Title: Taking measurements with CHART during the summer monsoon season in Petrified Forest National Park

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Introduction

On 6/25/22 and 6/26/22, we attempted to take measurements of hydrogen in the galactic plane with CHART. We were in a relatively radio quiet environment, compared to Phoenix, in northeast Arizona, in and near Petrified Forest National Park.

Lab Calibration

As a quick test before we left, we used the spectrum analyzer in the lab to determine the bandwidth and gain of our signal chain. Our signal chain was composed of two LNAs, separated by a bandpass filter. The LNAs were powered by the GPIO pins on the Raspberry Pi, one at 3.3v and one at 5v.

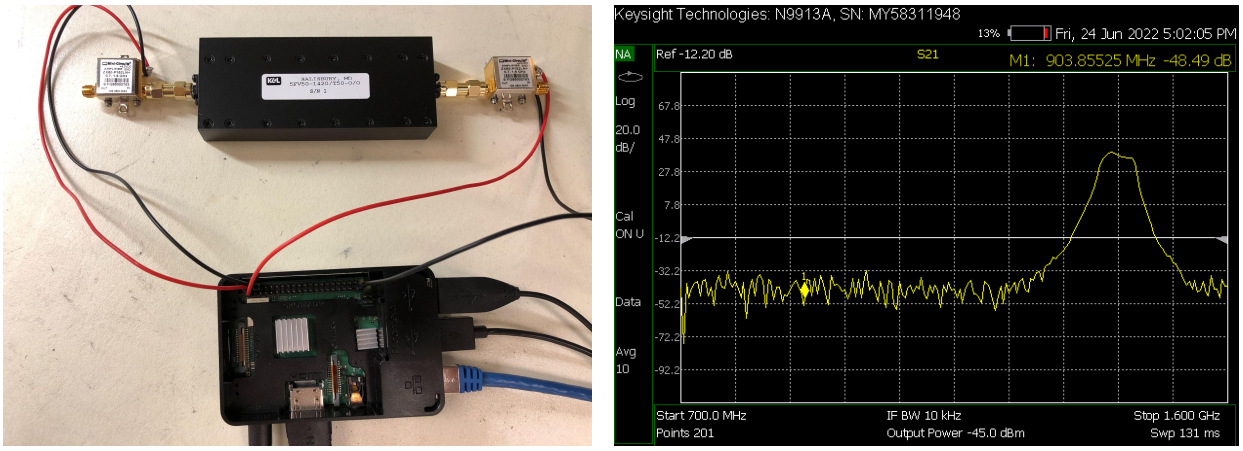

Figure 1. Setup of our signal chain.

Day 1 Measurements

On the night of 6/25/22, we took CHART to a relatively secluded area next to a baseball field, cemetery, and abandoned hospital (34°54’35.8’’ N, 110°09’16.1’’ W). Our goal was to take measurements of the 21cm line pointed on and off the galactic center. Below is a picture of our measurement setup:

Figure 2. *(top left)* Our first calibration measurement was a sanity check with a signal generator. *(top right)* We considered using a longer RF cable to be able to move our box of electronics further from the antenna, but found that the longer cable introduced too much loss. *(bottom)* Our final measurement setup, with short cables to avoid signal loss as much as possible.

We first took some calibration measurements. These measurements are detailed more in the measurement notes. A quick analysis of our calibration measurements revealed that leaving the car running did not affect our measurements in terms of RFI, and also revealed that using a longer cable to place the signal

chain and electronics further from the antenna actually resulted in signal loss, which offset any benefit of lower RFI from our electronics being further away.

Once we started to take measurements with the horn pointed at the galactic center, it started to rain, which cut our observing session short.

Day 2 Measurements

The next day, we decided to try to observe the galactic anticenter. Since we did our calibration measurements the night before, we only needed to do a quick sanity check before collecting data with the same measurement setup. We started observing at around 1:30pm, when the galactic anticenter was close to the horizon and facing north. We were in the Blue Mesa region of Petrified Forest National Park (34°56’11.3” N, 109°45’31.6” W), pointed 325° NW. After 10 integrations with 10 averages, we kept the same parameters and took data pointed off of the galactic anticenter, in the opposite direction as before.

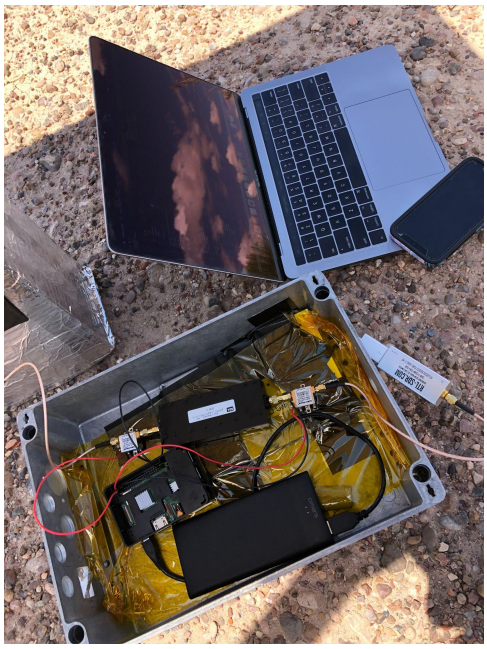

Figure 3. Day 2 measurement setup.

Conclusion

While our observing sessions weren’t under the most ideal conditions, we were successful in obtaining data with CHART. The next steps are to analyze our data for any irregularities, and for a possible 21cm detection.