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STRUCTURE OF DARK MOLECULAR GAS IN THE GALAXY I - A Pilot Survey for 18-cm OH near $l \approx 105°, b \approx +1°$

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A high-sensitivity, blind survey for OH emission in a small patch of sky near the Galactic Plane will be described (Allen, Hogg, & Engelke 2015). Spectra were recorded with 2 hr integrations on a sparse grid of 3 X 9 pointings with a step size of $0.5°$ using the GBT (FWHM $\approx 7.6'$). 21 of the 27 spectra show detectable 1667 MHz features, confirming the ubiquity of this molecular emission line in the general diffuse ISM. With few exceptions, the main OH lines at 1665 and 1667 MHz appear in the ratio of 5:9 characteristic of LTE at our sensitivity levels. No OH absorption features are recorded, consistent with the low levels of continuum background in this direction. At each pointing the OH emission profiles show several components coinciding with well-known features of Galactic structure such as the Local Arm and the Perseus Arm. In contrast, little CO emission is seen in the survey area; less than half of the ≥ 50 identified OH spectral features show detectable CO(1-0) counterparts at the sensitivity levels of the CfA CO(1-0) survey (Dame, Hartmann, & Thaddeus 2001), and these are generally relatively faint. There are no CO features without corresponding OH emission in our survey.

Some of the main conclusions of this work so far are as follows: 1. Main-line OH emission is ubiquitous in the Galactic ISM; it appears to come from a larger area of low-volume-density molecular gas. 2. The morphology and extent of main-line OH emission resembles that of the "dark molecular gas" in the Galaxy discovered earlier in far-IR and gamma-ray emission, but with the added advantage that radial velocity information is also provided. 3. The additional mass of molecular gas present in the ISM implied by these observations is substantial; although the volume density is low, its spatial extent is large, approaching that of the HI. Further work is needed to establish the quantitative details of this connection. Although UV absorption observations and modeling suggest that the relation between OH and H_2 column densities is less complicated than for CO and H_2, the question of what excitation temperature to use in order to convert the observed OH line strength into a column density remains somewhat uncertain.

Recent extensions and future directions for this work will be described.

REFERENCES

Allen, R.J., Hogg, D.E., & Engelke, P.D. (2015), Astron. J., 149, 123
Dame, T.M., Hartmann, D., & Thaddeus, P. (2001), Astrophys. J., 547, 729