



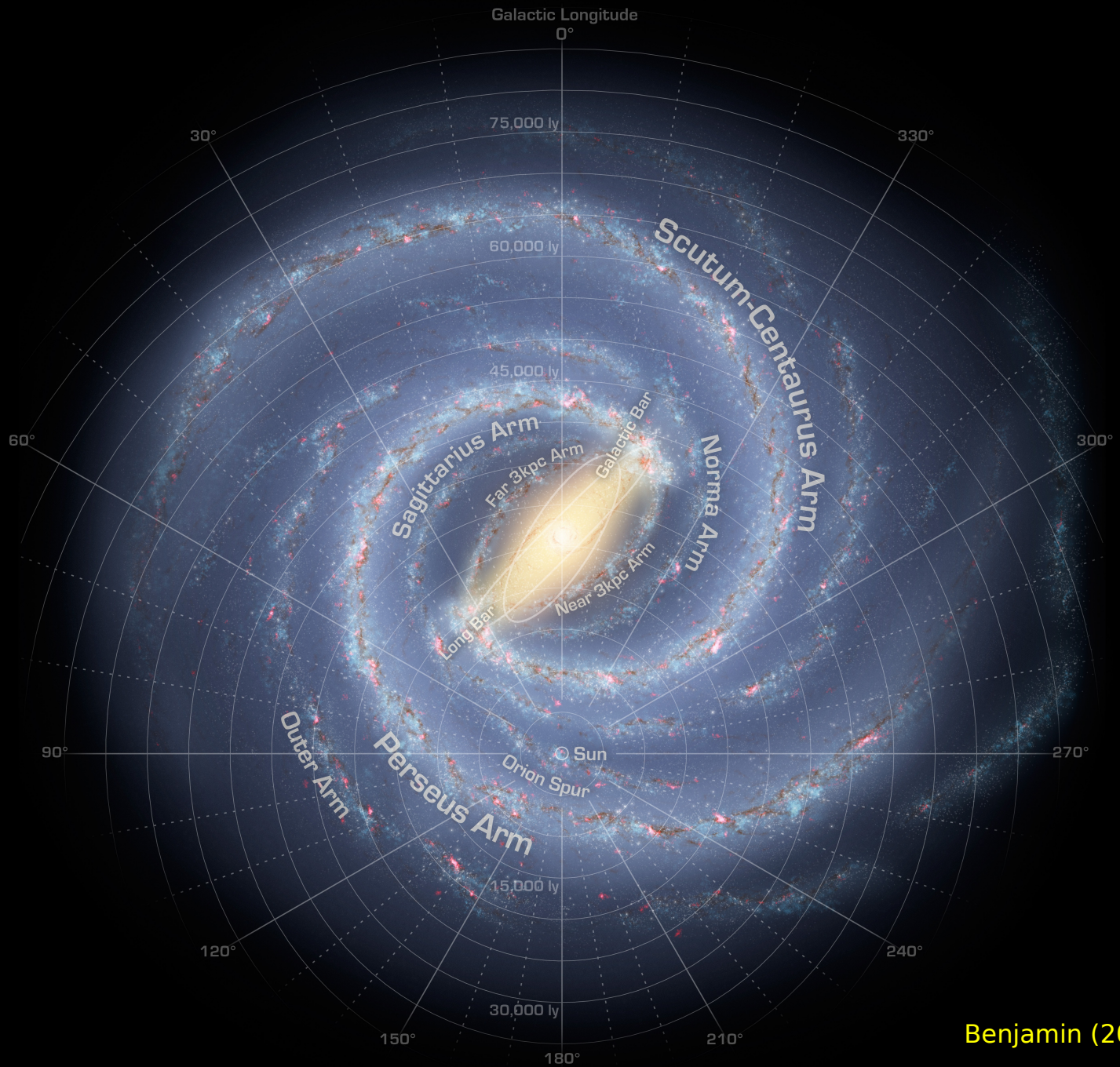
International  
Centre for  
Radio  
Astronomy  
Research

# Surveys of the Galactic Plane with the SKA

Dr Andrew Walsh (Curtin/ICRAR)  
Dr Jo Dawson (Macquarie/CASS)  
Dr Adam Ginsburg (ESO Garching)



THE UNIVERSITY OF  
WESTERN AUSTRALIA



Benjamin (2008)



# HOPS

H<sub>2</sub>O Masers

NH<sub>3</sub> (1,1)

310

300

290

Lada et al. (2010):

- Star formation threshold:  $A_K \sim 0.8$

330

320

310

$$\Sigma_{\text{gas}} \sim 116 M_{\odot} \text{pc}^{-2}$$

- Equivalent to star forming gas  $n \sim 10^4 \text{cm}^{-3}$

350

340

330

- Same density probed by NH<sub>3</sub> (1,1)

