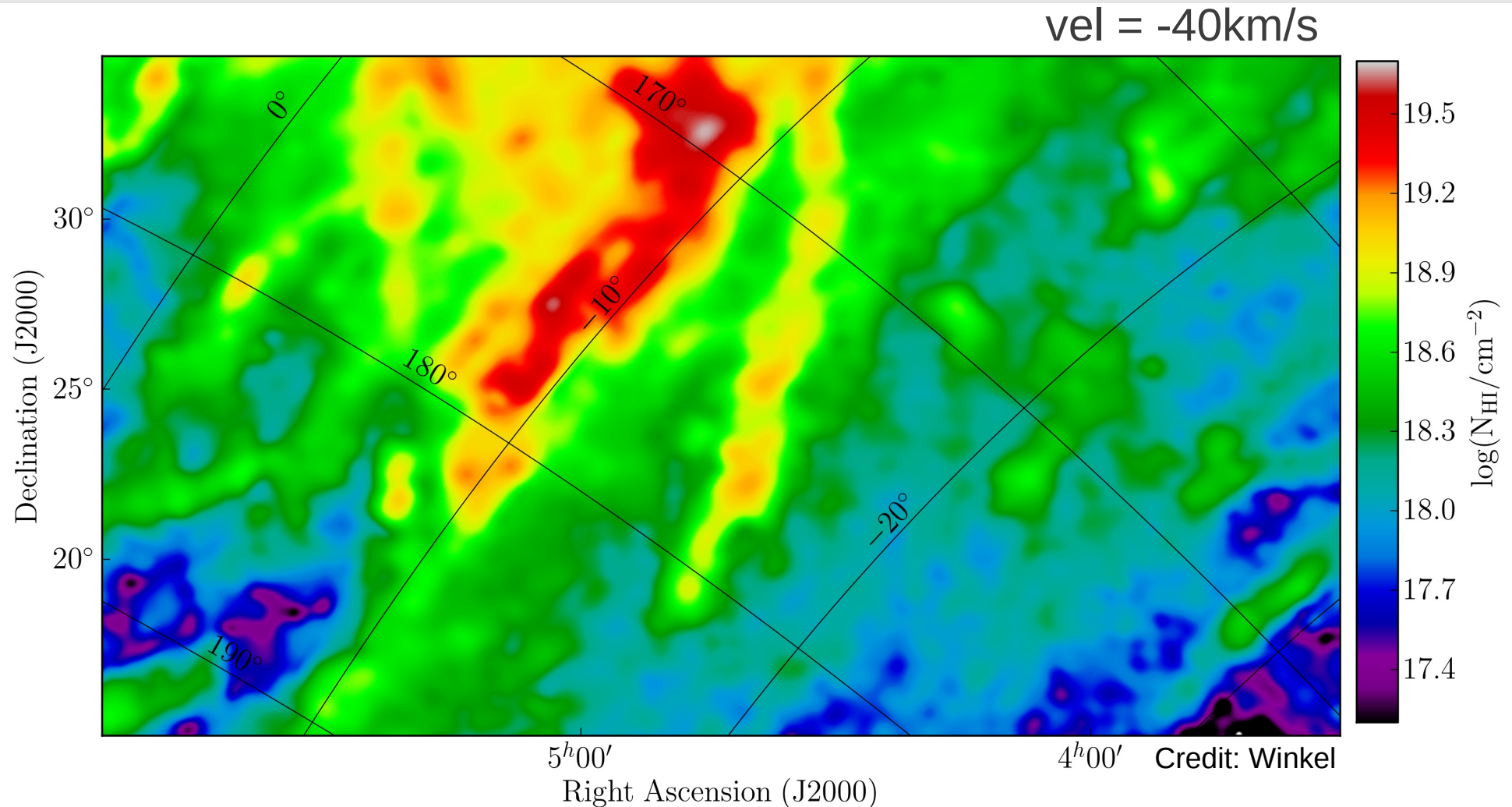
- First coverage ~ 2012
- L-band 7-beam array
- HI observations up to 230 Mpc
- Fully sampled
- Corrected for stray radiation

Sky coverage :  $\delta > -5^\circ$   
Angular resolution: 10.'5  
 $v_{\text{LSR}}$  range [km/s] :  $-600 < v < +18000$   
Channel width : 1.25 km/s  
 $1\sigma T_{\text{B}}$  noise :  $< 90$  mK



