

Plotting of interpolated velocity against galactic longitude in 3D for large data set at Lichfield Radio Astronomy (LRO-H1 Data from Second Lichfield Radio Astronomy Milky way Map) using new functionality in Easy Radio Astronomy Software Suite (ezRA).

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The Lichfield LRO H1 Radio Telescope.

Lichfield Radio Observatory (LRO) is located at latitude 52.6815 north, longitude -1.8255 (1.8255 west) in Staffordshire, central England, UK, roughly 16 mi (26 km) north of Birmingham. The LRO H1 Radio Telescope is composed of a Ptarmigan Triffid ex-military 4x4 dipole array, measuring 86cm x 86cm in size. Filtering is two-stage using a 1400-1427MHz cavity filter, followed by a Noelec SAWBird H1 LNA/filter. The system uses an RTL-SDR Blog V3 Software Defined Radio and data for this paper was recorded using Easy Radio Astronomy Software Suite (ezRA; Ted Cline; <https://github.com/tedcline/ezRA>).

The telescope is mounted on a simple wooden mount that allows variation in elevation. It points at the same azimuth constantly – data is collected using 24-hour drift scans which allow individual azimuth points to be calculated by the software during the sidereal day.

The Second Lichfield Radio Astronomy Milky Way Map.

The plots below are based on a substantial data set collected using the LRO-H1 Ptarmigan 86cm x 86cm 4 x 4 Dipole Array between 6 January 2024 and 1 November 2024, which constitutes the Second Lichfield Radio Astronomy Map of the Milky Way Radial Arms.

The data is comprised of 276 ezRA .txt data files, each covering a 24-hour period. Individual data points are the result of integration of data in Easy Radio Astronomy over 15 seconds which, on this particular telescope, equates to integration 31,000 in ezRA (number of samples in given time period varies depending on the computer speed/RAM/hard disc type/etc.)

A new script in Easy Radio Astronomy Suite (ezRA) to enable 3D plotting of interpolated velocity against galactic longitude.

Ted Cline's free Easy Radio Astronomy Suite (ezRA, <https://github.com/tedcline/ezRA>) is a popular option for collecting a processing Milky Way hydrogen line data. Many of us have large data sets available which will benefit from a new method of presenting this data. Rinearn 3D is another free software package, which can be used to present the data in a more accessible picture form.

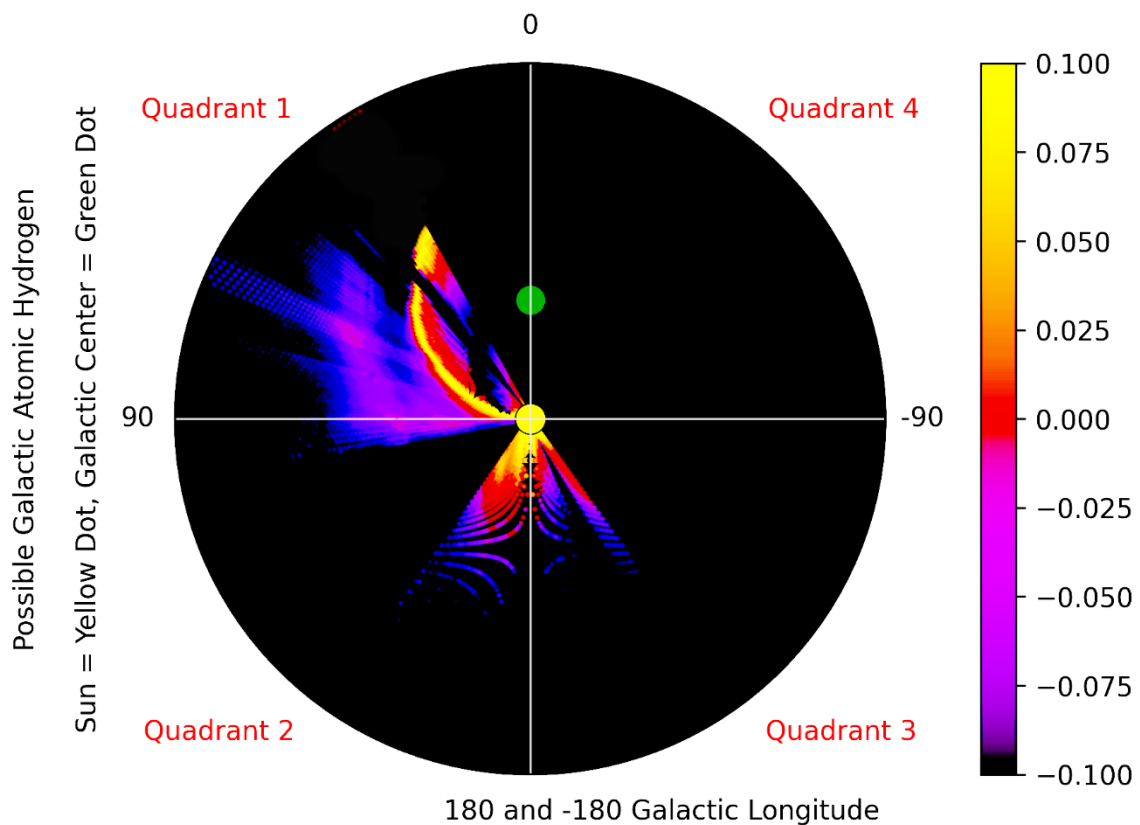
The plot produced by ezCon.py called ezCon510velGLon.png presents in two dimensions interpolated velocity against galactic longitude.

