The Effect of Constellation on Spectral Power on the 21cm Wavelength

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Q1: Research Question

- The purpose of this project was to compare the signals from the 21 cm hydrogen line in various parts of the sky.
- It was hypothesized that if a radio telescope operating at the 1420 MHz, or 21cm, the frequency was pointed at various constellations with and without the Galactic Plane passing through them, then the constellations with the Galactic Plane passing through them would have the highest signal intensity because of the hydrogen clouds within the Milky Way.

Q2: Methodology

- A horn antenna tuned for the 21cm wavelength with an aperture of 1.5 meters was used.
- This was combined with a Nooelec H1 amplifier and an RTL Software Defined Radio for receiving the signal.

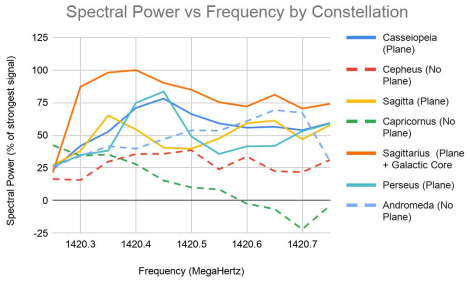
The horn antenna instrument, in operation.

After being collected, the data was processed in a way that removed noise. The reason why there are frequencies collected other than 1420Mhz is because the Doppler effect can shift the frequency depending on the motion of the source.

Q3: Data Analysis and Results

- The data was then processed to remove background noise.

Constellation	Cassiopeia	Cepheus	Sagitta	Capricornus	Sagittarius	Perseus	Andromeda
Frequency	Power Lever (%)						
1420.25	23.69376	16.46464	27.03776	42.40192	21.36512	26.15008	25.9616
1420.3	41.94592	15.72288	38.07904	34.37632	87.23584	34.91136	34.14528
1420.35	52.744	29.81024	65.24448	35.264	98.11296	38.25536	41.6176
1420.4	71.03872	35.63488	54.48896	27.88288	100.00384	74.9056	39.77536
1420.45	78.17056	35.82336	40.54752	15.33376	90.20288	83.53312	46.9984
1420.5	66.34496	38.55936	39.6416	10.05024	84.9376	49.08992	53.78976
1420.55	59.14016	23.94912	47.65504	8.47552	75.34944	35.73824	53.60128
1420.6	55.8448	33.73184	59.33472	-2.41984	72.16352	41.52032	60.87904
1420.65	56.55616	22.52032	61.27424	-6.536	81.10112	41.86688	69.4032
1420.7	53.94176	21.80896	46.97408	-21.98528	70.57056	53.18176	67.23872
1420.75	59.38944	31.1904	57.76	-3.91552	74.176	59.01856	30.08992



Q4: Interpretation and Conclusions

- The results are somewhat similar to other similar studies.
- There is a noticeable positive effect that the galactic plane has on the signal power
- There are also some spectrographic results, indicating Doppler shifts from the galaxy's rotation.
- Some things that could be improved are using better equipment and operating at a more remote site.
- Some things that could be done further are "imaging" the entire sky using a tracking antenna, or doing more detailed spectrography.