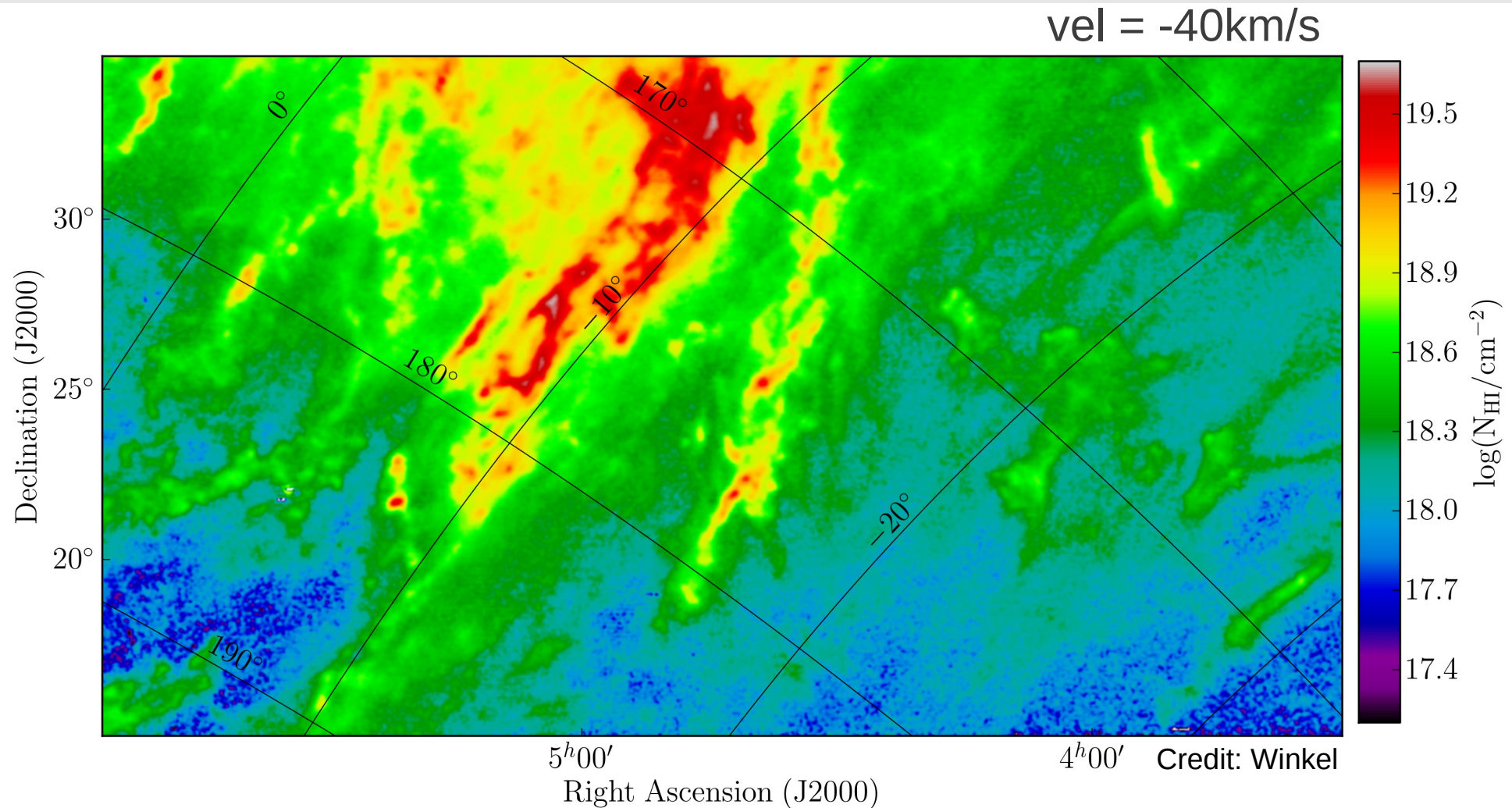
# Leiden–Argentine–Bonn Survey

(LAB; Kalberla et al., 2005)



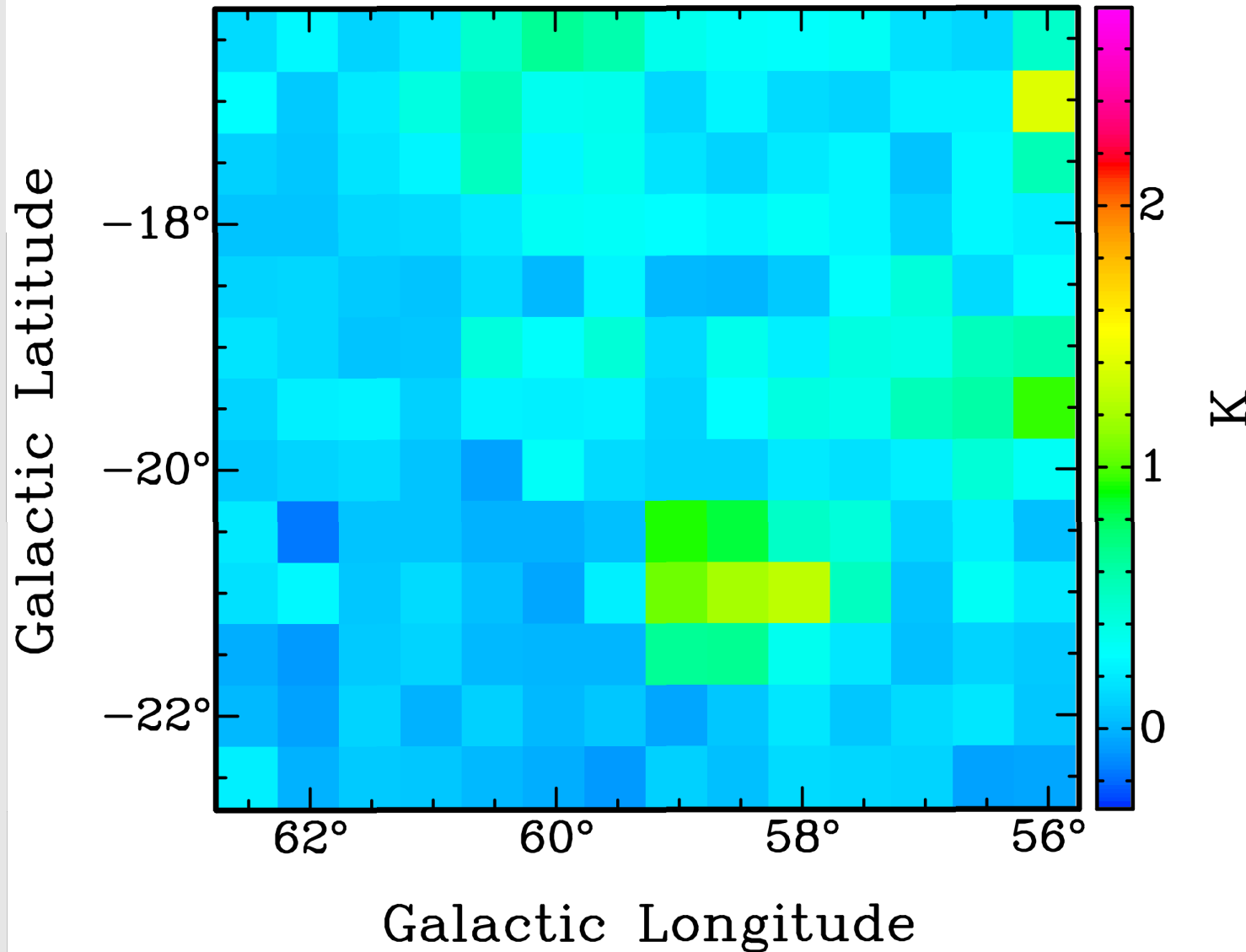
# Effelsberg–Bonn HI Survey (EBHIS)

(Winkel et al., 2010; Kerp et al., 2011)