There is now a new ezRA script available for ezRA (**ezGal250118e.py**) which will process NPZ/EZB files created via the ezCon.py script to produce a CSV file, ezGal510velGLonMsh.csv, capable of being processed in Rinearn 3D. These 3 dimensions plotted in Rinearn3D as a result of this process include galactic longitude, interpolated velocity, intensity reading for each interpolated velocity point.

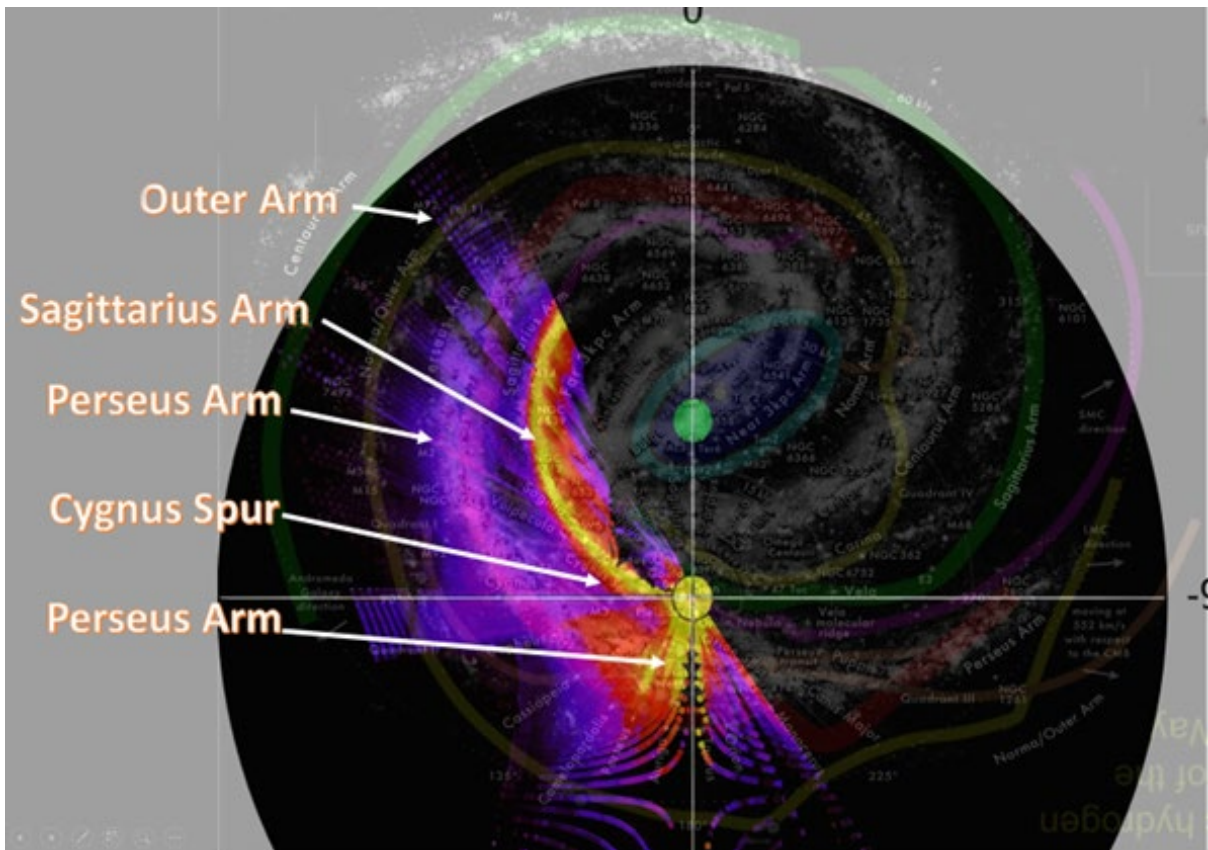
Results.

