line shapes are found to be complex. Velocity distributions derived from the line profiles will be presented. Broad wings on the profiles indicate proton velocity distributions that deviate significantly from that expected in a purely Maxwellian thermal distribution. Possible explanations for the observed high velocities will be discussed.

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Session 60: Galactic Structure
Oral Session, 10:15–11:45 am
Crystal Forum

60.01
Molecular Cloud Distribution in the Outer Galaxy
S.J. Carey (Rensselaer)

We present the results of a survey of a square degree of the outer Galaxy in the $^{12}$CO $J = 1 \rightarrow 0$ transition using the NRAO 12 meter telescope. This survey is the first to be sensitive to small and/or low surface brightness clouds. The survey covers galactocentric radii between 9 and 16 kpc. Although we have chosen a region with a strong HI spiral arm feature, $(l = 76.4^\circ, b = 1.5^\circ)$, the survey is not biased towards bright (massive star forming) or giant clouds, and is sensitive to clouds with temperatures of less than 1 K on the $^{12}$CO scale and sizes of $\geq 4$ pc at R = 16 kpc. In the survey region, 137 individual clouds have been observed. Two distinct cloud populations, arm and interarm, have been identified. The molecular spiral arm in this region is centered at $R = 13$ kpc and is $\sim 1.5$ kpc wide. As expected, the arm population is dominated by the more massive ($10^4 M_\odot$) clouds, while the interarm population consists mostly of small (diameter $< 10$ pc) clouds. The peak line temperatures and linewidths of comparable mass clouds in the two populations are similar, suggesting that the two populations have similar physical characteristics. However, the cloud size distributions of the two populations are very different. This discrepancy may possibly be explained by different formation mechanisms for large and small clouds.

We have also investigated the properties of the clouds as a function of cloud size. We find that $\sim 30\%$ of the mass ($1.1 \times 10^4 M_\odot$) of the survey region is contained in small clouds. Implications of this finding on estimates of the total molecular mass of the outer Galaxy will be discussed.

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60.02
Galactic Scale Heights of [N II] and [C II] Emission
S. J. Petuchowski and C. L. Bennett (NASA/GSFC), M. R. Haas, S. W. I. Colgan, and E. F. Erickson (NASA/Ames)

The distribution of diffuse [N II] 205 $\mu$m emission perpendicular to the Galactic plane at $l = 73.28$ has been measured from the NASA Kuiper Airborne Observatory and is compared with the distribution of emission by other atomic and molecular species. The profile of [N II] emission, characteristic of warm ionized gas, is modeled as a Gaussian of $129^{+1\sigma}_{-1\sigma}$ HWHM. The distribution of [C II] $158 \mu$m emission, characteristic of predominantly neutral photodissociation regions, and first measured by Stacey et al. (1985) at the same longitude, has a Gaussian HWHM of $184^{+1\sigma}_{-1\sigma}$. Line intensities are compared with those observed with the 7th beam of the COBE FIRAS.

60.03
The Vertical Equilibrium of the Molecular Gas in the Galaxy
S. Malhotra (Princeton University Observatory)

We examine the vertical structure and equilibrium of the molecular gas layer in the galactic disk, measuring its scale height and velocity dispersion as a function of galactic radius. These quantities are determined for the tangent point gas in a survey of $^{12}$CO($1\rightarrow 0$) in the first quadrant.

59.07
Solar Tomography
J. M. Davila (NASA/GSFC)

Images obtained by observing the solar corona from a single spacecraft typically measure the line-of-sight integral of the volumetric emissivity through the source. The resulting two-dimensional observations have an unavoidable ambiguity along the line of sight that can be removed only by making assumptions about the three-dimensional nature of the emission. These ambiguities can be removed by observing the Sun from different vantage points at the same time, i.e., solar tomography.

The basic concept of tomographic is fairly simple. For an optically thin emission source, like the solar corona, each pixel in an image represents the line of sight integration of the volumetric emissivity of the plasma at the wavelength of observation. By obtaining several of these observations, from various angles, the underlying three dimensional structure of the emission can be deduced. This principle has been used extensively in the medical community for the imaging of internal structure of the body with such techniques as Computer Aided Tomography (CAT) scanners and Magnetic Resonance Imaging (MRI).

The purpose of this paper is to take an initial look at the following two questions: (1) Is tomography feasible with a few spacecraft?; and (2) What scientific objectives can be addressed?

59.08
Scattered Light in Solar Images using Hankel Transforms

We have been investigating the scattered light properties of the San Fernando Observatory (SFO) Cartesian Full Disk Telescope (CFDT). Recently, Toner and Jeffries (1993, Ap. J. 415, 832) have published a technique for the accurate determination of the solar limb position, based on the Hankel transform of a radial solar profile. They show that the Hankel transform of the observed solar limb profile yields a seeing-independent determination of the solar limb position and limb darkening profile. In principle, the ratio of the transform of the observed profile to that of the model, polynomial, solar limb darkening would then be the modulation transfer function (MTF) of the atmosphere and telescope. In practice, as with all such ratios of an observed power spectrum to an analytic one, the noise at high spatial frequencies makes the division difficult. We have taken a different approach. Using observed limb profiles from the SFO CFDT, we do a non-linear least-squares fit of the observed profile to the convolution of a model limb darkening profile and a model MTF. The model limb darkening is an expansion in orthonormal Legendre polynomials in $\mu$ rather than simple powers of $\mu$, as orthonormal polynomials have many desirable numerical features. The model MTF is a sum of short-range (typically Gaussian) and long-range (typically Lorentzian) parts (Lawrence, Chapman, Herzog, and Shelton 1985, Ap. J. 292, 297). We will present results from these model fits and comment on their robustness.

We gratefully acknowledge Eric Hansen of Dartmouth College, who supplied us with a copy of his Hankel transform code. This work has been partially supported by NSF grant ATM-9115111 and NASA grants NAGW-2770 and NAGW-3017.