# New Possibilities

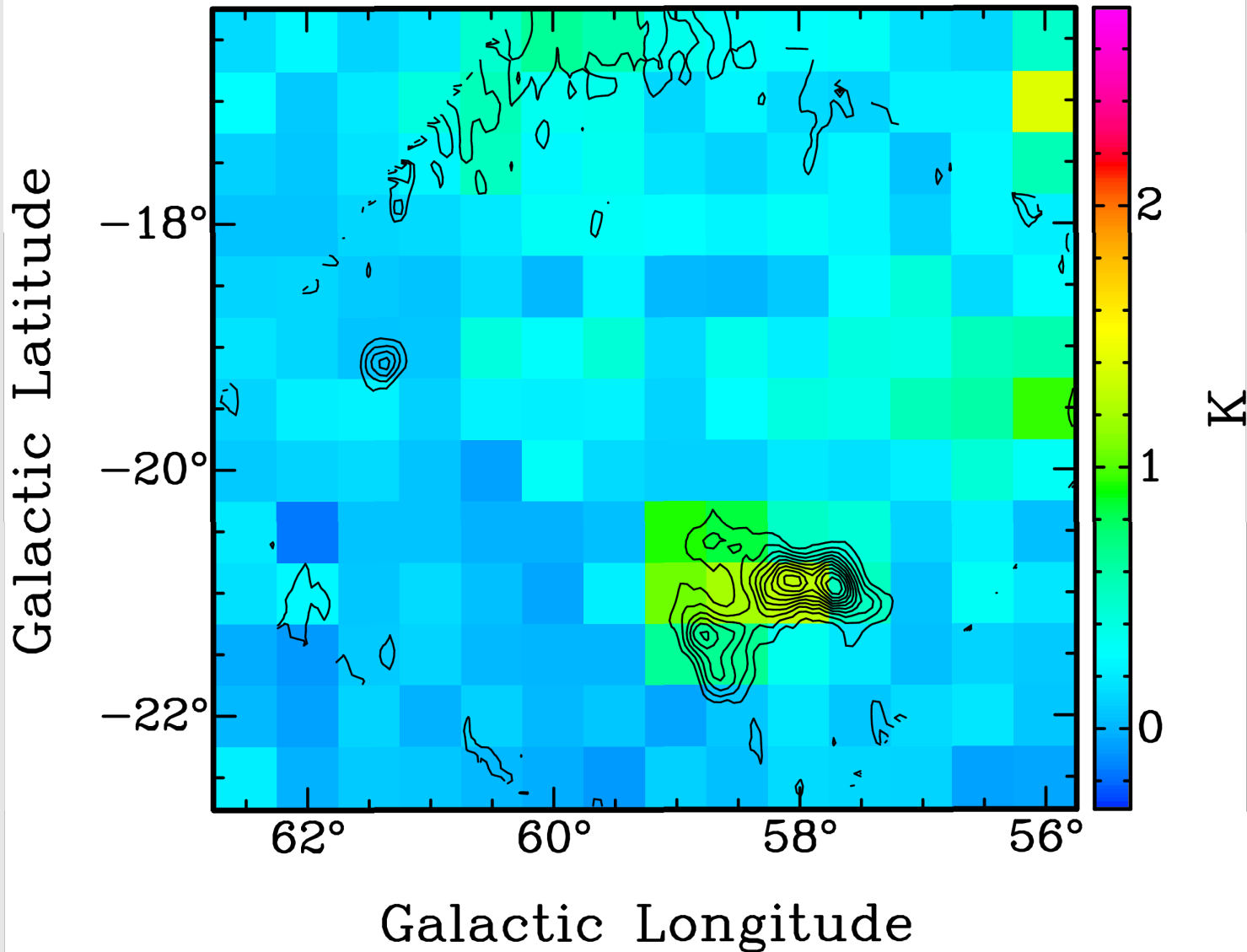
Velocity: +55.65 km/s



Channelmap:  
LAB

# New Possibilities

Velocity: +55.65 km/s

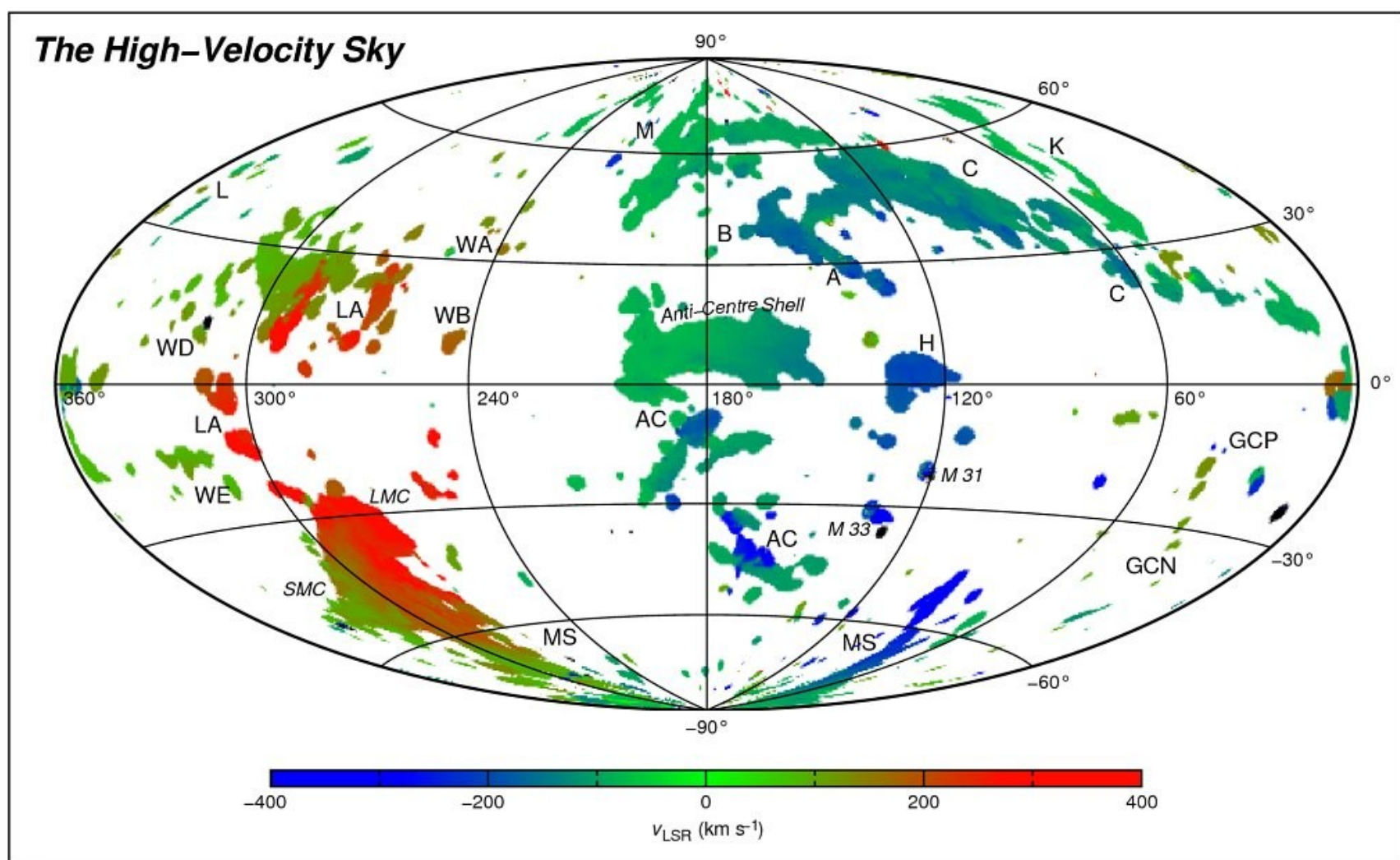


Channelmap:  
LAB

Contourlines:  
EBHIS data



