The Distribution of Gas Densities in the Milky Way

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Abstract

We use observations of molecular and atomic Hydrogen from several surveys that coincide with the 20° by 6° CHaMP region to derive mass estimates and a mass probability density function. The Southern Galactic Plane Survey (McClure-Griffiths et al. 2005) & the Galactic All Sky Survey (McClure-Griffiths et al. 2009) are used for the HI, while the Nanten survey (Yonekura et al. 2005) is used for the H_2 tracers of ^{12}CO, ^{13}CO, $C^{18}O$ and HCO^+.

Dataset	Angular Resolution	Velocity Resolution	Coverage	Velocity Range
HI SGPS	2.2'	.82 km s^{-1}	280° ≤ l ≤ 300° |b| ≤ 1.5°	-229 km/s ≤ V ≤ 100 km/s
HI GASS	16'	.82 km s^{-1}	280° ≤ l ≤ 300° -4 ≤ b ≤ 2	-400 km/s ≤ V ≤ 500 km/s
Nanten	~ 2'	1 km s^{-1}	280° ≤ l ≤ 300° -4 ≤ b ≤ 2	-50 km/s ≤ V ≤ 50 km/s

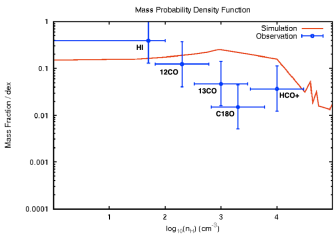
Mass Totals (Msun x 10^6)

	Near	*Far*
HI-GASS	236	260
HI-SGPS	116	129
12CO	10.8	14.0
13CO	3.78	5.15
C18O	1.02	1.58
HCO+	3.08	4.00

Methods

Our mass estimates try to account for the distance ambiguity that arises within the solar radius by setting all ambiguous points at the far point and then at the near point, for a maximum and minimum mass range. We assume a flat rotation curve model as well. From our mass results we were able to generate maps of the distribution of HI and H_2 covering galactic longitudes 280° to 300° as viewed from above.

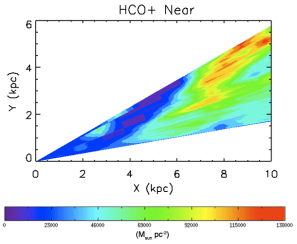
With total mass calculated for HI and H_2, mass fractions have been derived for the region. Our mass probability density function displays the variance of the mass with the range of densities covered by each tracer and can be compared to the simulations run by Tasker & Tan (2009).

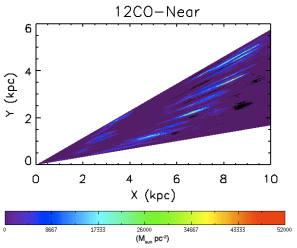


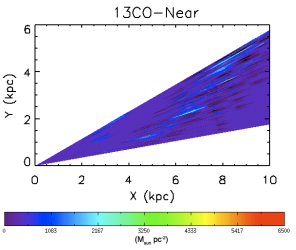
Results

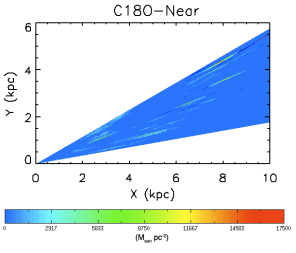
In our maps the Carina Arm can be distinctly seen within each plot and it contains most of the massive clumps seen in each tracer. Clumps within 5 kpc may be shifted due to any distance ambiguity.

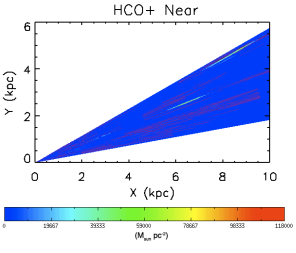
The mass pdf generally agrees with the model. The ^{13}CO is a lower limit since it is based on the assumption of being optically thin. We are working on a way to include the effects of optical depth.











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