The results from this new script and plotting within Rinearn3D are presented below. The 3D plots of interpolated velocity give a more accessible method of visualising the difference in velocity at different parts of the Milky Way. Understanding this plot is inherently difficult as the concepts it embodies are alien to many people who have little experience in radio astronomy, even if they have considerable experience in other aspects of astronomy such as visual observing or astrophotography. Any method of improving access to the data is valuable to us as we explain our findings in talks, articles and outreach to these communities.

2D map in ezRA ezCon.py of Milky Way from the same data set for comparison with the 3D plots from Rinearn3D:

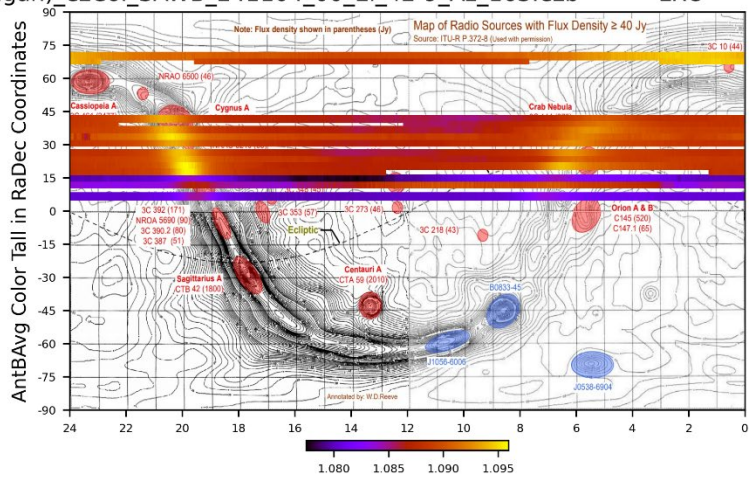


Features of the structure of the galactic arms of the Milky Way above labelled in plot below:

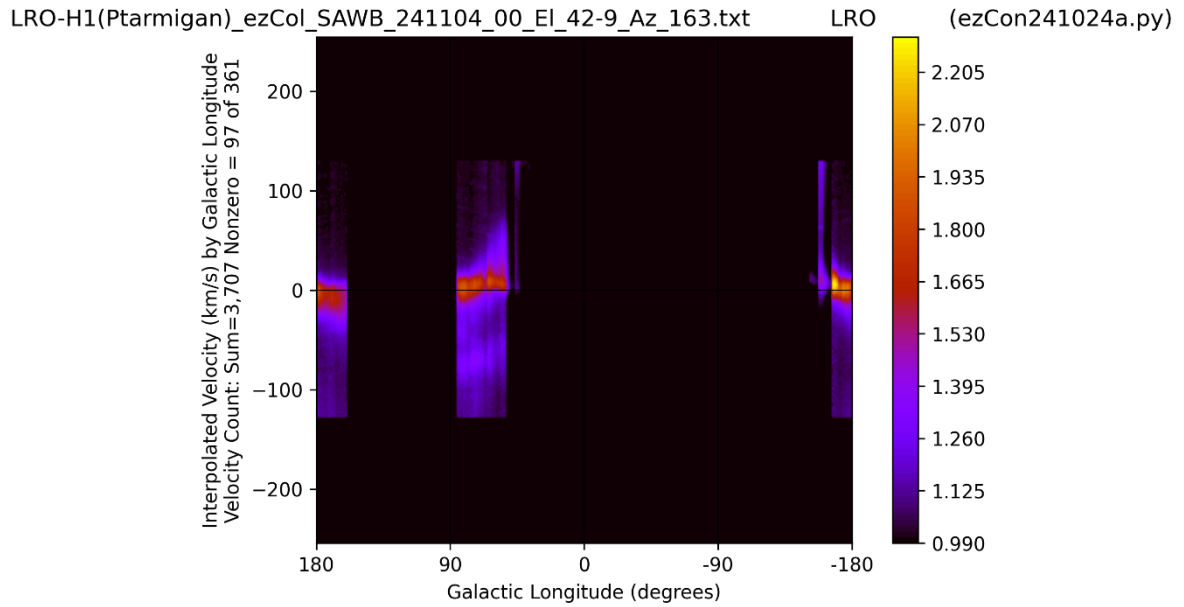


Parts of Milky Way covered in drift scans making up this data set:

