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.

Supported in part by NASA Grant no. NAG 5-613 to the Smithsonian Astrophysical Observatory.

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 → 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 $< 10^4$K on the $^{12}$CO scale and sizes of $> 4$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 on R = 13 kpc and is $\sim 1.5$ kpc wide. As expected, the arm population is dominated by the more massive ($10^6 M_\odot$) 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 ($1.1 \times 10^6 M_\odot$) 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.

S. Carey was aided by the travel support program of the Astronomical Society of New York and a Grant-in-Aid of Research from the National Academy of Sciences, through Sigma Xi, The Scientific Research Society.

* The National Radio Astronomy Observatory is operated by Associated Universities, Inc., under cooperative agreement with the NSF.

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)

We have been investigating the scattered light properties of the San Fernando Observatory (SFO) Carteis 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 this 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.

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 → 0) in the first quadrant.