# Galactic Centre Negative

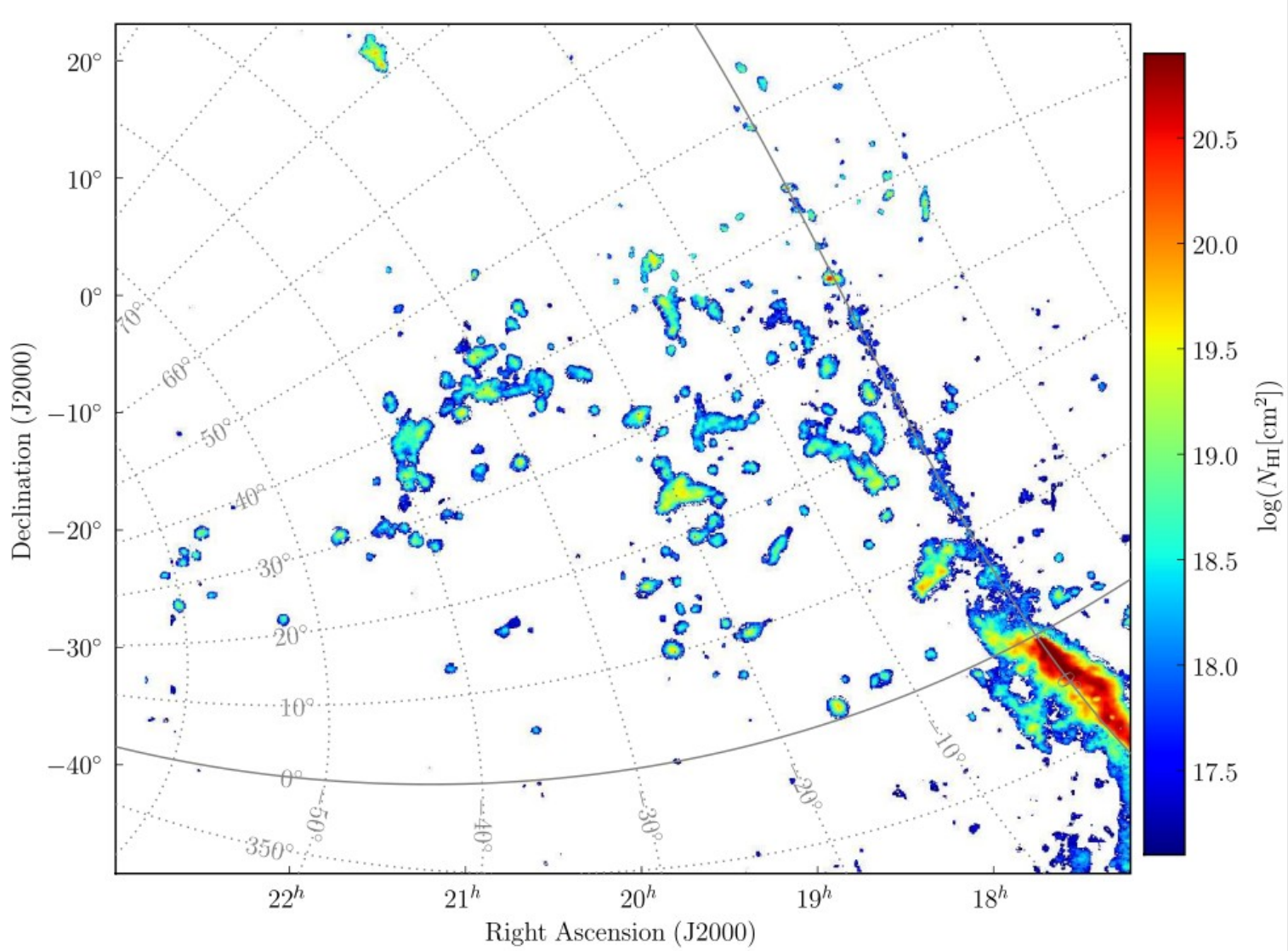


**Tobias Westmeier, CSIRO Australia Telescope National Facility**

*Based on the Leiden/Argentine/Bonn Survey (Kalberla et al. 2005, A&A 440, 775)  
and the Milky Way model of P. Kalberla (Kalberla et al. 2007, A&A, in press).*



