Radio Map of North Galactic Pole Reveals Influx of Hydrogen

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Abstract

A 21-cm radio map around the north galactic pole reveals both an influx of Hydrogen with a velocity of 25-30 kps and and outflux of Hydrogen at about 2 kps. Data in this region shows a distinct double peak in signal strength vs velocity centred at 1.42 GHz. The map shows a quasi-circular region of Hydrogen influx centred on the north galactic pole and having a diameter of about 10 degrees of arc.

Data Aquisition

Data files were downloaded from 49 locations near the north galactic pole. The files were then collated and read for velocity peaks, both positive and negative. The velocities and locations were then used in a half-wave cosine Fourier decomposition in order to produce maps in the region.

Measuring points were at about 5 degrees of arc along right ascension and declination from 12:00 hrs to 14:00 hours and from 10 degrees to 40 degrees. A requested beam width of 0.9 degrees was chosen from reach location to obtain maximum beam width in each measure. Each accessed data point returned the nearest location to that requested, within a few arc minutes, and the accessed location was used for the Fourier decomposition.

Data Survey

Data was collated from the Hi Survey server of the Argelander-Institut für Astronomie. HI All-Sky-Profiles (EBHIS/GASS/LAB) were used.

Effelsberg-Bonn HI Suryey (EBHIS): Effelsberg 100m telescope, $\delta > -4^\circ$ Galactic All Sky HI Survey (GASS): Parkes 64m telescope, $\delta < 1^\circ$ Leiden/Argentine/Bonn HI Survey (LAB): Villa Elisa 30m and Dwingeloo 25m telescopes

Data Page Link

> This interface allows you to extract HI profiles from the EBHIS, GASS, and the LAB survey. The profiles are generated on the fly using a weighted interpolation with a Gaussian kernel. The effective beamsize includes telescope beam and beam smearing due to interpolation. The beam for the GASS is 14.4 arcmin (64m Parkes telescope),

for EBHIS it is 10.8 arcmin (100m Effelsberg telescope), while for the LAB it is 36 arcmin for declinations > -27.5 deg (25m Dwingeloo telescope) and 30 arcmin for declinations < -27.5 deg (30m Villa Elisa telescope).

Due to interpolations the minimum effective FWHM beam is 16 arcmin for the GASS, 12 armin for EBHIS, and 40 arcmin for the LAB for declinations > -27 deg and 35 arcmin for declinations < -27 deg. This implies for the profiles a different FWHM beam if you select an effective beamsize < 36 arcmin. If you want to compare the calculated column densities, the FWHM needs to be taken into account. Expected uncertainties are in each case at a 2-3% level (about 1% scale uncertainty and 1% for uncertainties in the correction for stray radiation). Additional contributions may be due to noise, residual baseline errors, and RFI (causing occasionally scale errors for the LAB). Column densities are calculated for $-400 < v < 400$ km/s. [1]

[1] https://www.astro.uni-bonn.de/hisurvey/AllSky_profiles/index.php