010

0

350

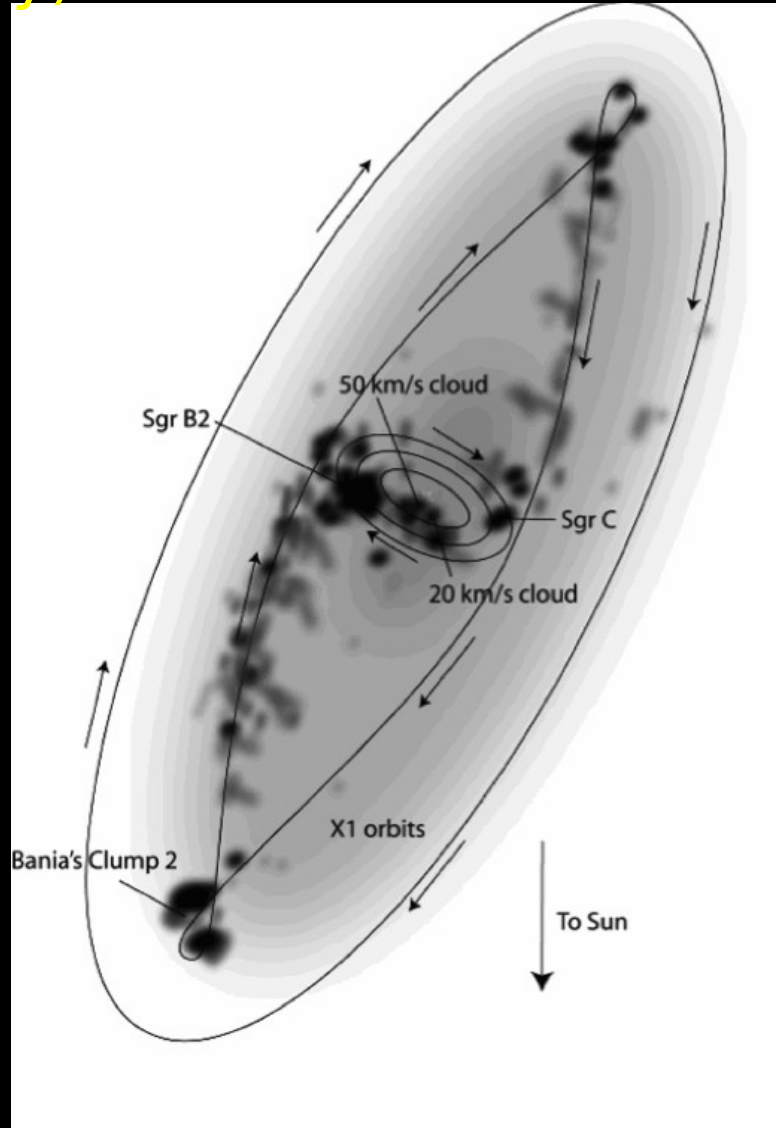
030

020

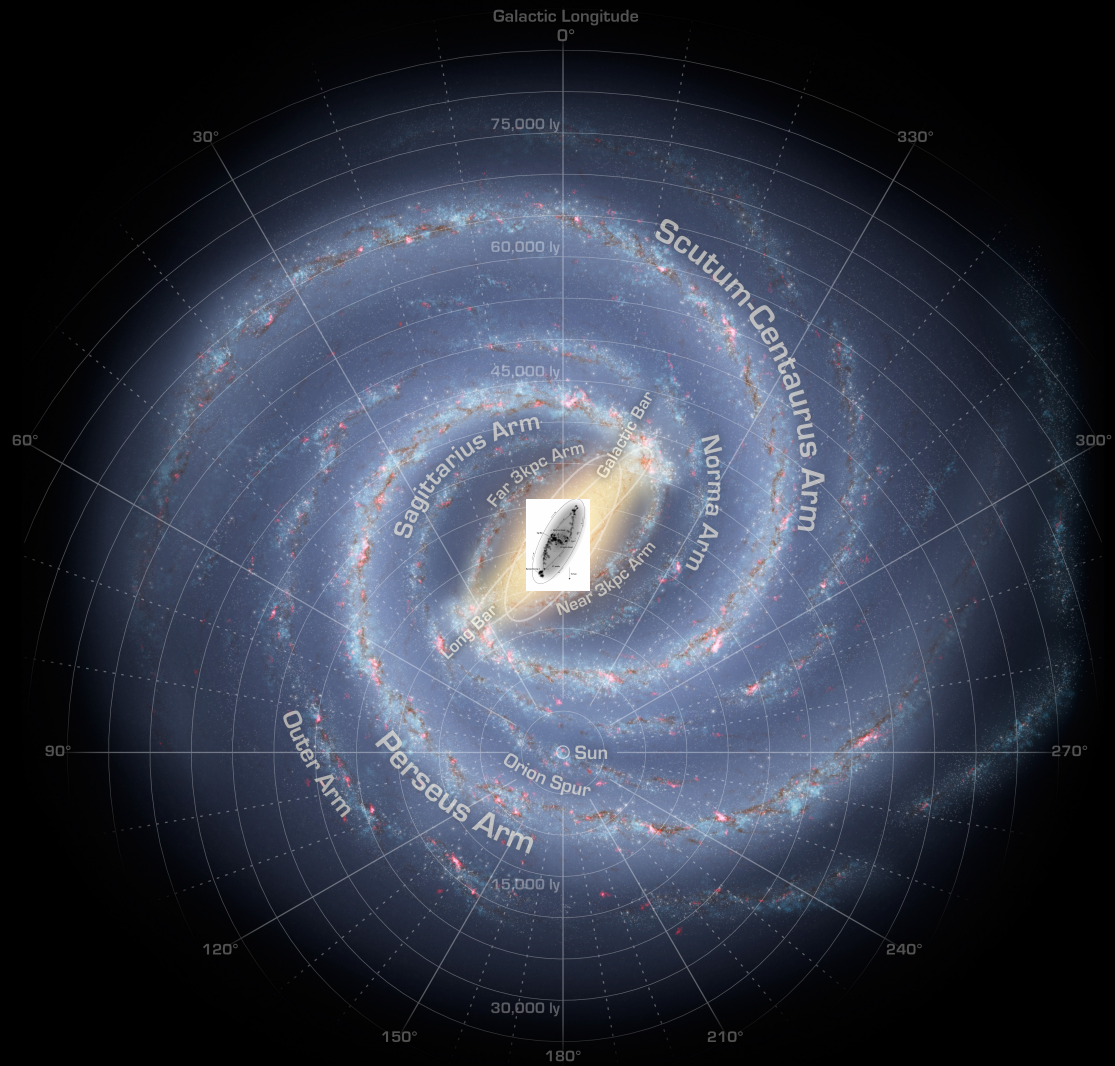
010

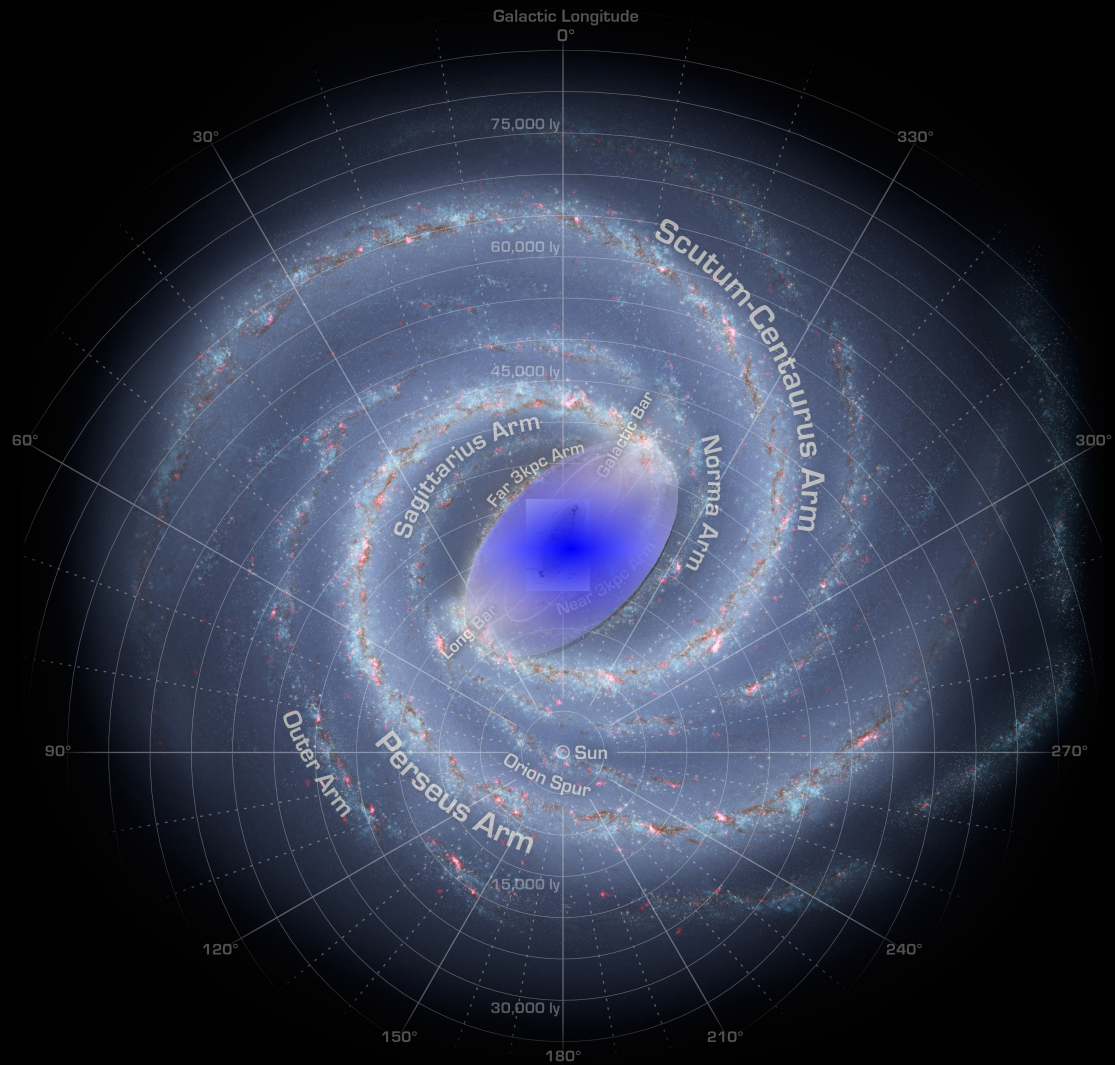