# Complex Galactic Centre Negative



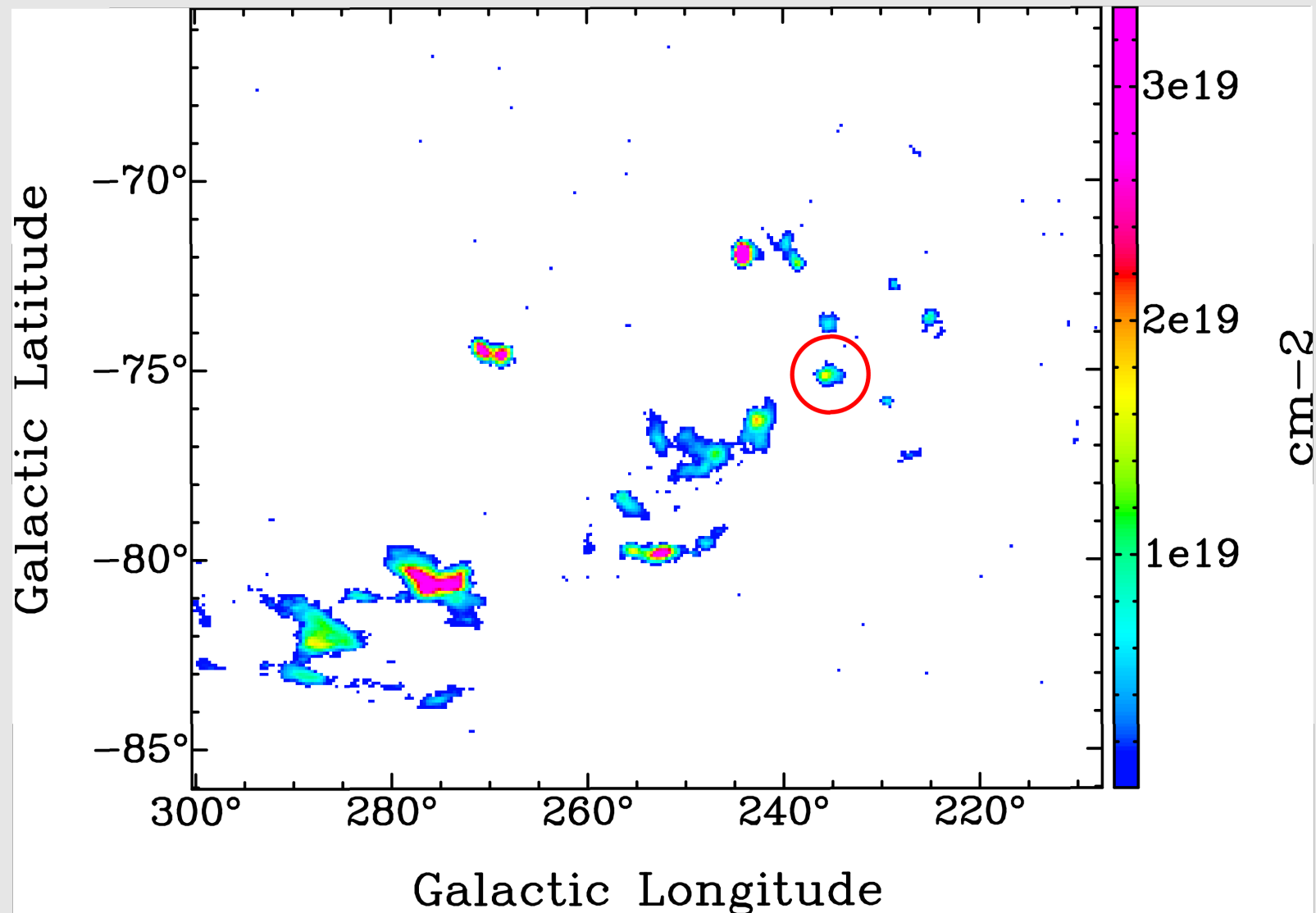
To Be, or Not to Be, ...

Compact, isolated HVC

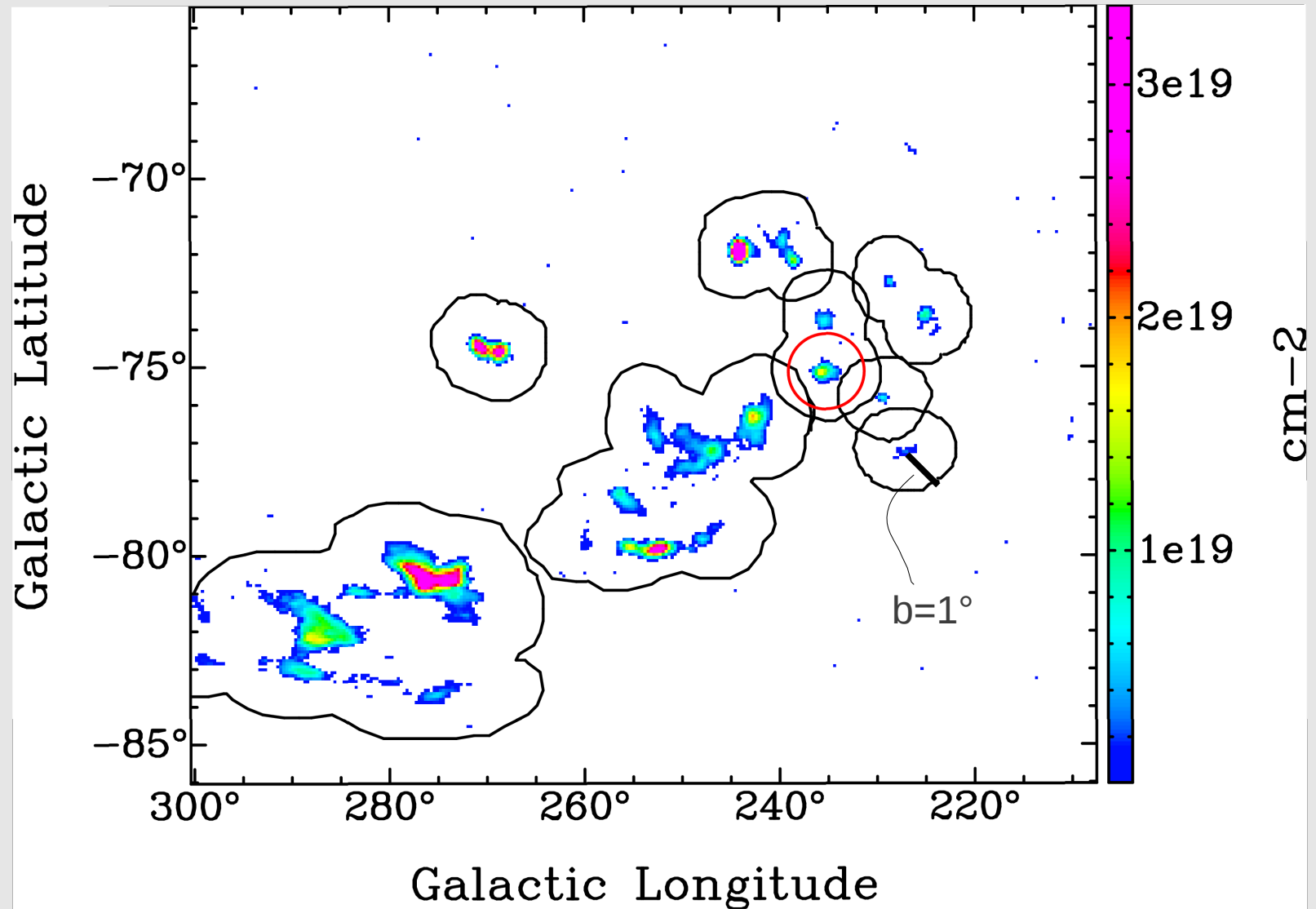
vs.

