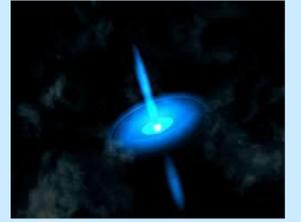


Searching the Universe for Pulsars



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What is a Pulsar?

A pulsar is a spinning neutron star that emits energy in the form of electromagnetic radiation, much like a lighthouse emits light. A radio-telescope can detect radio waves, which are a small part of the spectrum emitted.

This study will focus on data collected at the Greenbank Observatory in Green Bank, WV, on the world's largest fully steerable radio telescope. The telescope is about 150m tall, and the dish is 100x110m.

The Pulsar Search Collaboratory involves hundreds of high school students and teachers, college students, and principal investigators from different institutions around the world who analyse the data in their quest for pulsars.

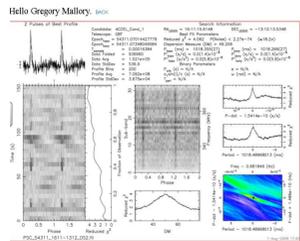
Results

As members of the PSC we analysed 455 separate and unique data plots, which revealed the 3 pulsars presented. We also observed some interesting interference fingerprints.

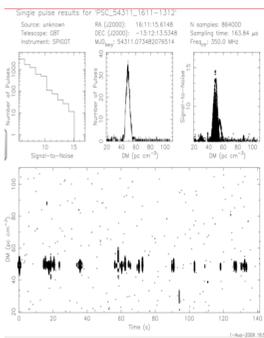
RFI

This is an example of Radio Frequency Interference (RFI). Notice the curve in the Phase Time plot at the lower left. The other indication of RFI is a Dispersion Measure (DM) of near zero. Also notable is the period of this signal, 16.6ms which is equivalent to a frequency of 60 Hz. This is exactly the frequency of the power lines in the United States. So we expect this is an example of interference from the local power lines.

J1610-1322

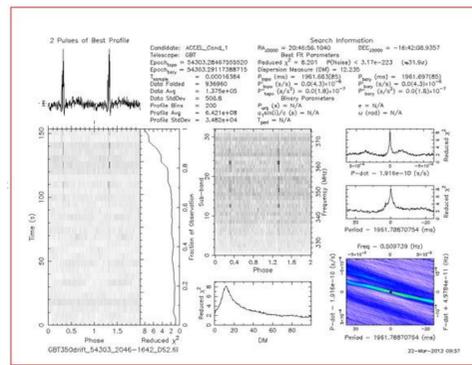


Double Prep-fold Plot (left) and Single Pulse Plot (below)

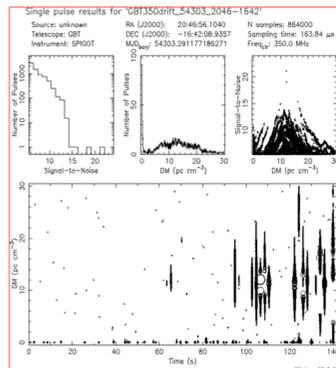


Definitive Peaks,
Two different observations of the same pulsar.

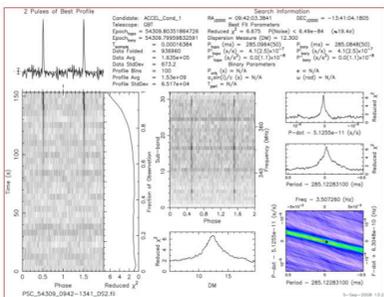
J2048-1616



Notice the period of this pulsar is 1.9s, which is indicative of this being a pulsar. This pulsar is also situated in the Milky Way Galaxy, at a distance of 0.6 kpc from the Earth (see below).

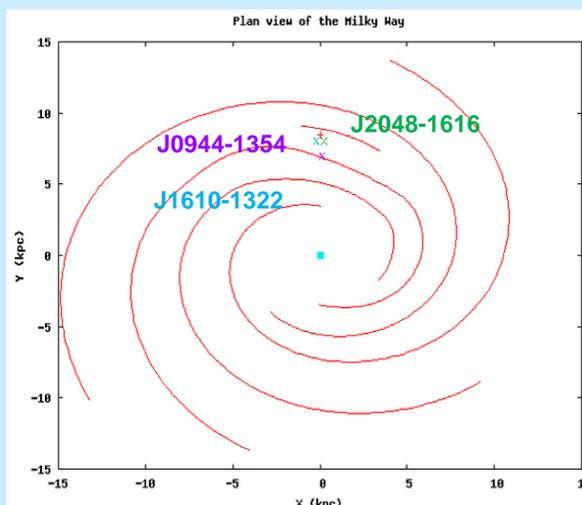


J0944-1354

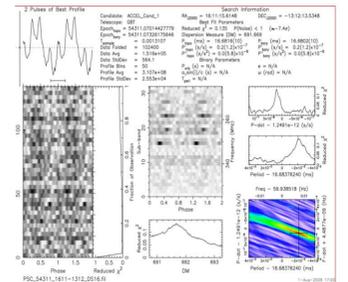


This pulsar is 0.7 kpc away from Earth and is situated in the Milky Way Galaxy. It is listed in the ATNF database with ascension of 9:44:28 and a declination of 13:54:41. The difference between older data in this database and the newer data indicates a slight movement by the pulsar. In addition to the change in the ascension and declination, the period has decreased from 0.57 seconds to 0.2 seconds.

All of the data from #433 indicate radio frequency interference. These scans were taken at an ascension of 12:05 and a declination of +37:52. If these were celestial sources of radio waves, we would expect them to be located 25.8 kpc away. Most of these scans exceed the maximum DM predicted by the model or else present only banding in a single frequency on the subplot.



This is another example of RFI. Notice the DM is not zero in this plot, however there



Directions for Future Research

- Use pulsars to detect gravitational waves
- Study the life cycle of massive stars in our galaxy
- Use pulsars to study interstellar medium
- Study where in the magnetosphere partial acceleration occurs
- Study how emissions from pulsars are generated
- Increase our awareness of the diverse array of objects that are scattered across the universe

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