# Artist's impression of the Central Molecular Zone (John Bally)







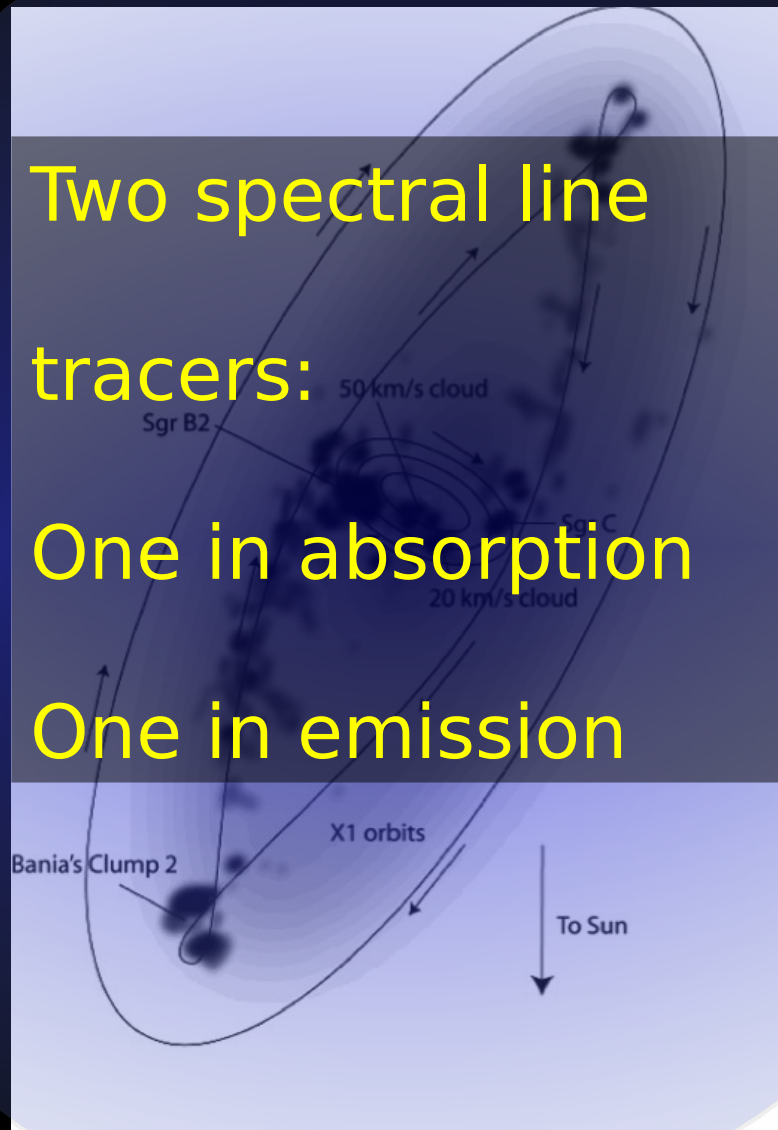


Two spectral line

tracers:

