

Looking for collaborators to work on a research project for Dark Matter detection

by Rodney Howe, <http://www.deep-space.org/news.shtml> Rev. November, 2008

Professional astronomers do not have time to do drift scans at 1420.406MHz (with perhaps the exception of Arecibo). It may also be that highly focused beam widths done by VLA and Arecibo at this frequency cause astronomers to overlook large quantities of HI clouds that inhabit the outer arms of our galaxy. There have been galactic surveys at 1420.406MHz of the HI clouds at narrow beam widths, but perhaps there needs to be a large beam width (0.7 to 3 degrees) spectral Doppler survey of the HI clouds. (Reich, Wolfgang, 2008, Galactic polarization surveys, Max-Planck-Institut für Radioastronomie, Auf dem Hugel 69, D-53121 Bonn, Germany) http://arxiv.org/PS_cache/astro-ph/pdf/0603/0603465v1.pdf

The Spectra Cyber (<http://www.jupiterspacestation.org/spectrometer/index.shtml>) spectrometer shows velocities of these clouds in the outer arms to vary considerably with respect to the Local Standard of Rest for our solar system. Spiral arms in the direction of Cygnus are coming toward us (and/or we're going toward them) at velocities in excess of 150km per second. However, clouds at the galactic center move very little either toward or away from us. It is likely that toward the center there is less HI gas and more visible matter (stars), but toward the extremities of the Milky Way there is more HI (cold dark matter) and fewer visible stars.

If there were cold 'dark matter' in the outer arms of our Milky Way, it might satisfy professional astronomer's reasoning why stars in the outer arms have not flown off into intergalactic space. It seems the only way the outer arms can be moving as fast as they are, and still remain part of the galaxy, is if there is dark matter (non visible mass) holding everything together. There are more HI clouds looking toward the outer arms than looking toward the galactic center (spectral line broadening), although they are less dense and much colder than the inner galactic HI clouds. The hypothesis might be that because we are located in the second/third spiral arm, and given that there are more HI clouds toward the galactic extremities, it may be that the HI clouds represent a form of cold 'dark matter' in the Milky Way.

One way we might test this hypothesis is to measure the area under polarized 'spectral curves' as we do drift scans of the inner and outer galactic arms with polarized feed horns.