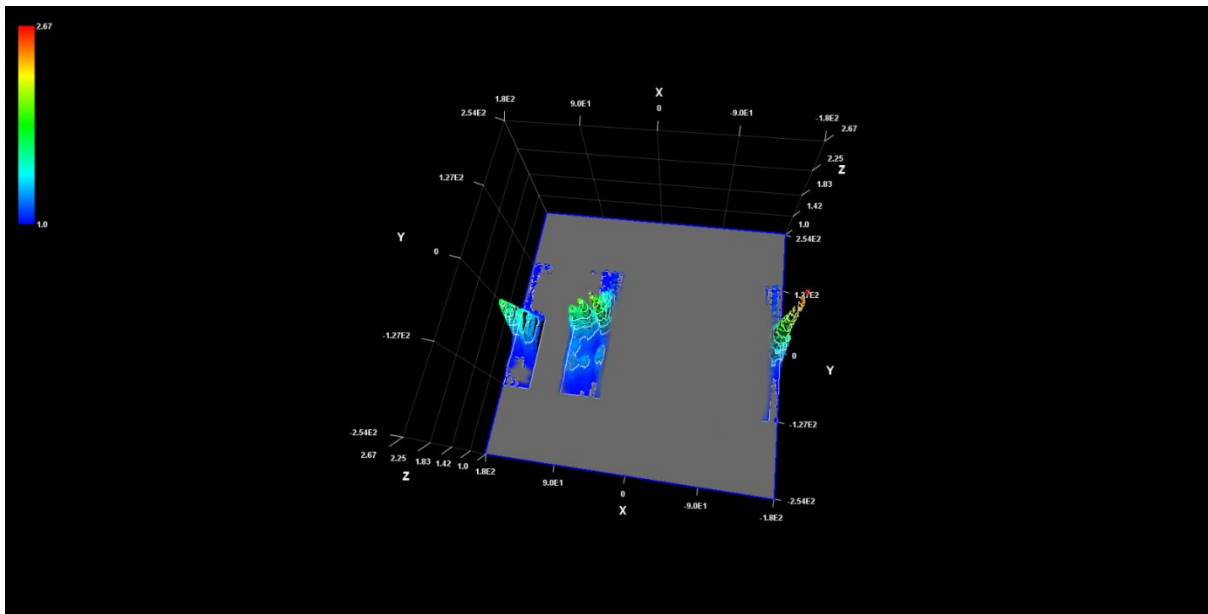
LRO-H1(Ptarmigan)_ezCol_SAWB_241104_00_El_42-9_Az_163.ezb LRO (ezSky241201a.py)

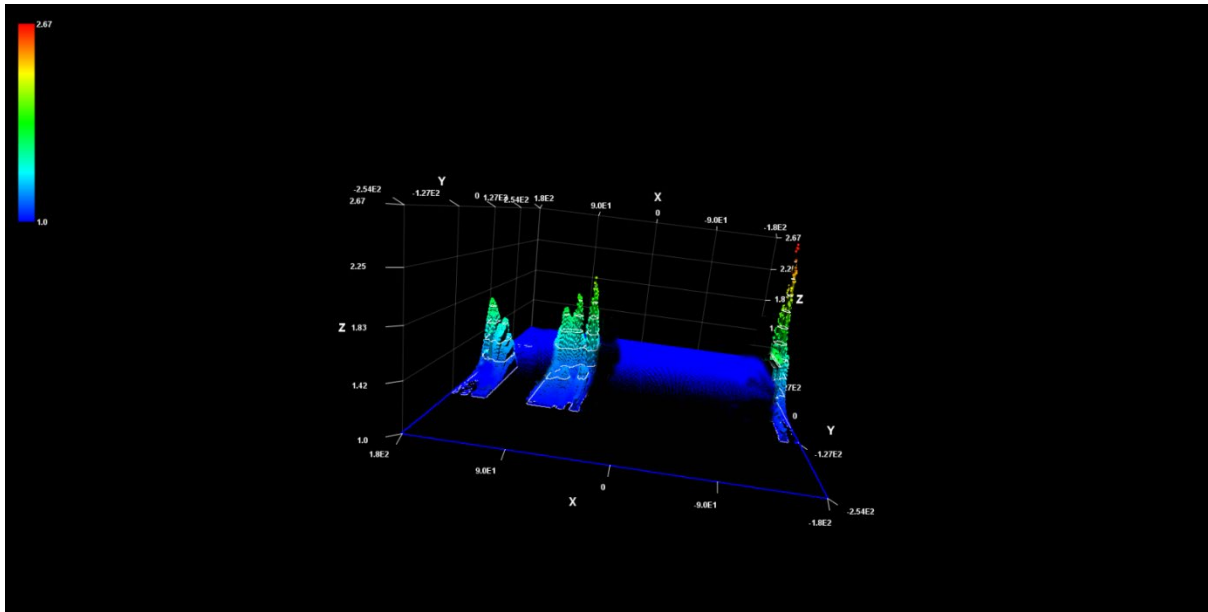


2D representation of interpolated velocity against galactic longitude in this data set:



Plotting 3D images with Rinearn3D using Ted Cline's new ezGal250218e.py script to generate Rinearn3D mesh CSV data file from all viable ezRA NPZ and EZB data files 6 January 2024-1 November 2024:





Further information.

Further information about this project is available on the www.astronomy.me.uk website or by contacting me using the “contact us” page on that website.