One in absorption

One in emission





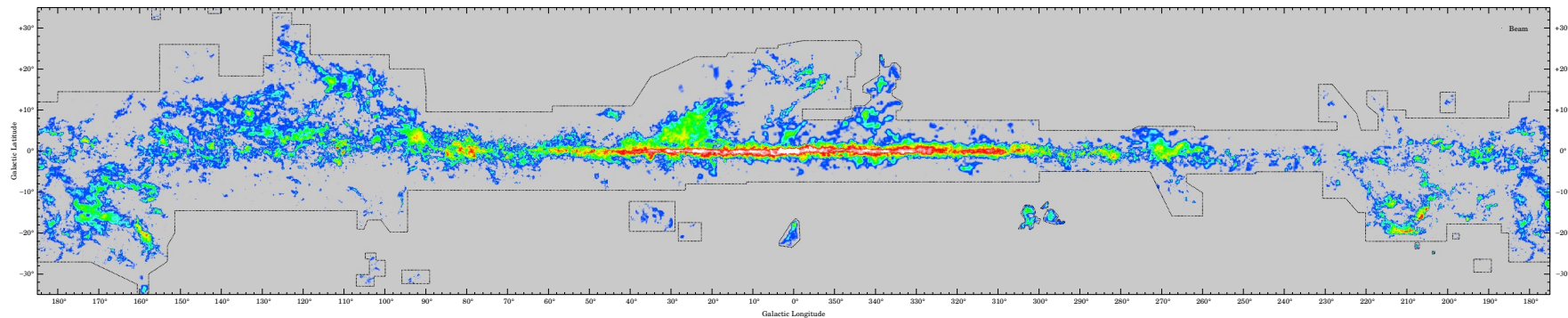


FIG. 2.—Velocity-integrated CO map of the Milky Way. The angular resolution is 9' over most of the map, including the entire Galactic plane, but is lower (15' or 20') in some regions out of the plane (see Fig. 1 & Table 1). The sensitivity varies somewhat from region to region, since each component survey was integrated individually using moment marking or clipping in order to display all statistically significant emission but little noise (see §2.2). A dotted line marks the sampling boundaries, given in more detail in Fig. 1.

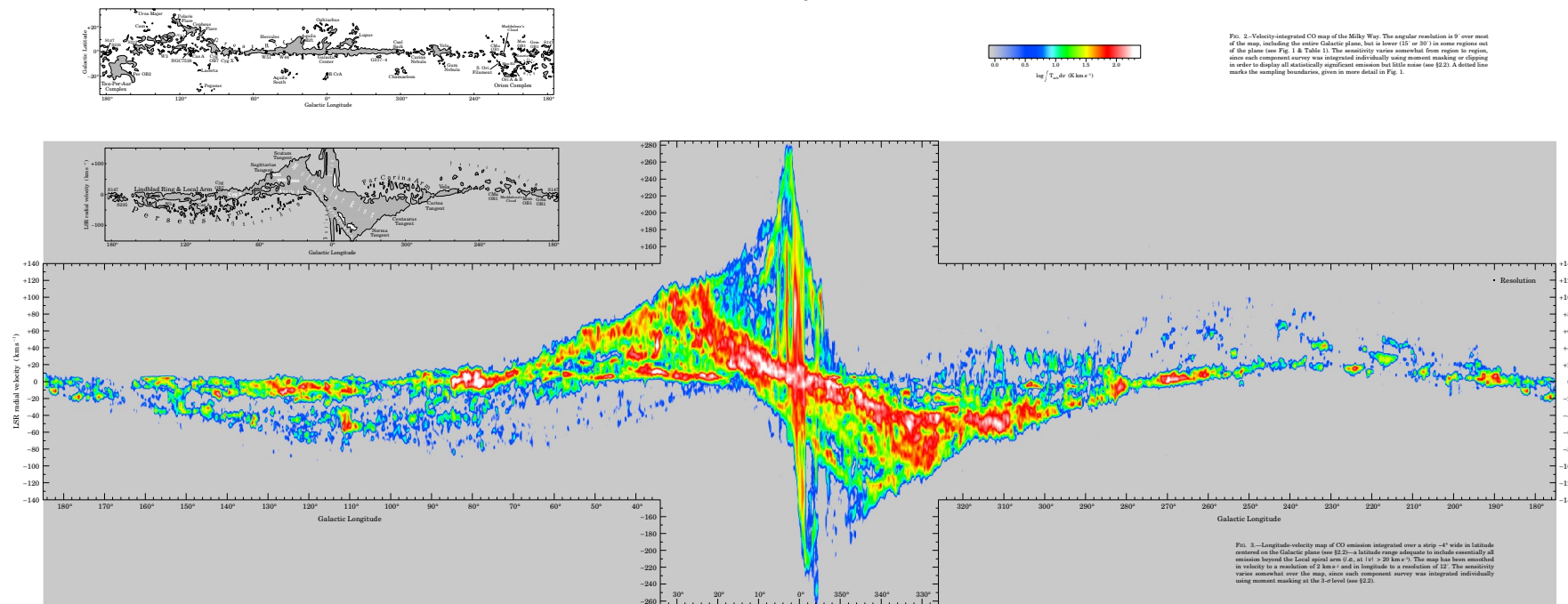


FIG. 3.—Longitude-velocity map of CO emission integrated over a strip  $\sim 4'$  wide in latitude centered on the Galactic plane (see §2.2)—a latitude range adequate to include essentially all emission beyond the Local spiral arm (i.e. at  $l > 30$  km s $^{-1}$ ). The map has been smoothed in velocity to a resolution of 2 km s $^{-1}$  and in longitude to a resolution of 12'. The sensitivity varies somewhat over the map, since each component survey was integrated individually using moment marking at the 3- $\sigma$  level (see §2.2).