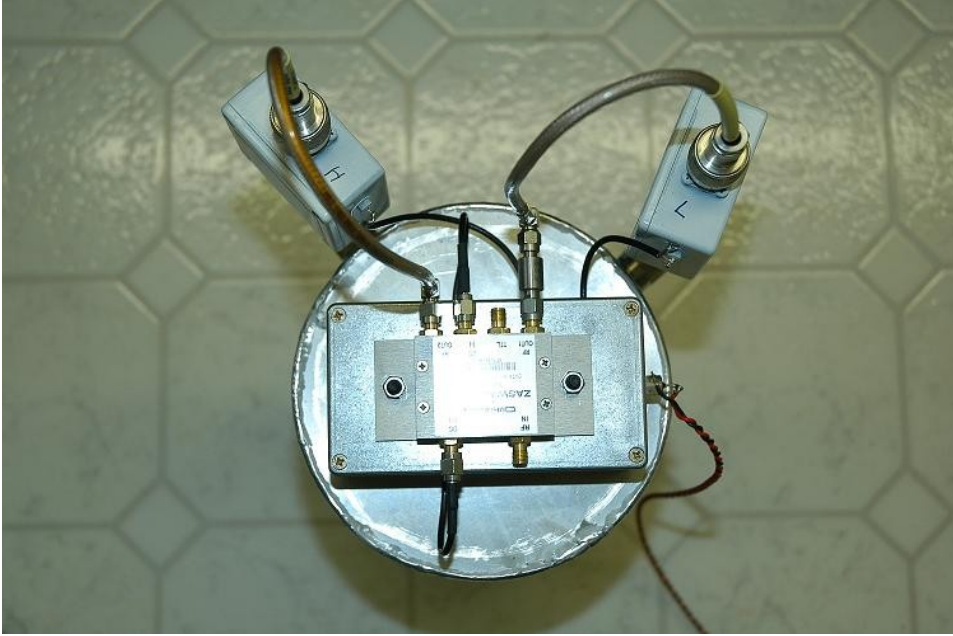
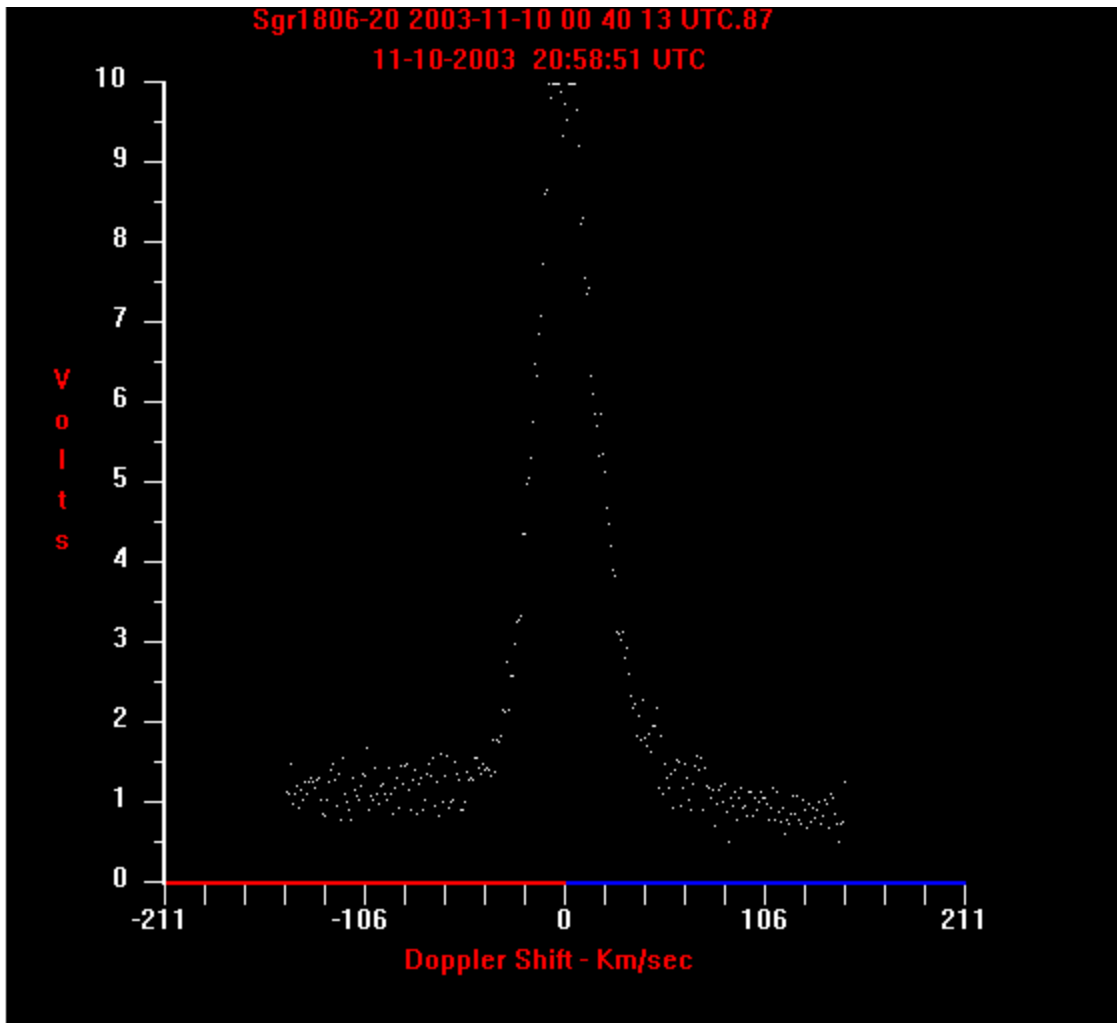


Figure 1, Polarized 1.420 GHz feed horn with RF switch (built by Carl Lyster)