Complex-associated HVC

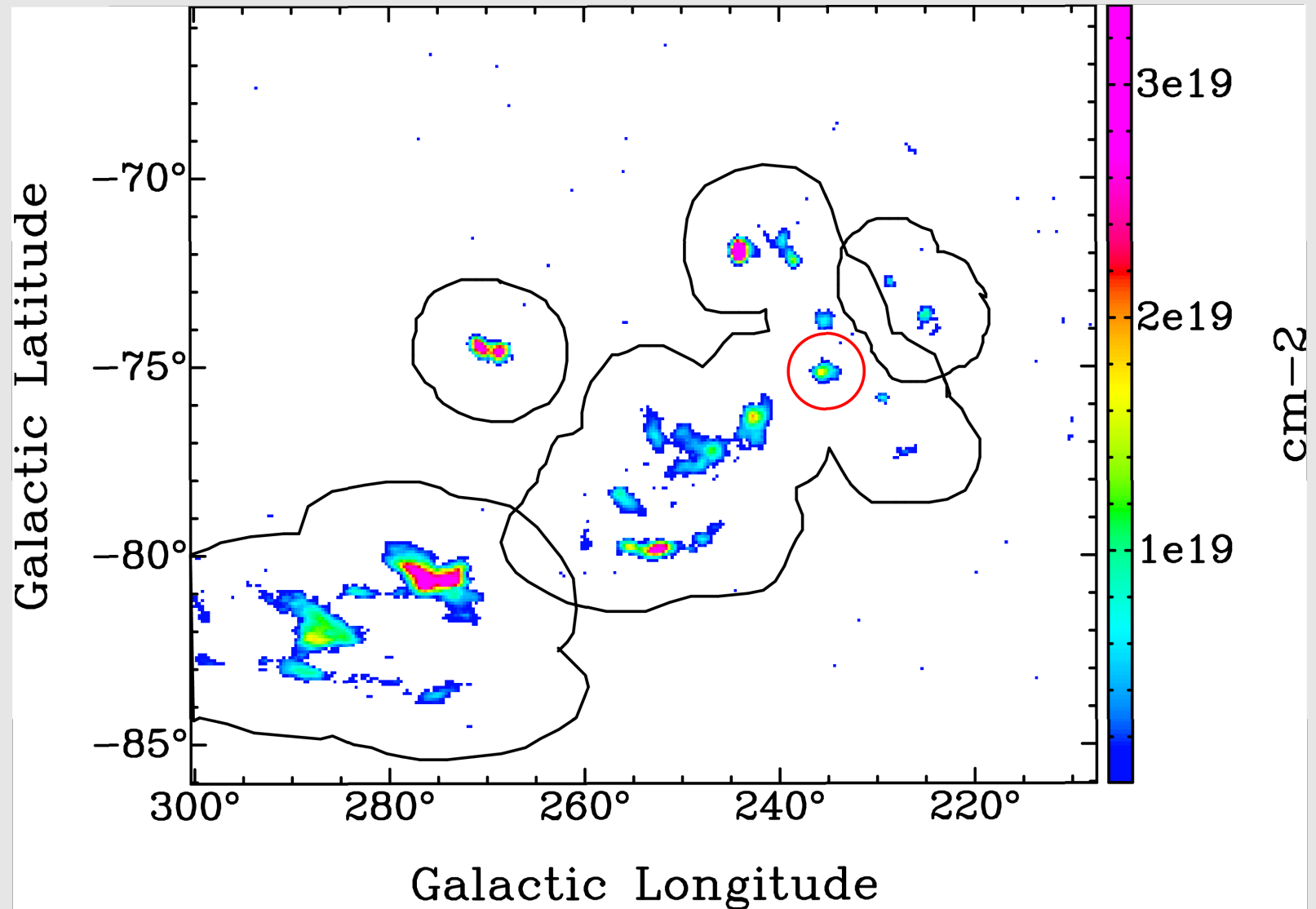
# CHVC vs. Complex HVC



# Borderline: $b = 1^\circ$

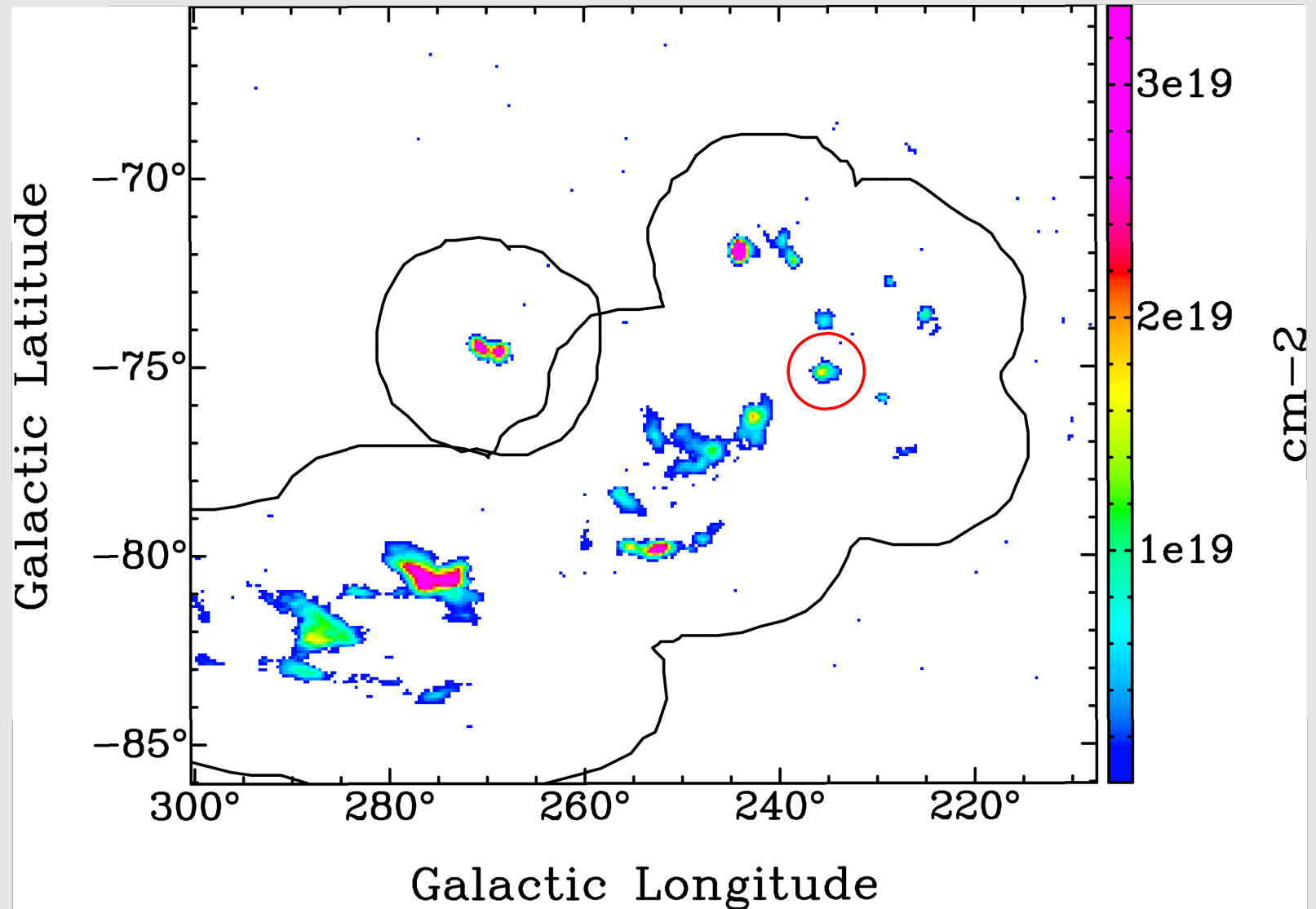


# Borderline: $b = 1.5^\circ$





# Borderline: $b = 2.5^\circ$

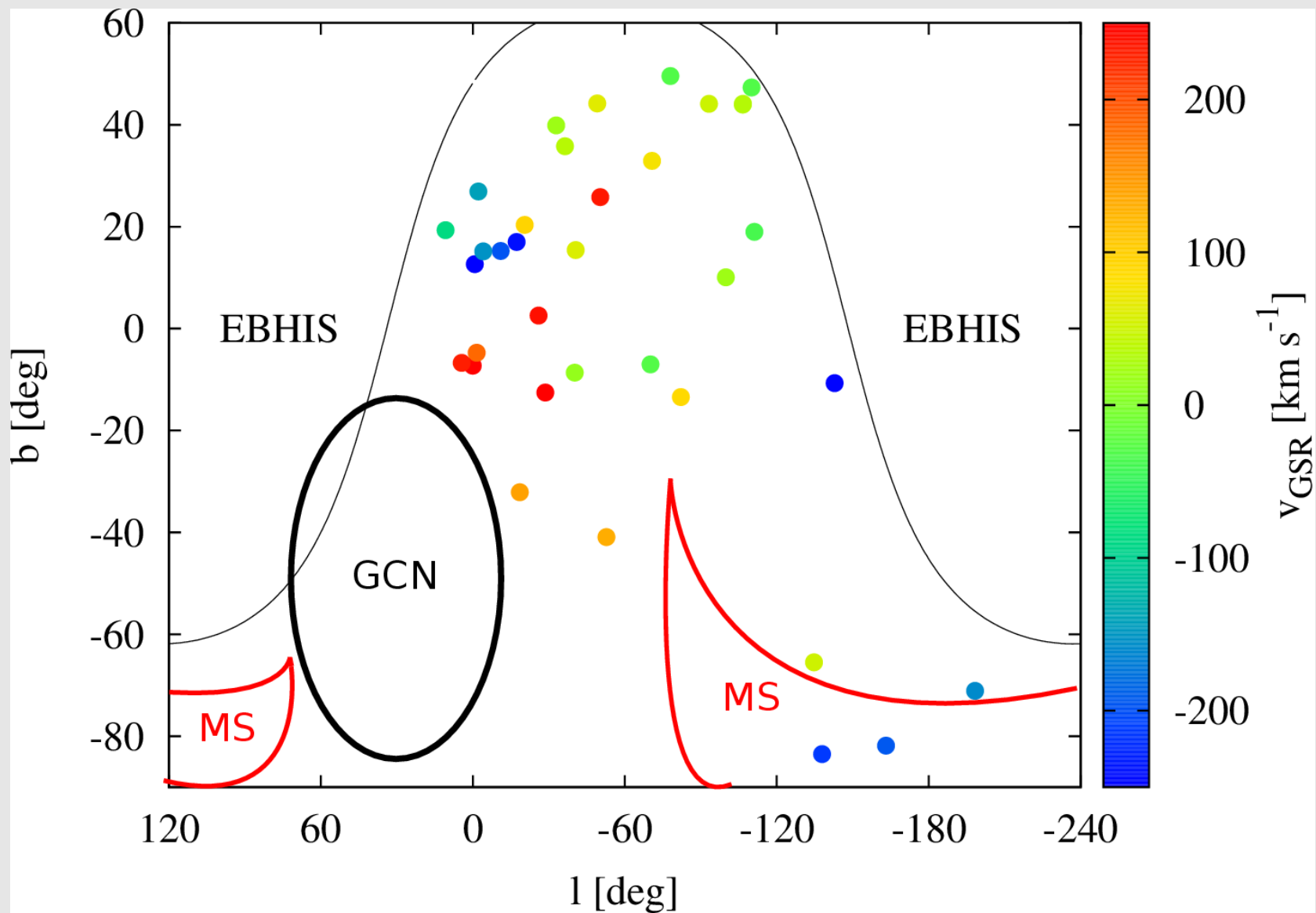


# Catalogue Selection Criteria

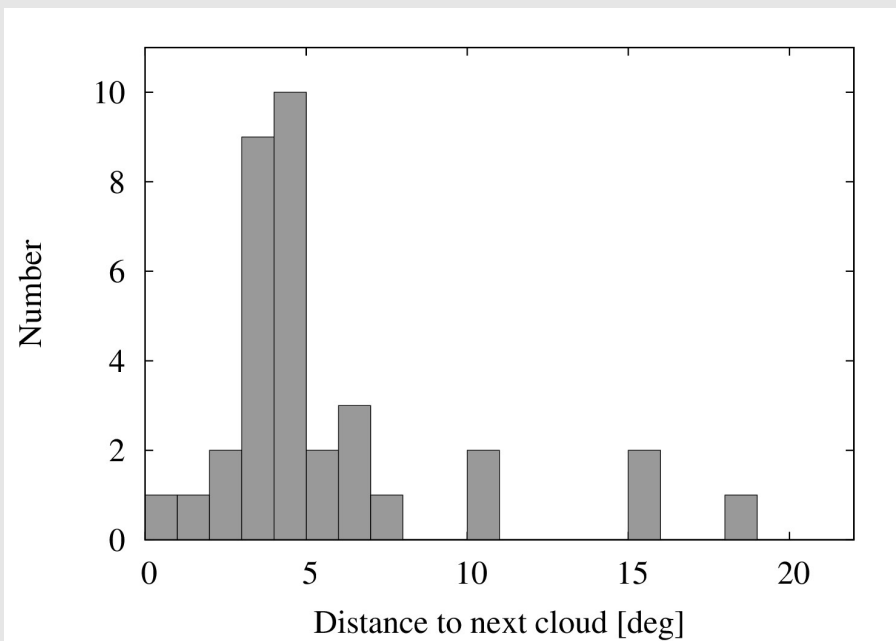
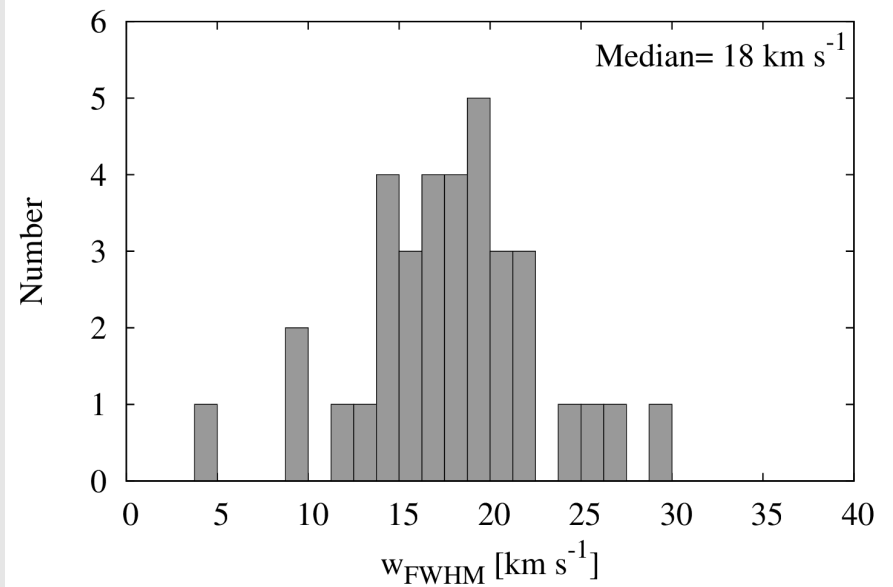