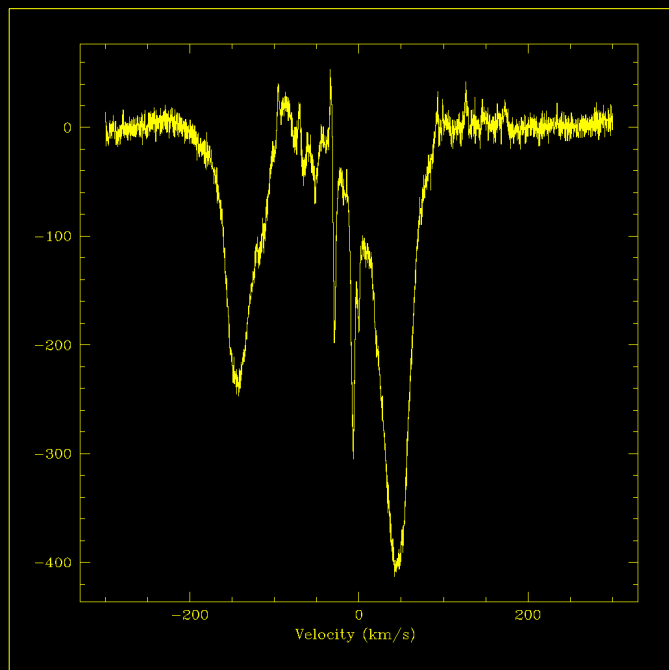


# SPLASH: The Southern Parkes Large-Area Survey in Hydroxyl

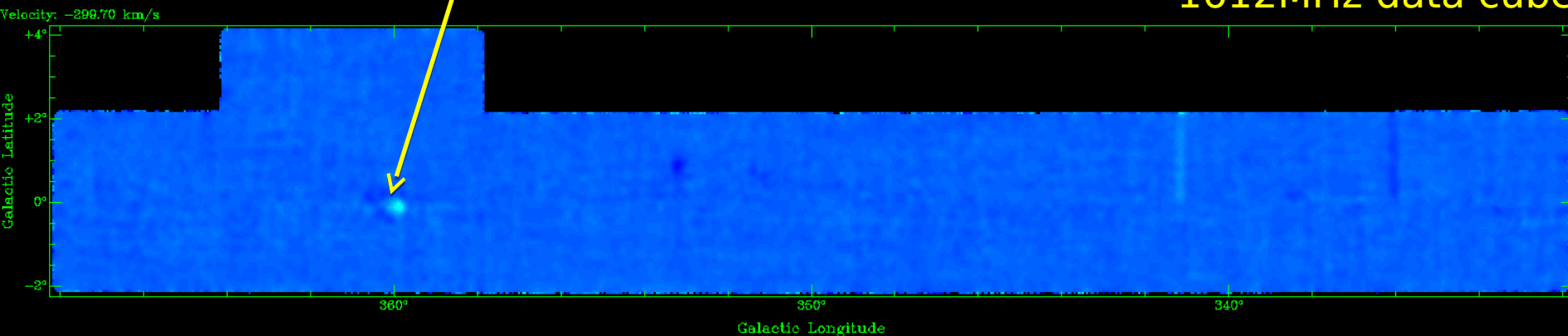


65, 1667 and 1720 MHz

of the southern inner  
disk  $|l| < 10^\circ$ ,  $|b| < 2^\circ$



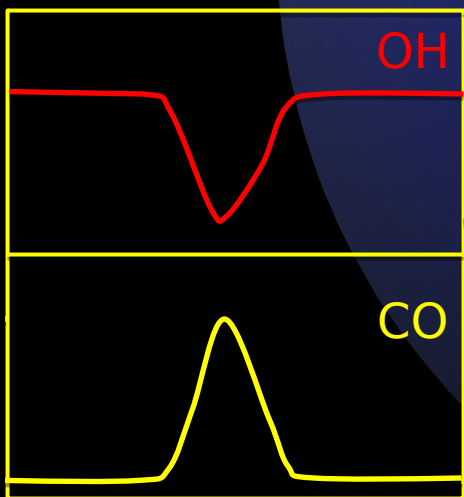
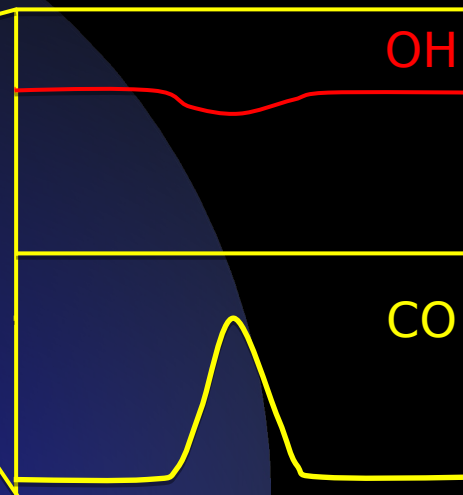
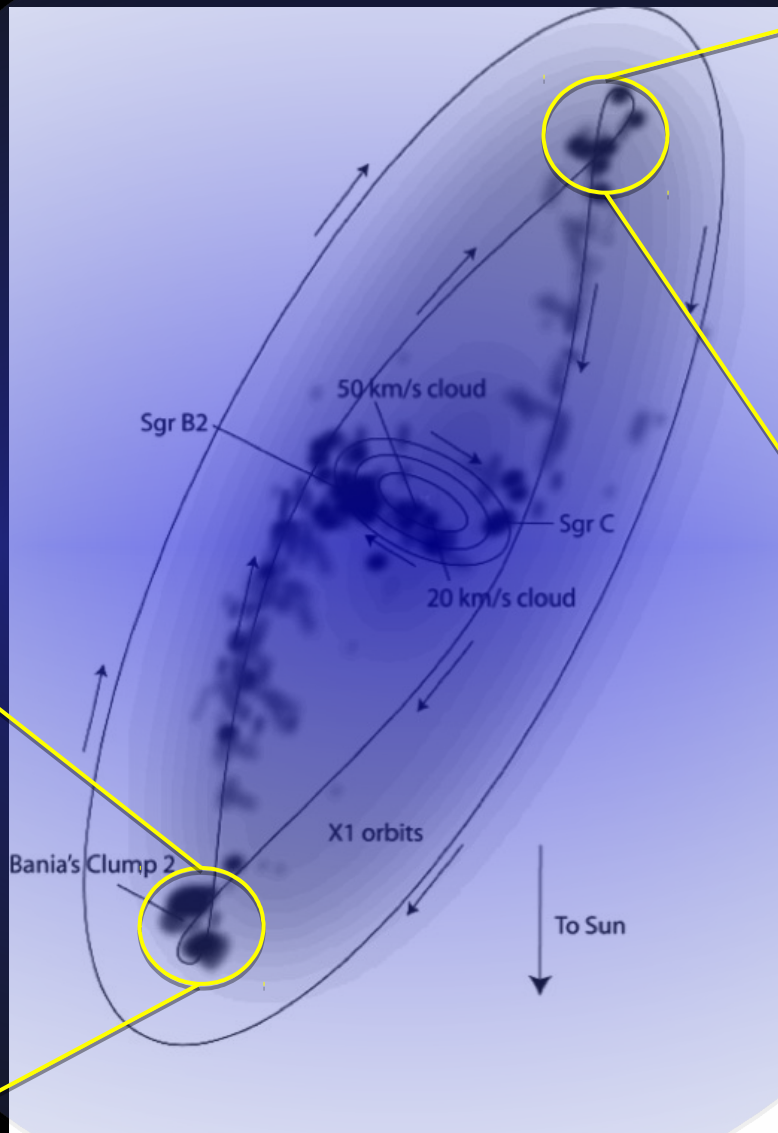
1612MHz data cube

