SPEAR Maps of Emission from Hot Diffuse Gas in our Galaxy

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Abstract

The distribution of a low-density hot (10^5-10^6 K) phase of the interstellar medium conveys the character and evolution of diffuse matter in the Galaxy. This difficult to observe component of the ISM emits mainly in the far-ultraviolet (FUV) (912-1800 A) band. We present spectral maps of FUV emission lines from highly ionized species (CIII, CIV, OIII, OIV, OVI, and HeII) likely to exist in the hot phase of the ISM. The maps were obtained using an orbital spectrometer, SPEAR (or FIMS), that was launched in 2003 and has observed the FUV sky with a spectral resolution of ~500 and an angular resolution of 10'.

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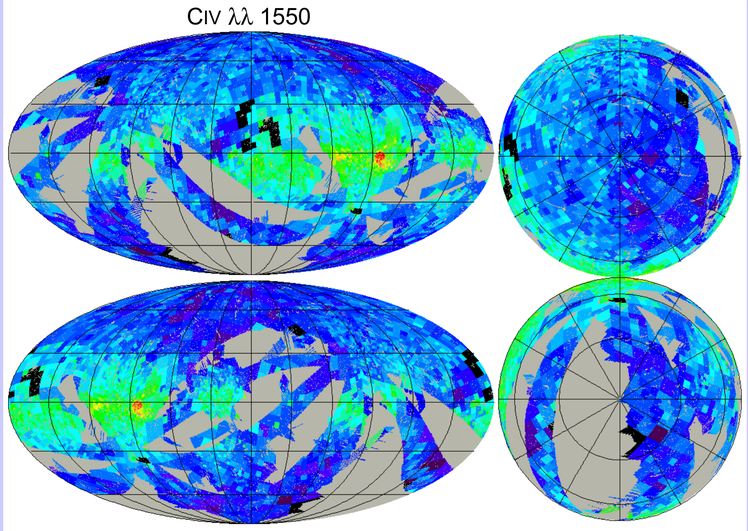
CIV λλ 1550



Mapping Procedure

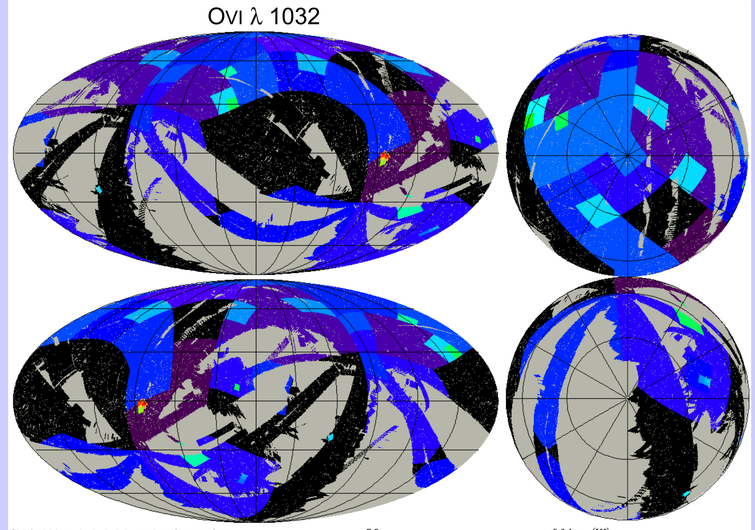
The maps were created using a nested adaptive binning method. For each scale (starting at 15') fits of the line emission, scattered stellar spectra, and scattered lines. The line values from pixels where significant detection were made were transferred to the result maps. The remaining pixels were then rebinned by a scale factor of two. This process was repeated until the scale factor reached 256. Significance limits used at each scale were set such that less than one spurious detection would be expected at each scale.

The in the scaled maps, the color black represents regions where no detection of the line was made. Grey regions represent areas with no exposure and regions where stars were removed.

