**Deep Space Exploration Society Papers**

**2017-2018**

**Papers can be accessed on the SARA website by SARA Members:** [www.radio-astronomy.org](http://www.radio-astronomy.org)

**SARA 2018 Western Conference**

**Geographically-spaced Synchronized Signal Detection System**

**Skip Crilly**

**Abstract:**

A system has been designed and implemented that makes simultaneous geographically-spaced time-and-frequency-synchronized measurements of hypothetical extraterrestrial narrowband signals in the 1405-1448 MHz band. One radio telescope is the Sixty Foot Deep Space Exploration Society Plishner Telescope in Haswell, Colorado, and the second radio telescope is the Forty Foot Telescope in Green Bank, West Virginia. A GPS-signal-locked reference oscillator and a digital back-end is used at each site to permit differential Doppler measurements to a precision of +-1.8 Hz. This presentation will describe the system, observations of simultaneous close-frequency pulses, and future plans to enhance capabilities of the system.

**SARA 2018 Western Conference**

**Galactic Navigation Position Data**

**Using HI Interstellar Medium Velocity Measurements**

**Richard Russel D.Cs., Ae.E.**

**Deep Space Exploration Society**

**Abstract**

This paper explores the use of HI Doppler measurements as an aid to galactic navigation. Historic HI measurements of the Milky Way are used to determine the galactic rotation rate. The location of the interstellar medium producing the HI signals can then be calculated. Knowing the location of the HI signals, the HI frequency corrections can be made for a spacecraft moving between two points in the galaxy. This data can then be used to supplement optical, pulsar and other galactic navigational aids.

**SARA Journal December 2017**

**Getting Ready for SETI**

**Skip Crilly, Steve Plock, Ed Corn, Richard Russel,**

**Deep Space Exploration Society**

**Abstract** The SETI research conducted by SARA member and Green Bank Observatory volunteer Skip Crilly has been extended to the Deep Space Exploration Society’s Plishner Radio Astronomy and Space Science Center located in Haswell, Colorado. The SETI research involves the use of the Green Bank Observatory’s 40-foot radio telescope to detect various types of pulses and determine if there is any intelligible potentially shared information apparent~~.~~ The astronomical object of this study is currently the -7.6 declination arc, containing 40 Eridani. The use of a second medium-sized radio telescope at Haswell provides a unique capability. This aids the resolution of RFI and the better refinement of pulse and triplet detection.

**SARA Journal October 2017**

**2017 Solar Eclipse Prediction Results**

**using the Sudden Ionospheric Disturbance Radio Telescope**

**Richard A. Russel**

**Deep Space Exploration Society**

**Abstract:** This is a follow-up to the paper presented at the July 25, 2017 SARA Annual Conference in Green Bank, W.V., “*Ionospheric Reflection Variation During Sunrise and Sunset and Predictions for the 2017 Total Eclipse*” (1).This paper showed the development of a mathematical model to predict the signal response of the solar eclipse on the SuperSID radio telescope. The data of five SuperSID observers who measured data during the eclipse was obtained and analyzed. The model was applied to each observers’ data to determine its predictive properties.

**SARA Journal October 2017**

**September 2017**

**M and X Flare Solar Flare Observations using the**

**SuperSID Radio Telescope**

**Richard A. Russel**

**Deep Space Exploration Society**

**Abstract**

September 2017 had four days of significant solar activity which resulted in a series of M and X Class flares. These flares were recorded using the SuperSID radio telescope.

The SuperSID radio telescope [1] uses low frequency transmitions to bounce signals off of the ionosphere. The ionosphere becomes reflective when exposed to a solar flare. This results in higher intensity signals on the SuperSid output.

After exposer to a flare the ionosphere takes time to recover. This recovery time results in an exponential dwnward slope from the peak intensity to the normal intensity level before the flare. This signal characteristic is known as a shark-fin. Both the M and X Class flare show significant shark tales. In fact the X8.5 flare resulted in a tale that lasted for multiple hours!

**SARA 2017 Eastern Conference**

**Plishner Radio Astronomy and Space Science Center**

**The Use of Monte-Carlo Analysis to Evaluate Radio Astronomy Source Detection**

**Richard Russel**

**Deep Space Exploration Society**

**Abstract**

The Plishner Radio Astronomy and Space Science Center is operated by the Deep Space Exploration Society based out of Colorado Springs, Colorado. Monte-Carlo analysis uses multiple iterations to evaluate all ranges of variables in a systems performance. The 1420 MHz receiving system for the Plishner Radio Astronomy and Space Science Center 60-foot dish system was evaluated. This analysis shows the antenna and receiving system component performance ranges and the effect of each against the expected signal source detection capability.

**SARA 2017 Eastern Conference**

**Plishner Radio Astronomy and Space Science Center**

**Total Solar Eclipse Sudden Ionospheric Disturbance (SID) Monitor Signal Predictions using Sunrise and Sunset Measured Historic Data**

**Richard Russel**

**Deep Space Exploration Society**

**Abstract**

The Plishner Radio Astronomy and Space Science Center is operated by the Deep Space Exploration Society based out of Colorado Springs, Colorado. The Sudden Ionospheric Disturbance (SID) monitor shows significant variations at sunrise and sunset. The Northern Hemisphere will experience a total solar eclipse on August 21, 2017. This paper characterizes the transition characteristics of the SID data and uses this data to predict the effects of the total solar eclipse will have on the SID system signal levels.

**SARA 2017 Western Conference**

**Plishner Radio Astronomy and Space Science Center**

**The Use of Statistical Process Control to Improve the Detection of Extraterrestrial Radio Sources**

**Richard Russel**

**Deep Space Exploration Society**

**Abstract**

The Plishner Radio Astronomy and Space Science Center is operated by the Deep Space Exploration Society based out of Colorado Springs, Colorado. The largest antenna system is a 60 ft. parabolic reflector. This paper describes the use of statistical process control to troubleshoot the prototype UHF radio telescope and enhance the detection of weak radio sources.

**SARA 2017 Western Conference**

**Plishner Radio Astronomy and Space Science Center**

**60-Foot Dish Position Indication System Development**

 David Molter Glenn Davis Richard Russel

Deep Space Exploration Society Deep Space Exploration Society Deep Space Exploration Society

**Abstract**

The Plishner Radio Astronomy and Space Science Center is operated by the Deep Space Exploration Society based out of Colorado Springs, Colorado. The largest antenna system is a 60 ft. parabolic reflector. This paper describes the development of a position indication system that enables precision pointing for radio astronomy experiments as well as Earth-Moon-Earth and tropospheric communications at 1296 MHZ, 432 MHz and 144 MHz frequencies.

**SARA 2017 Western Conference**

**Efficiency Analysis of the Plishner Radio Astronomy and Science Center Solar Power Systems**

**Bill Miller**

**Deep Space Exploration Society**

**Abstract**

The Plishner Radio Astronomy and Space Science Center is operated by the Deep Space Exploration Society based out of Colorado Springs, Colorado. The largest antenna system is a 60 ft. parabolic reflector. The site is usually unmanned and completely off the power grid. The site is powered with a propane generator when occupied and a random collection of solar panels and batteries when unoccupied. Analysis of the available power system capacities and site solar insolation provides insight for modeling to determine the total power available for the remote computers and radio astronomy receiver systems.