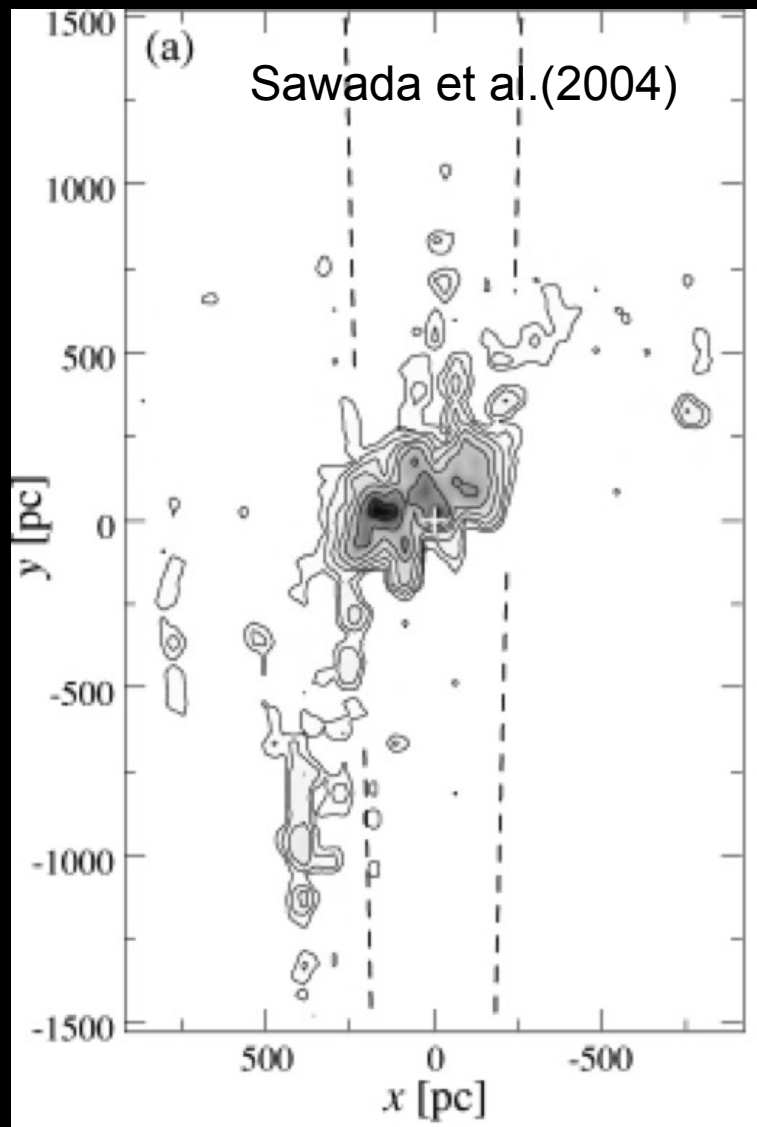
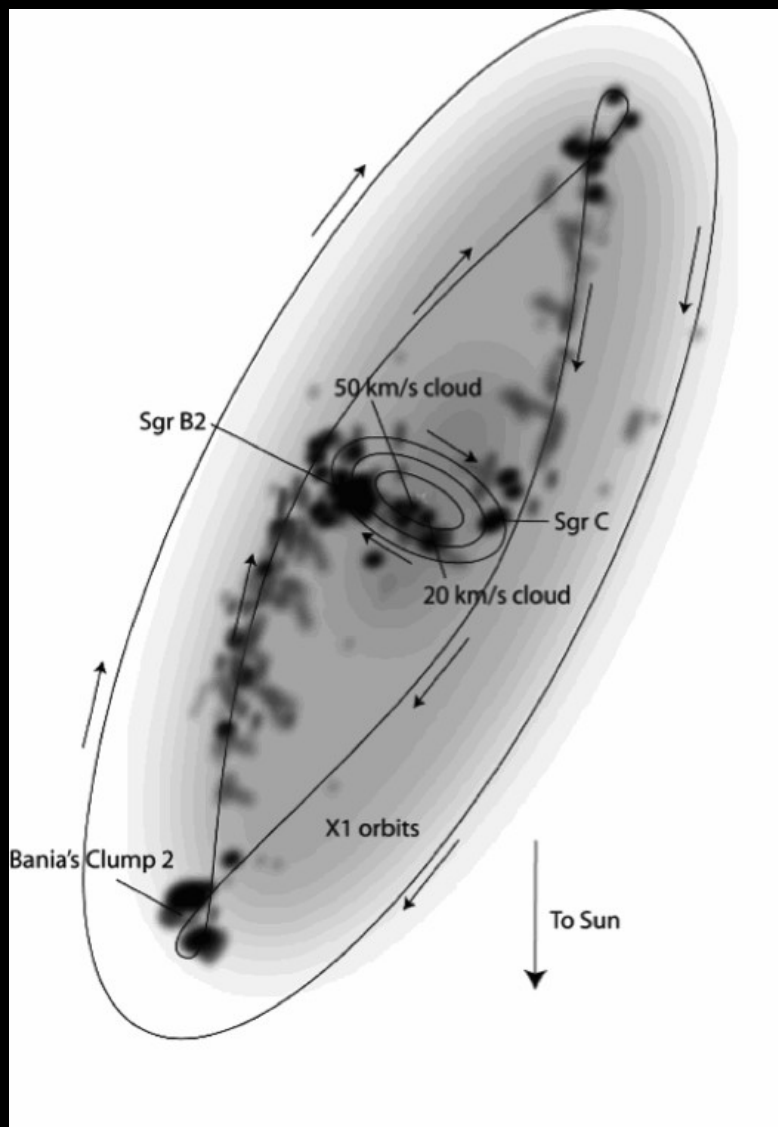