Stellar Continuum

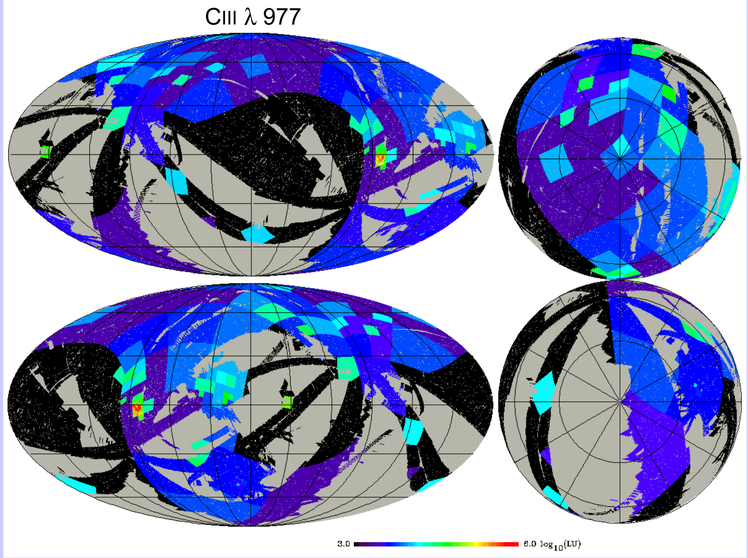
In the long wavelength band (λ>1300), the dominant background component is dust scattered stellar continuum. This continuum contains absorption features for some of the of the lines we are fitting. For these maps we have used an upper main sequence luminosity function and a set of Kurucz model stellar spectra to generate a single spectrum that was used for these fits. Because of this there are likely to be systematic errors in the Galactic plane for CIV map. However, the high correlation between the CIV and the maps of the semi-forbidden OIII] and OIV] lines gives us confidence that these errors are relatively small. We tend to rectify this potential issue with more accurate modeling of the scattered continuum. See poster 17.07 for more details on continuum modeling

OVI λ 1032



OVI λ1038 not included due to interference from CII λ1037

CIII λ 977

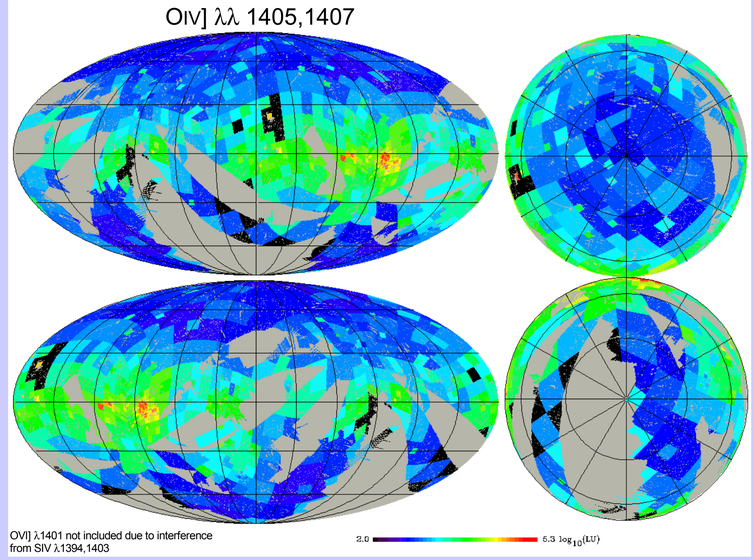


Discussion

The maps share many features although these features may be detected as different spatial resolutions.

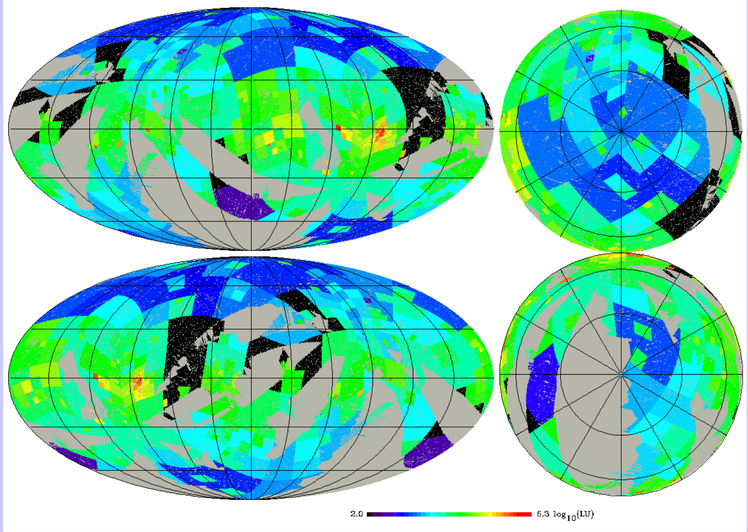
- The brightest feature in each map is the Vela supernova remnant at (l,b)~(265,-2)
- The maps made with the long wavelength spectrometer data (λ>1300Å) show a bright galactic plane and faint galactic poles.
- The maps made with the short wavelength spectrometer data tend to show less or no contrast between the galactic plane and poles. This may be due to increased dust opacity and decreased dust albedo at short wavelengths, or it could be an artifact of the low short band sensitivity
- The HeII λ1640 map could contain significant contamination due to atmospheric OI l1641. However, the correlation between the HeII and the other maps indicates that the contamination is small and likely contained near the ecliptic poles which were observed near the start and end of orbital eclipse.
- Emission related to Radio Loop-1 and the north polar spur is clearly seen in the CIV and OIV] maps. Correlation between enhancements of CIV and other species indicate that emission due to Loop 1 is also present in the OVI, CIII and HeII maps.

