

THE CARBON MONOXIDE DISTRIBUTION IN THE INNER GALAXY

T.M. Bania

Department of Astronomy, Boston University, Boston, MA

The latitude distribution of the emission from the ^{12}CO $J=1\rightarrow 0$ rotational transition has been surveyed for the region $350^\circ \leq l \leq 25^\circ$ at $b = 0'$, $\pm 10'$ and $\pm 20'$. Most of the ^{12}CO emission in the inner Galaxy, the region extending from the galactic center to 4 kpc radius, is produced by three large and massive objects: the nuclear disk/bar, the 3-kpc arm and the "+135 km s $^{-1}$ feature". These structures all have observed HII counterparts and each shows extremely large deviations (50-180 km s $^{-1}$) from circular motion. Observations of ^{13}CO in selected directions show that the two structures outside the nuclear disk each span at least 2 kpc in length and that together they imply $> 10^{55}$ ergs in kinetic energy of expansion away from the galactic nucleus.

The properties of the clouds within these inner-Galaxy features are quite similar to those derived for the Giant Molecular Cloud population residing beyond 4 kpc from the galactic center. The inner-Galaxy clouds are typically 100-150 pc in diameter with H_2 masses of $\approx 10^6 M_\odot$ (inferred from $^{13}\text{CO}/^{12}\text{CO}$ data toward selected clouds). The average properties for the 3-kpc and +135 km s $^{-1}$ arm clouds are summarized below. The most striking object is the "Clump 1" cloud at $(l, b, v) = (355^\circ, 0.4^\circ, +100 \text{ km s}^{-1})$. It lies at the edge of an HII region, G354.67,+0.25, making it one of the only clouds in the inner Galaxy outside the nuclear disk which shows evidence for recent star formation.

AVERAGE PROPERTIES OF CO CLOUDS IN INNER-GALAXY EXPANDING FEATURES

	3-kpc Arm	+135 km/s Arm	Clump 1
Number of Clouds	10	9	1
Mass (H_2) (M_\odot)	$1.0 \pm 1.1 \times 10^6$	$9.6 \pm 8.2 \times 10^5$	2.6×10^6
Diameter (pc)	120	130	85
$N(\text{HI})/2N(\text{H}_2)$	0.5	0.1	0.1
Arm Filling Factor	0.7	0.6	--
Arm Proton Mass (M_\odot)	$2-6 \times 10^7$	$2-6 \times 10^7$	2.9×10^6
E_{exp} (ergs)	$0.6-1.7 \times 10^{54}$	$0.3-1.1 \times 10^{55}$	5.2×10^{53}

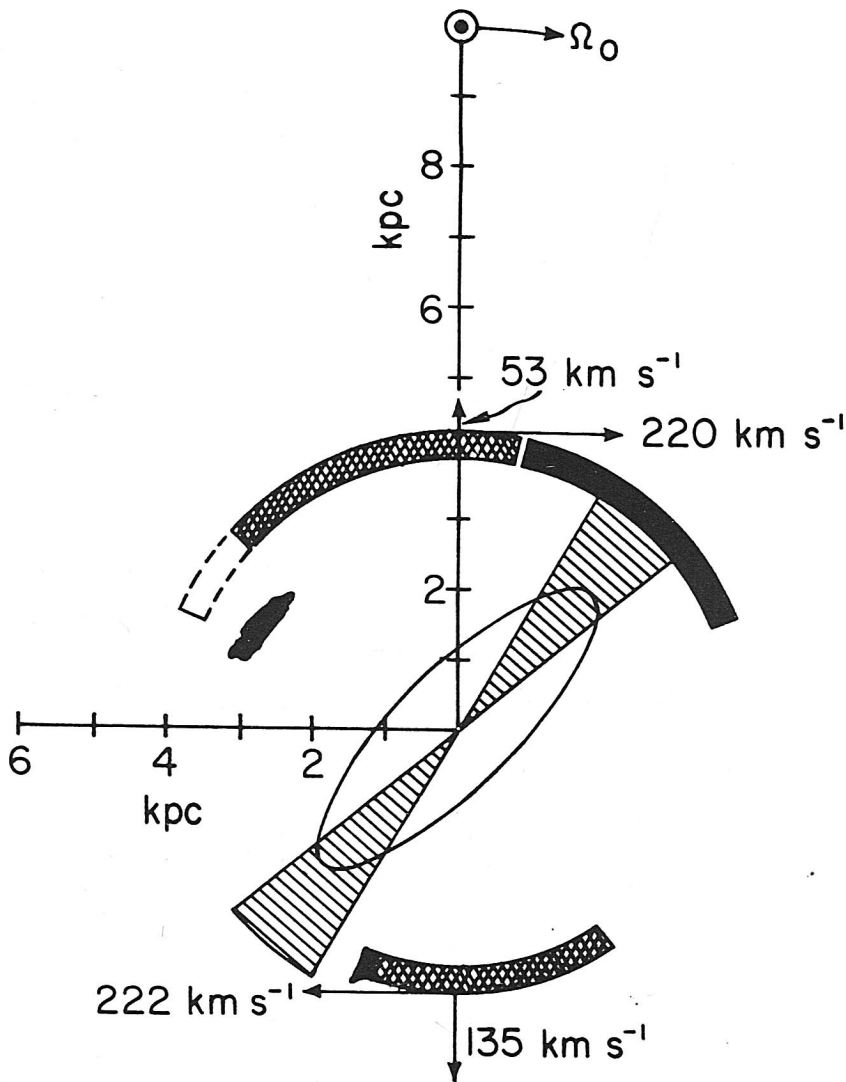


Figure 1: Schematic map of the distribution of the largest and most massive molecular objects in the galactic-center region based on ^{12}CO data (Bania: 1980, Ap.J. 242, 95). The positions of the ^{12}CO structures result from analyses which assume that the (l, v) -loci of the molecular clouds are produced by simple kinematic models that have fixed radii and which also rotate and expand. The shaded ring segments are conservative estimates for the extent of the molecular gas in the two expanding arms. Outside the nucleus itself, there is evidence for HII gas in the inner Galaxy only for the fully shaded regions (this includes the remarkable Clump 1 cloud). Also shown is the ≈ 1.5 kpc radius nuclear disk/bar whose major-axis position angle coincides with the position angles (stripes) required by resonant-orbit models for the 3-kpc arm.