GALFA-H I: The Inner-Galaxy ALFA (I-GALFA) Low-Latitude H I Survey

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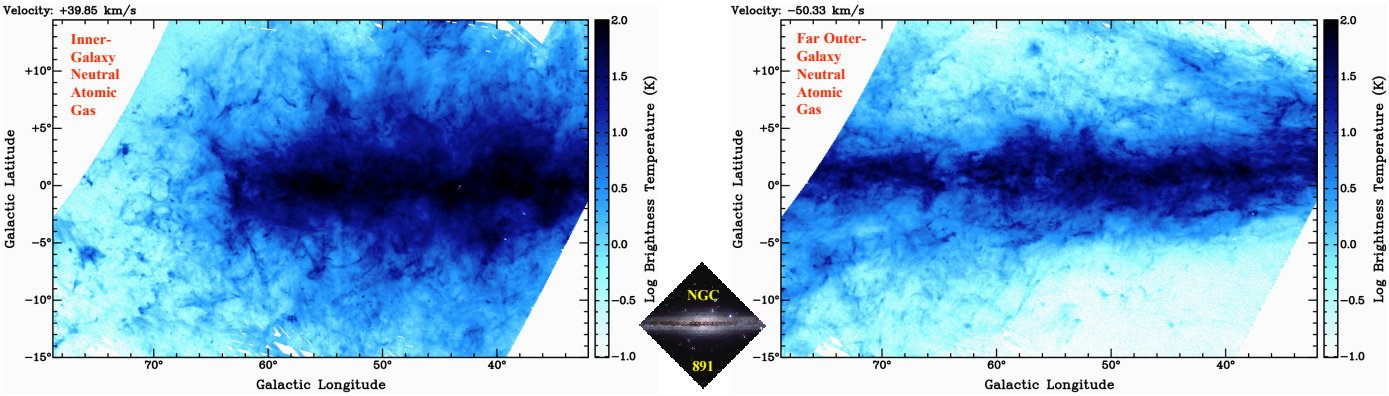

Figure 1. I-GALFA 1st-quadrant HI emission on and off the Galactic plane, at both inner- and outer-Galaxy velocities. All gas within 10° of the plane is covered, with many latitude extensions. At 3 kpc distance, 10° of latitude = 500 pc, and the Arecibo beam subtends 3 pc. The vertical HI worms in the left panel resemble optical dust filaments in other galaxies (NGC 891 inset; Howk & Savage 1997). By contrast, the far-side outer-Galaxy HI structures in the right panel are predominantly horizontal (Koo et al. 2011). Arecibo's unique sensitivity and dynamic range for HI work are highlighted by the logarithmic intensity scale. Areas outside the Arecibo Declination range of -1.33° to +38.03° are blank.

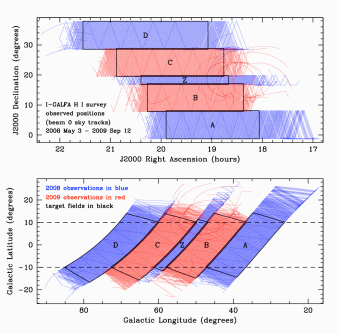

Figure 2. I-GALFA was observed primarily by ``nodding'' the Arecibo 305m telescope over a given DEC range on the meridian as the Earth turned. Each day's zig-zag scans were then ``woven'' into a coherent map, with many velocity channels at each position. The final data products are HI brightness temperature *(l,b,v)* FITS cubes.

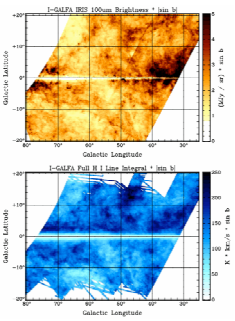

Figure 3. I-GALFA HI traces extraplanar dust structures very well, while retaining full kinematic information. The IRAS dust (top) and I-GALFA HI (bottom) maps here, which have similar angular resolutions, have their intensities multiplied by the absolute sine of the latitude to illustrate the gas-dust correspondence over large spatial and brightness ranges. A large front-like feature is visible near *(l,b)* = (60°,-10°) (see Newton poster 349.24).

A Breakthrough Survey of the Inner Galaxy

The Inner Galaxy ALFA (I-GALFA) survey presents a new, richly-detailed view of neutral atomic hydrogen (HI) gas in the Galactic disk. Using the Arecibo 305m radio telescope and 7-beam ALFA receiver, we have mapped all HI 21cm line emission and absorption at Galactic longitudes 32° to 77° and latitudes -10° to +10°, with some extensions to 20°-25° off the plane. I-GALFA covers more than 1650 square degrees with a 4-arcminute beam and over 8 million observed spectra, using 0.184 km/s velocity channels covering LSR velocities from about -700 to +700 km/s. The brightness temperature RMS noise is 0.2 K in single empty channels and less over larger velocity intervals. These combined parameters represent a breakthrough for studies of the diffuse interstellar medium in a wide range of environments.

Early Results and Data Release

Newly-revealed features include finely-structured chimneys and worms in the disk-halo region (Figure 1), coherent extraplanar multiwavelength structures (Figure 3), narrow-line cold HI clouds in areas of molecular formation (Figure 4), and expanding shells from ancient supernovae (Figure 5), among other discoveries.

Following extensive refinements of the data processing pipeline (Peek et al. 2011), a full public release of all I-GALFA survey data is anticipated for early 2012. Data access information and other details will be given on the survey website (www.naic.edu/~igalfa).

The I-GALFA survey is part of the larger Arecibo GALFA-HI data set covering the entire sky observable with the Arecibo 305m radio telescope (32% of the celestial sphere). All of these data will be combined and released when the observations are completed.

References

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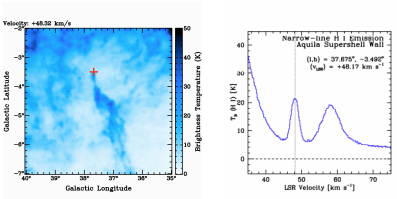

Figure 4. I-GALFA's combined sensitivity, angular resolution, and narrow velocity channels allow rich spatial and spectral analysis of cold emission and absorption clouds, including spin temperature and optical depth fits to some line shapes (see Newton poster 349.24). Many clouds appear to contain significant cold, opaque HI that may be condensing into H_2, the first step on the road to star formation (Gibson 2010; see also Bell poster 349.28 on the dust SEDs in such clouds.)

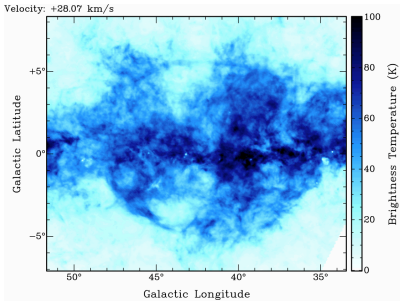

Figure 5. I-GALFA is revealing new details in major supershells like this one in the Sagittarius arm (GS 041+01+27; Heiles 1979), as well as uncovering many other previously-hidden shells from old supernovae that appear as ``forbidden-velocity'' HI line wings (Kang et al. 2011).

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I-GALFA survey website: www.naic.edu/~igalfa