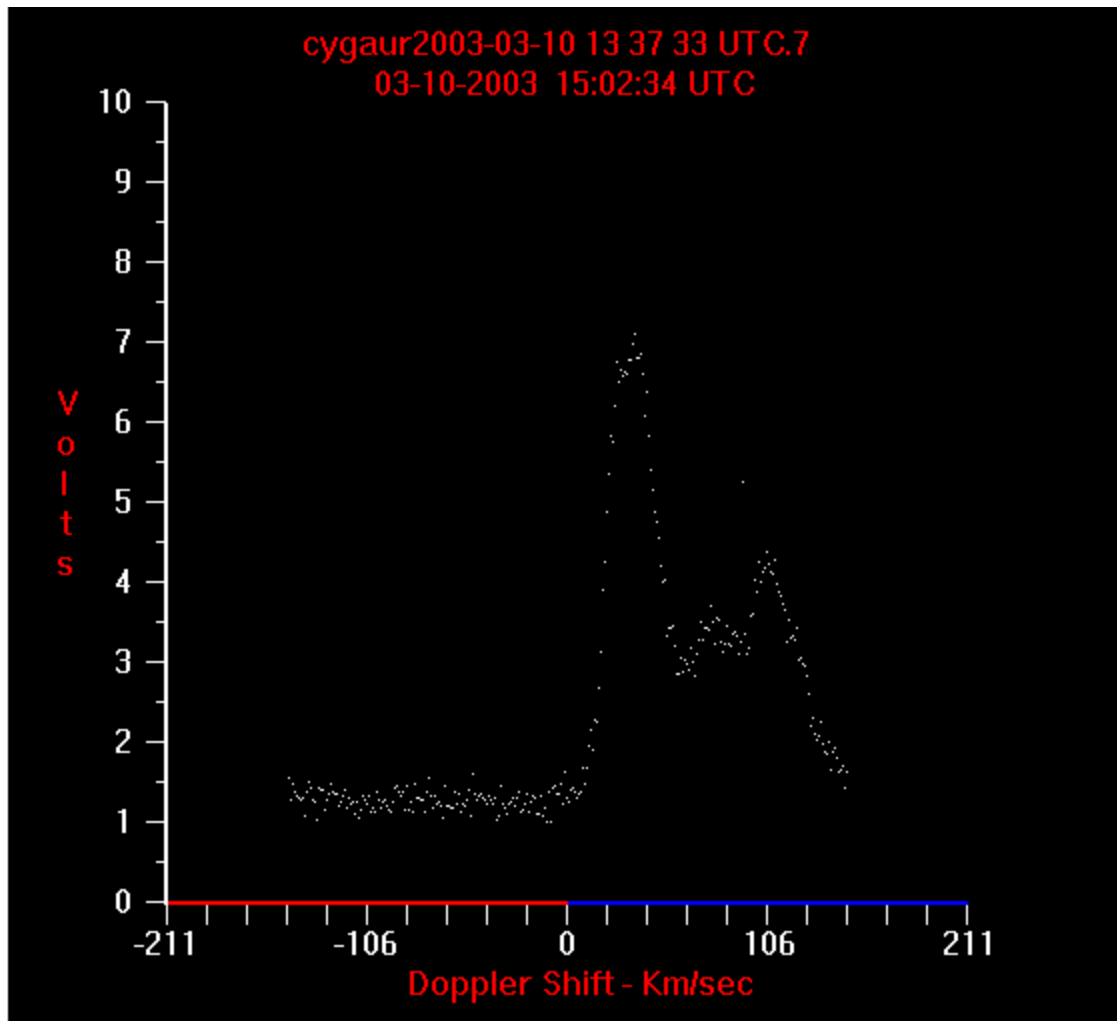
Data from the center of the galaxy show a narrow peak of unmoving HI clouds. This may represent less cold dark matter toward the center of the galaxy as well as our general motion neither toward nor away from the center. Whereas data from the outer arms show a relative motion toward us, as well as a broader spectral curve, since we're looking through multiple galactic arms.

<http://www.atlasoftheuniverse.com/galaxy.html>



This Figure 2 above shows a steep but narrow curve. There is neither a movement toward nor away from our position, which is about 2/3 the distance from the galactic center. The combination of a narrow peak and little movement might be an indication of less cold dark matter.

But as we look out toward the distant arms in the direction of Cygnus many of the HI clouds, in at least 3 outer galactic arms, are coming toward our Local Standard of Rest (solar system motion). There is also a broadening of the 'spectral curve' because of the large quantity of HI clouds in these multiple arms. But, are there differences in the magnetic structure between the outer and the inner galactic arms, which can help determine the temperature and quantity of HI in these outer arms?



