Cornell FRB Workshop Biography and Summary: measuring RFI at potential GReX cluster sites

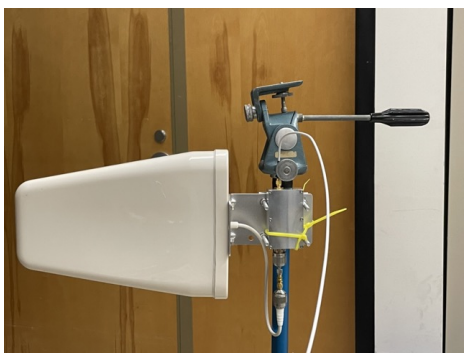
Sashabaw Niedbalski[1]

[1] Cornell University
sn526@cornell.edu

Summary

We are working with Liam Connor on the Galactic Radio Explorer (GReX) telescope. The GReX project seeks to install an international all-sky monitor to study the galaxy in the 0.7-2.0 GHz range [Connor et al., 2021]. As a real-time telescope, GReX will detect sources with ~ 10 μs time resolution and save pertinent data for comparison with other clusters in the network. The spread of clusters will work to lower the effect of local RFI and provide a global baseline for the telescope. The antenna design is based on the STARE2 pancake antenna and will use the same LNA as the DSA-110. Target sources are galactic FRBs and giant pulsar pulses, with the additional hope of discovering new phenomena.

Cornell University will host one of the GReX antenna clusters. James Cordes, Shami Chatterjee, and I have constructed a portable device for exploring the levels of RFI present at different possible antenna sites. The device is housed within a standard Gator rack for portability that contains a Siglent Spectrum Alanyzer (SSA) 3032X. The rack also houses a bias-T and bandpass filter, along with the power supplies required to run the SSA and supply the bias-T (Figure 1b). The SSA is connected to a Wideband Directional Antenna from Wilson Electronics that is attached to a portable tripod. The DSA-110 LNA is attached directly to the output of the antenna (Figure 1a).



(a) Antenna & LNA.

(b) Gator rack.

Figure 1: Left: the Wideband Directional Antenna from Wilson Electronics and DSA-110 LNA attached to a portable tripod. Right: the Gator rack holding the SSA (top) and power supply (bottom) with bias-T (unattached).

I have written a python script based on the code written by Kiran. Kiran's code is a publically available modern python library for interacting with

Siglent-brand test equipment on github. My script communicates with the SSA, allowing for control of the device from a computer attached by USB or Ethernet. The script also extracts data from the SSA at a user-defined rate greater than 10s, and saves the data in .npy format. We use this script to save hour's worth of RFI data for later examination to get a full understanding of RFI pervasiveness at each potential cluster site.

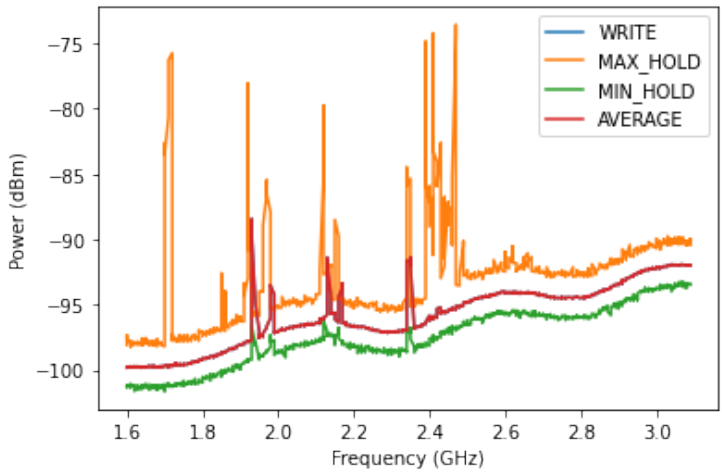


Figure 2: Plot of the data extracted from the SSA using my script. This is one of multiple plots collected. It is possible to construct a video time lapse of RFI using this data to inspect the intensity changes over time.

Biography

My name is Sashabaw Niedbalski and I am a graduate student in the Cornell University Astronomy department. I graduated from Hillsdale College in 2021 with degrees in mathematics and physics. While at Hillsdale, I worked with Timothy Dolch in constructing the Low-Frequency All-Sky Monitor (LoFASM) V station. I also wrote python scripts for analyzing the data gathered by LoFASM V. I also worked with David Neilsen of BYU on simulating binary BH mergers using the Post-Newtonian approximation. At Cornell, I am working as a research assistant with James Cordes on a number of different radio astronomy projects. My main interests are FRB detection, machine learning, and pulsar astronomy. My current projects are in exploring the use of machine learning as a method of real-time FRB detection and the GReX project.

References

[Connor et al., 2021] Connor, L., Shila, K. A., Kulkarni, S. R., Flygare, J., Hallinan, G., Li, D., Lu, W., Ravi, V., and Weinreb, S. (2021). Galactic radio explorer: An all-sky monitor for bright radio bursts. *Publications of the Astronomical Society of the Pacific*, 133(1025):075001.