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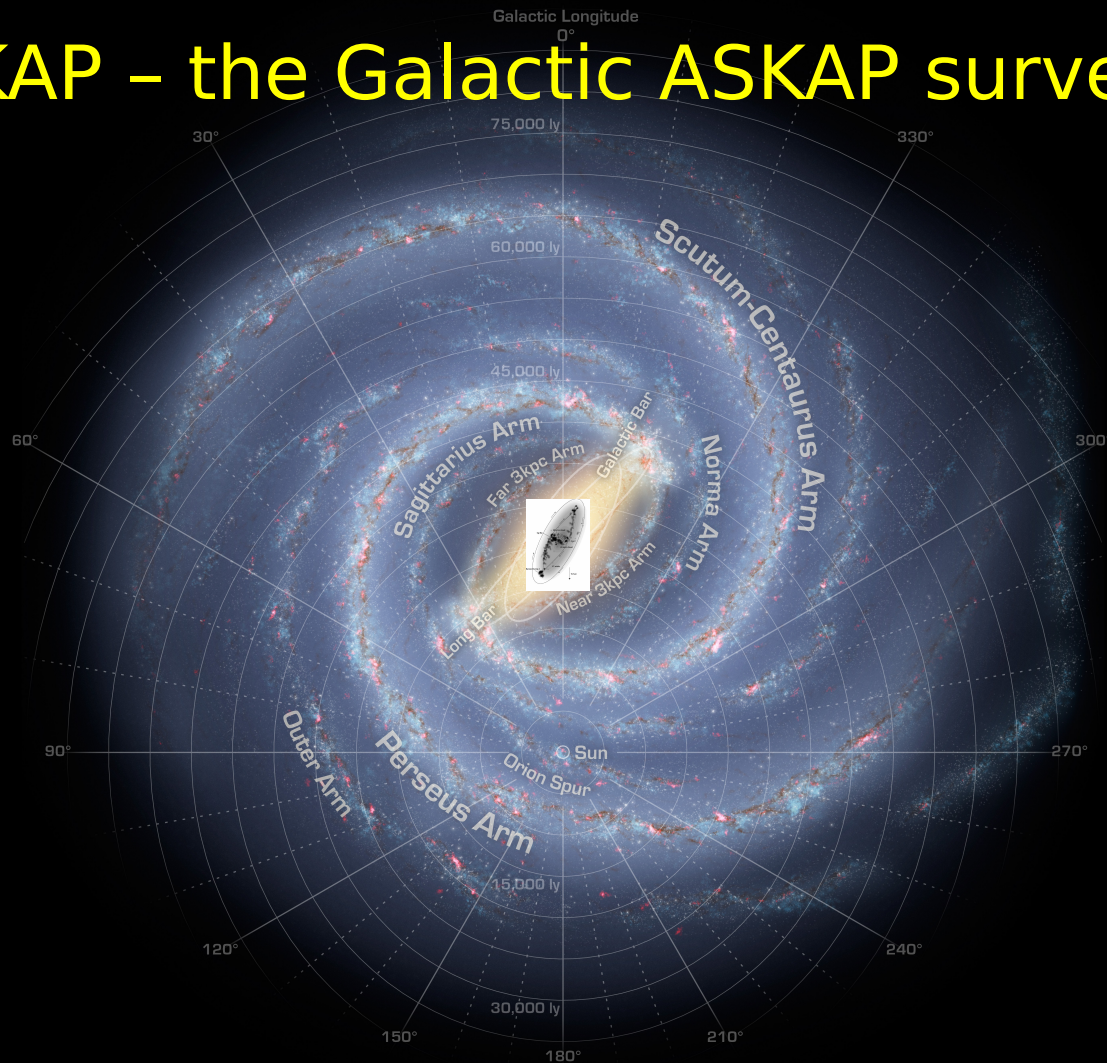
CO in emission  
OH in absorption  
Diffuse continuum







# GASKAP – the Galactic ASKAP survey – OH





# Formaldehyde - H<sub>2</sub>CO

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---

Similar abundance "profile" to CO (most gas seen ~  
10<sup>2</sup>-10<sup>4</sup> cm<sup>-3</sup>)





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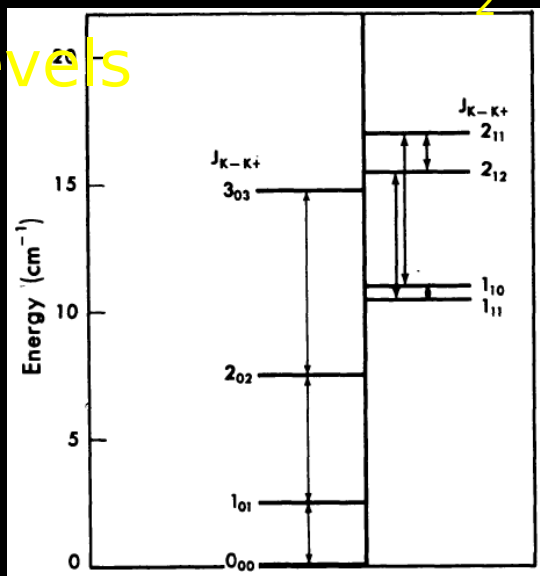
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Collisions with H<sub>2</sub> create "anti-inversion" in low energy levels