In Figure 3, both the larger area under the curve and the velocity of approaching clouds might be an indication a larger quantity of HI clouds and perhaps an indication of cold 'dark matter'. If we find a significant difference in area and velocity and magnetic structure we could build an index that might correlate with other data from other surveys such as that of A.J. Romanowsky et.al., (2003, Vol 301, Science) who suggests the only way to determine the motion of elliptical galaxies is to look at the planetary nebulas and their OIII emissions, i.e. SNR nebulas exciting, in the UV, the blown out clouds from progenitor stars. They think they've found a connection with elliptical galaxies that have little or no dark matter. Where a lack of dark matter, apparently, maintains Keplerian motions of the elliptical galaxy's outer arms. Everything seems to obey standard Newtonian motions and Kepler's laws for these elliptical galaxies. But that seems not to be the case for large spirals like the Milky Way.

This research proposal makes some assumptions about what cold 'dark matter' is and how we might measure it. Here are a few of those assumptions:

1. Dark matter may be made up of inter-stellar space that is very (to extremely) cold. Perhaps as cold as the cosmic microwave background (CMB). The CMB is around 2.69K to 2.73K.
2. Cold dark matter may reflect a behavior similar to a super fluid phase, in that it acquires a non-classical rotational inertia (NCRI), and can be

detected by a magnetic polarized structure that is different than the polarized structure in the inner galactic arms.

3. If Hydrogen (cold dark matter) in the inter-stellar medium (ISM) changes to a super fluid phase then it might satisfy the Onsager-Feynman relation. (R.P. Feynman, 'Progress in Low Temperature Physics' (North-Holland, Amsterdam, 1955) chap. 2.) Where $2\pi R * v_s = (h/m) * n$, v_s is the super flow velocity, h is Planck's constant, m is the mass of the Hydrogen [in this case in a column of the gas], and the integer n is the angular momentum of the entire column looking down the galactic arm.
4. The velocity of outer galactic arms are on the same order of magnitude as the critical velocity v_c which might be measured as the velocity of the non-classical rotational inertia (NCRI). There is a temperature dependence of ρ_{oc}/ρ_o at different pressures that is NCRI curves might be measured at the lowest velocities while looking toward the galactic center (ρ_{oc}), and compared to the higher velocities toward the galactic extremities, i.e. some kind of index.
5. This requires us to estimate, to the best we can, the temperature and velocity of the galactic center clouds, versus the temperature and velocity of the outer galactic clouds, as well as their relative motions (velocities). Then compare these velocity/temperature measures with what they should be in a classical rotational inertia frame, which would imply higher temperatures. Mapping the inner and outer arms with polarized feed horns might help detect the super fluid phase (cold temperatures) in the outer arms compared to the magnetic structure of the inner warmer galactic arms.