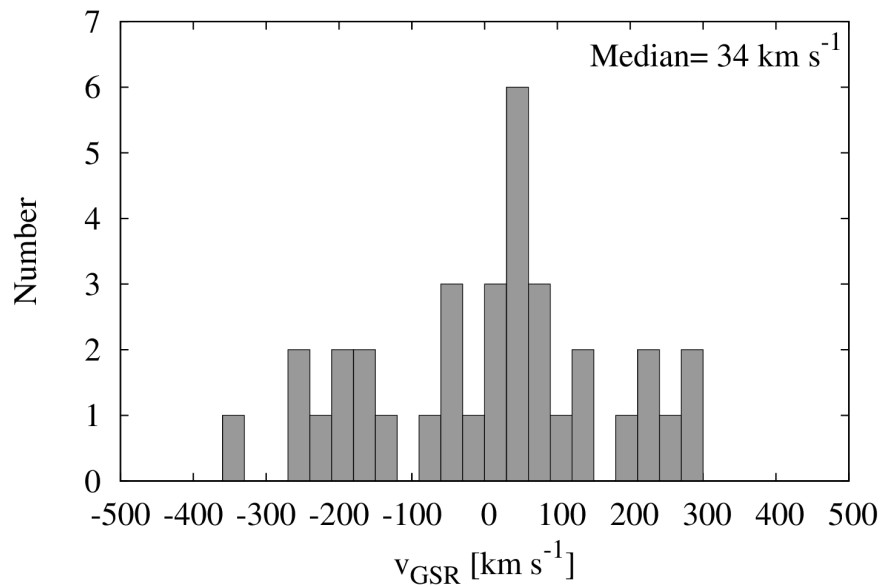
1. 1- $\sigma$ -contourlines: spatially and kinematically distinct from galactic HI emission
2. Spatial separation to complexes  $> 2.5$  deg (7.5 deg for GCN), multiple velocity intervals
3. Angular size  $< 2$  deg (for FWHM-contourline)

This results in a catalogue of 35 CHVC  
on the southern sky

# Spatial Positions of CHVCs



# First Statistical Results



# Summary

- GASS and EBHIS provide:
  - High angular and spectral resolution
  - High sensitivity
  - Fully sampled datafor entire sky
- New definition of complex boundaries
- First statistical results

# Outlook

- Northern Hemisphere
- Variation of parameters with distance to complexes
- Interferometric observations
  - Substructure
  - Cold components?

Thank you!