OIV] λλ 1405,1407

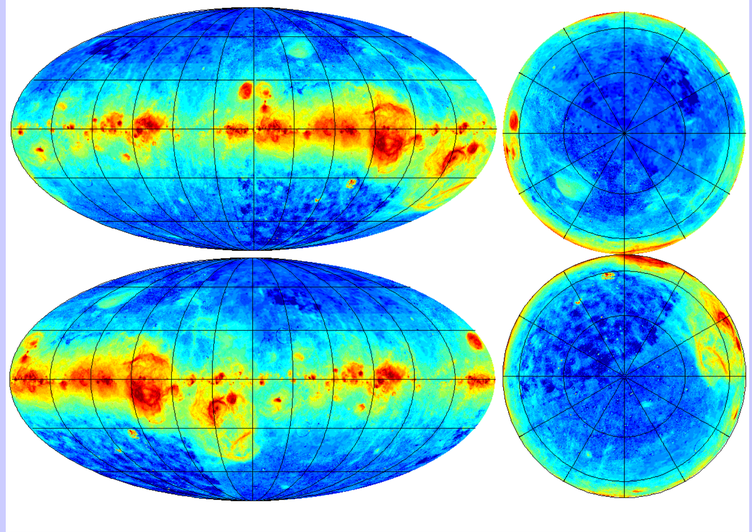


OVI] λ1401 not included due to interference from SIV λ1394,1403

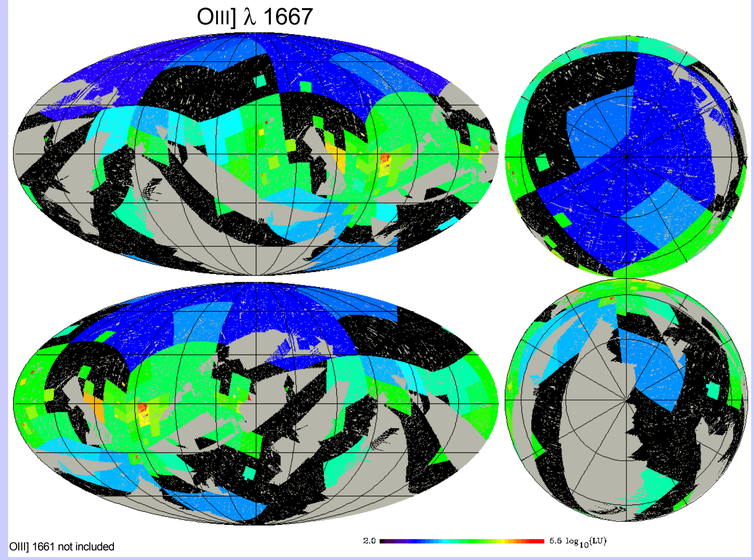
HeII λ1640+OI λ1641



Hα



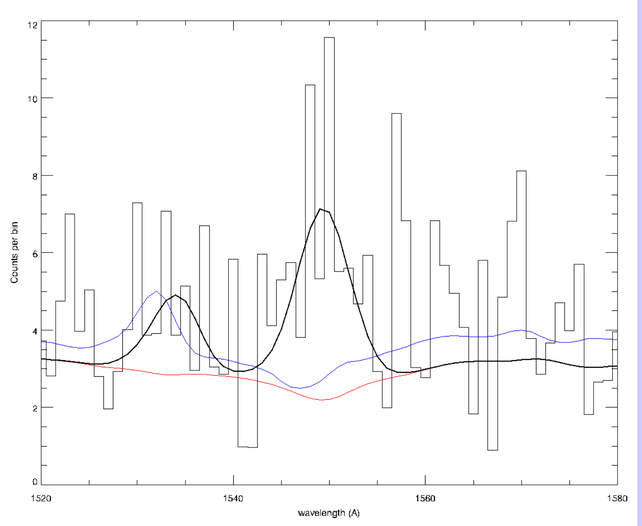
OIII] λ 1667



OIII] 1661 not included

Detection Significance

The figure to the right shows a typical 3σ fit to the CIV λλ 1550 line. The line at 1533 Å is the SiII* resonance line. The dark line is the best fit model. The red line shows the underlying scattered stellar continuum. The blue line shows the best fit that could be made by assuming a CIV λλ 1550 intensity of zero. Detection significance is determined by comparing the χ^2 of the fits with and without the line.



References:

Edelstein et al. 2006 ApJ, 644, L153
Edelstein et al. 2006 ApJ, 644, L159
Korpela et al. 2006 ApJ, 644, L163