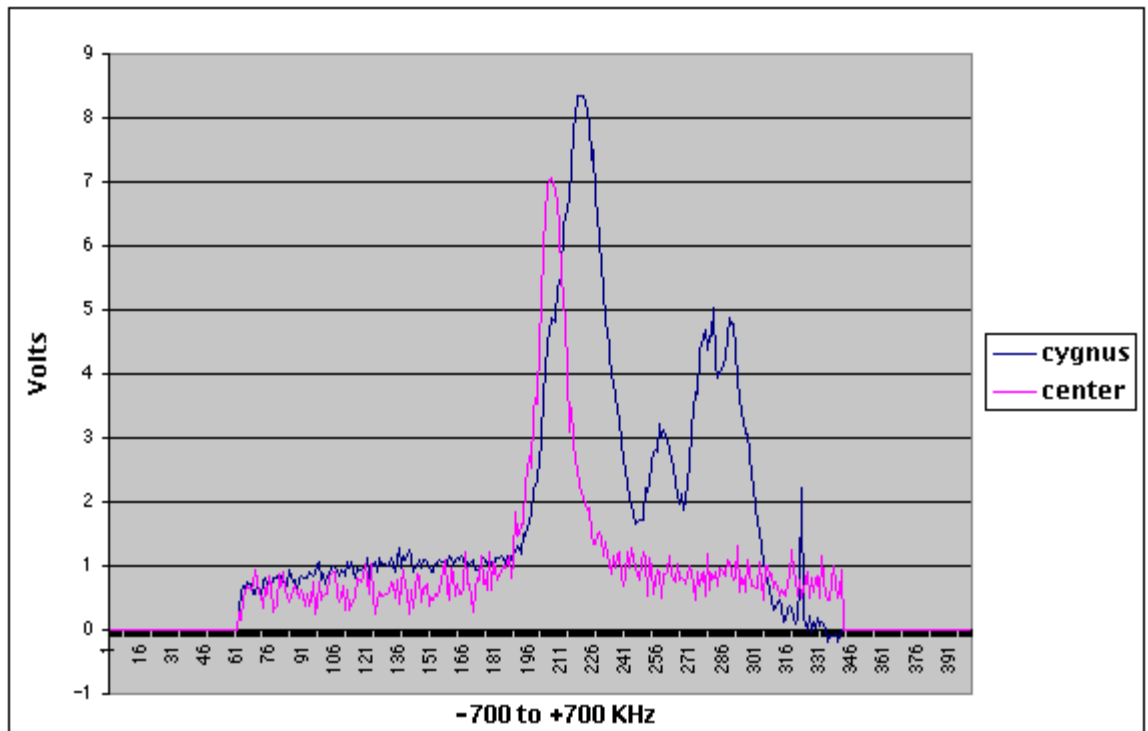


Figure 4 is an overlay of the HI spectra for the center of the galaxy (red) and looking at the Cygnus arm toward the outer galactic arms (blue), with 3 distinct humps.

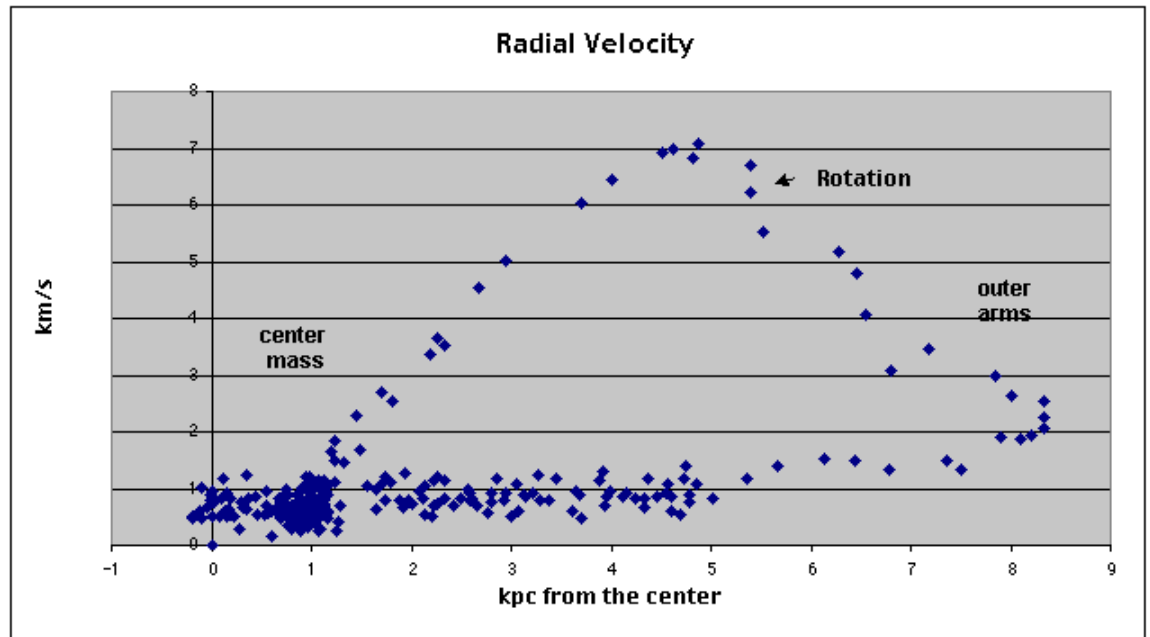


Figure 5 is a model of how the mass in the Milky Way would be distributed, which would cause non-Keplerian radial velocities. If the outer arms have a different magnetic structure for the cold HI clouds, which might be detectable with small amateur radio dishes, then it may be possible to measure these structural differences with polarized detectors, and make some inferences about the extent of the HI clouds, and their temperatures, and their influence in the gravitational pull they have on stars in the outer galactic arms.

If there are amateur astronomers who might like to collaborate on a research project to map the inner and outer galactic arms with 1.420 GHz polarized feed horns please contact me at ahowe@frii.com

References cited:

A.J. Romanowsky et.al., (2003, Vol 301, Science)

R.P. Feynman, 1955, 'Progress in Low Temperature Physics', North-Holland, Amsterdam, 1955, chap. 2.

Reich, Wolfgang, 2008, Galactic polarization surveys, Max-Planck-Institut für Radioastronomie, Auf dem Hugel 69, D-53121 Bonn, Germany,
http://arxiv.org/PS_cache/astro-ph/pdf/0603/0603465v1.pdf