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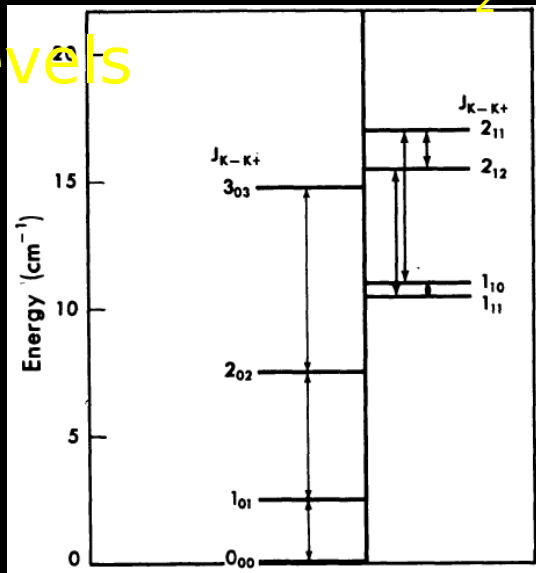


Townes & Cheung (1969)

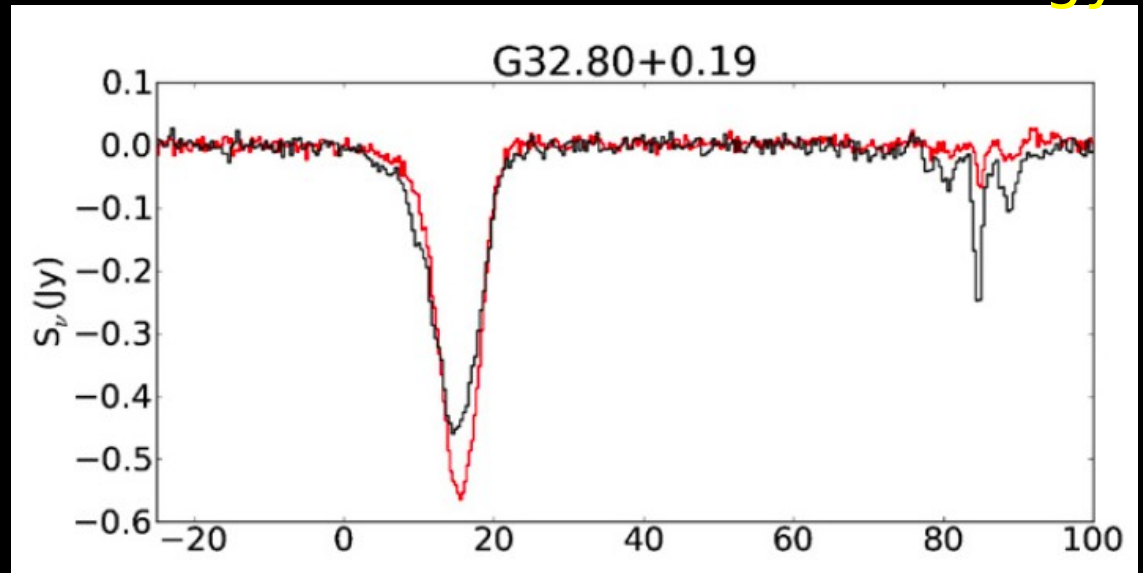
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Ginsburg et al (2011)





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Weak line: avg. Galactic molecular cloud requires 12 hours on JVLA.

But 1-2 hours on SKA1-MID



Capabilities provided by SKA1-MID and other telescopes:

Focus on intermediate density regime (  $\sim 10^2$ -  
 $10^4 \text{ cm}^{-3}$ )

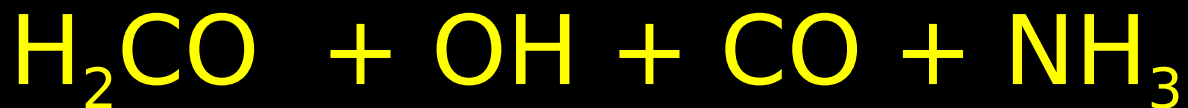
The formation of molecular clouds

Line of sight geometry  
Volume density



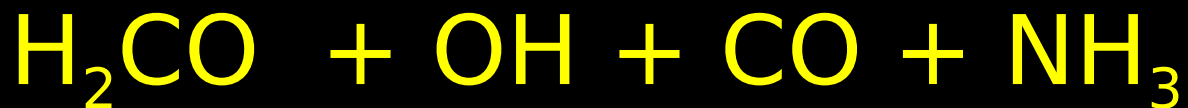


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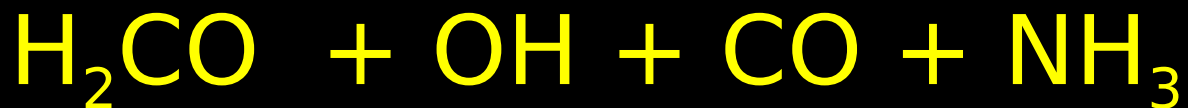
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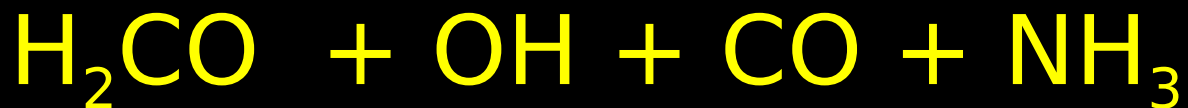
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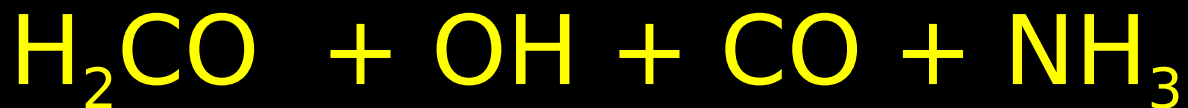
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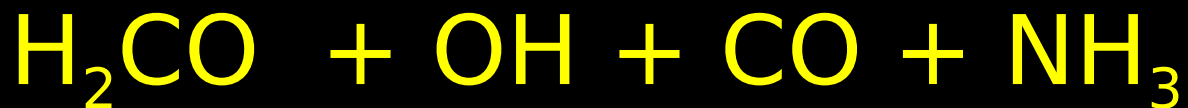
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Now we have the sensitivity to extend to the extragalactic scale!