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Arcminute Resolution VLA Imaging of High Latitude HI

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12.10

A Sensitive Search for High-Velocity Galactic HI

E.M. Murphy (U. Virginia and NRAO), F.J. Lockman (NRAO), B.D. Savage (U. Wisconsin)

We have conducted a sensitive 21-cm search for Galactic HI high-velocity ($|V_{\text{LSR}}| > 100 \text{ km s}^{-1}$) clouds in the directions of quasars which have appeared on planning lists for the Quasar Absorption Line Key Project of the Hubble Space Telescope. Our aim was to understand the distribution and properties of the high-velocity galactic clouds that will be seen in UV absorption lines against the quasars. We have found that 37% of the sky is covered by high-velocity clouds, excluding the Galactic warp, to a 5σ completeness limit of $7 \times 10^{17} \text{ cm}^{-2}$. This is a significant increase over the 18% found by previous surveys. The majority of this new high-velocity emission can be associated with previously known HVC complexes. From this, we conclude that the HVC complexes are surrounded by extensive low column density, neutral envelopes. This result may have important implications for the hypothesis that the narrow metal line systems seen in the spectra of quasars arise in the intervening gaseous halos of galaxies. If there is a population of HVCs not associated with the complexes, they must have a column density less than $7 \times 10^{17} \text{ cm}^{-2}$, cover a small fraction of the sky, or they must be ionized.

12.11

Modeling the Distribution of Interstellar Scattering at Low Latitudes

D.R. Iyengar (Carleton College), T. Ghosh, C.J. Salter (NAIC)

The distribution of the ionized component of the interstellar medium in our Galaxy may be investigated through observations of compact extragalactic sources. Density fluctuations of the ionized material scatter the radio waves from these sources, resulting in the angular broadening of their images. This broadening is described by the following relation:

$$\theta_{\text{arcsec}} = 1.72 \times 10^{-2} \lambda^{2.2} \left(\int_0^s C_N^2(s') ds' \right)^{0.6}$$

where C_N^2 is a measure of the scattering strength, λ is the observing wavelength in meters, and s' the line-of-sight distance to the object in pc. An estimate of the scattering strength along the line of sight to an object may thus be obtained by measuring the angular broadening of its image. Observations of many objects allow the calculation of the scattering strength along a range of lines of sight, and a model of the large-scale distribution of the turbulence in the ionized component of the ISM may be obtained.

Earlier studies have suggested a two-component distribution, with perhaps a spiral pattern at low latitudes.

In an attempt to verify this model, we have made VLBI observations at 0.61, 1.66, and 5 GHz of a sample of 26 flat-spectrum extragalactic sources located at $|b| < 1$ degree, and 9 deg. $< l < 109$ deg. Details of these observations, their data analysis, and the results are presented in this poster.

12.12

Arcminute Resolution VLA Imaging of High Latitude HI

M.A. Holdaway, M.P. Rupen (NRAO), G.R. Knapp (Princeton), S. West, W. B. Burton (Leiden)

We have used the VLA and the Dwingaloo 25-m telescope to mosaic HI at one arcminute spatial resolution and 1.3 km/s velocity resolution in two high latitude $2''$ fields. One field is centered on a bright filament in an infrared cirrus cloud, the other is a blank field with essentially no IRAS structure. We detect extended HI features with large ($> 6 \text{ km/s}$) velocity widths in the cirrus field and filamentary HI emission with velocity widths of 2-6 km/s in both fields. In the cirrus field, the HI shows qualitative agreement with the dust emission. We will display a detailed comparison between the HI and deconvolved IRAS images. In the "blank field," the weaker HI filaments appear at intermediate negative velocities and are ~ 30 times brighter than the background.

12.13

The Collision Origin of Cohen's Stream

C. Tamanaha (UC Berkeley)

High spacial and spectral resolution H I observations of the high-velocity cloud in Cetus called "Cohen's Stream" reveal 21 cm features at velocities of $-280, -120, -37, \text{ and } -3 \text{ km s}^{-1}$. These new observations show in detail that the high- and very-high-velocity gas are anticorrelated in position on the sky. These observations cover only a small portion of H I clouds involved, but the anticorrelation persists on the larger scales mapped by Cohen (1981, 1982). The obvious explanation is that the high-velocity gas is the remnant of a collision between the very-high-velocity gas and a low-velocity cloud. A simple mass and momentum conserving simulation demonstrates the elegance of this model. The asymmetric velocity distribution of the individual pixels composing the remnant is a natural consequence of the different sizes of the parent clouds. Reasonable column density fluctuations added to the simulated parent clouds result in a remnant whose velocity distribution is much broader than observed. Some form of damping or momentum redistribution is needed to reduce the large velocity dispersion. The redistribution of momentum by the enhanced magnetic field in the compressed postshock gas appears to be the most promising damping mechanism. The magnetic tension in the field lines accelerates slower moving components while decelerating the faster moving ones. Recently shocked remnants are expected to have strong asymmetries in their velocity distributions. Older remnants will have more symmetric distributions, owing to the longer time over which the enhanced magnetic field has been allowed to damp the disparate velocities produced in the collision.

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12.14

All-Sky Surveys in H I and X-ray Intensity in Simulations of the Interstellar Medium

Rosen, A. and Bregman, J.N. (U. Mich.)

Previously, we have generated six hydrodynamical two-dimensional two-fluid simulations of the interstellar medium that naturally create the filamentary structure of cold gas apparent in neutral hydrogen in the Galaxy. The two fluids in these simulations represent the stars and gas in the interstellar medium, and interact via star formation, mass loss, and heating from stellar winds or supernovae. We have analyzed one image from the simulations for the variation of H I column density with galactic latitude from five positions in the simulation, three of which are within bubbles of hot gas. In addition, we calculate the X-ray intensity in bands near 0.25 keV and 0.75 keV for each of these five positions as well. Our study shows the dominance of the local environment at 0.25 keV, and relatively larger importance of distant material to the 0.75 keV intensity. Our results also show that the 0.75 keV data are more frequently anti-correlated with the H I column density.

12.15

X-Ray Morphology, Kinematics and Geometry of the Eridanus Soft X-Ray Enhancement

Zhiyu Guo (The Pennsylvania State University), David N. Burrows (The Pennsylvania State University), Wilton T. Sanders (University of Wisconsin - Madison), Steve L. Snowden (NASA/GSFC), Bryan E. Penprase (Claremont College)

We present mosaics of X-ray intensity maps and spectral fit results for selected regions of the Eridanus soft X-ray Enhancement (EXE), as well as kinematics of the X-ray absorbing clouds in the EXE region and geometrical properties of this X-ray emitting bubble. The work is based on pointed observations with the ROSAT Position Sensitive Proportional Counter, 21 cm observations with the NRAO 140 foot telescope at Green Bank and interstellar Na D line observations with the NOAO Coudé Feed telescope at Kitt Peak. The ROSAT pointed observations examine two regions of the EXE. The first is an X-ray absorption lane produced by an IR filament which is located at galactic coordinates of about ($199^\circ, -45^\circ$). The second is in