Deep Space Exploration Society

A Non-Profit Corporation Dedicated to the Excitement of Hands-on Space Exploration

Society of Amateur Radio Astronomers
Western Regional Conference 2019

Milky Way Rotation Rate and Mass Estimation
Using HI Measurements
Latest Updates as of February 2019 Observational Data

Earth's Orbital Position in the Solar System
using Galactic HI Measurements
Updated to Include: Forth Observation Results with Solar System Yaw Measurements

Richard Russel D.Cs., Ae.E.

Milky Way Rotation Rate and Mass Estimation Using HI Measurements

Latest Updates as of February 2019 Observational Data

Richard A. Russel

Deep Space Exploration Society

Abstract

The measurement of the Milky Way rotation rate is a basic for HI radio astronomy. The Deep Space Exploration Society's 60-foot dish in Haswell, Colorado has recently come online with a 1420 MHz feed and SpectraCyber system. This paper documents the conduct of the HI measurements that resulted into the production of a galactic rotation curve and a good estimate of galactic mass. This is an update to the paper in the Nov-Dec 2018 SARA Radio Astronomy Journal. Extra observations were taken to fill in the rotation curve especially closer to the galactic center.

Earth's Orbital Position in the Solar System using Galactic HI Measurements

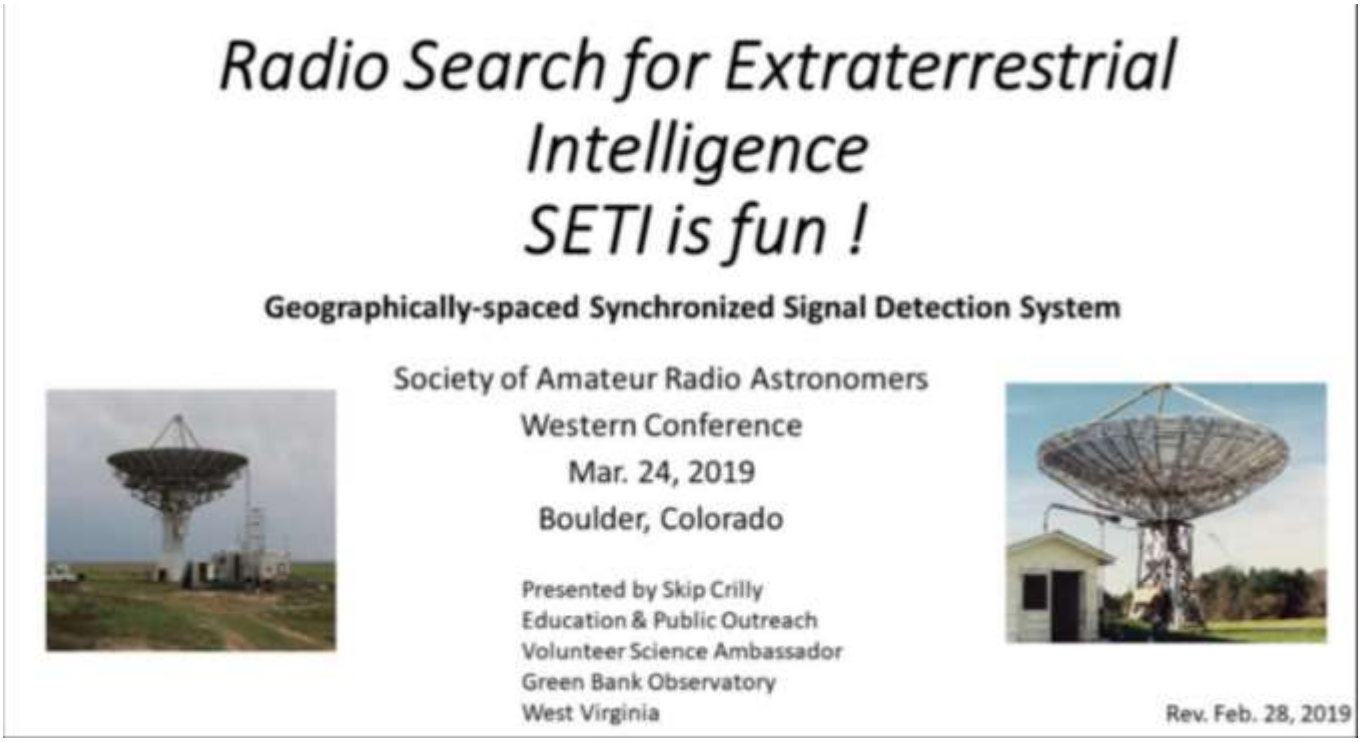
Updated to Include: Fourth Observation Results with Solar System Yaw Measurements

Richard A. Russel

Deep Space Exploration Society

Abstract

The Sun moves in an almost circular path around the Milky Way. The Earth orbits the Sun at one astronomical unit in an elliptical orbit. The goal of this study is to determine if HI measurements using the Haswell, Colorado 60-foot dish and the SpectraCyber system can be used to determine the Earth's orbit position in the solar system with reference to the Milky Way center. Multiple observations were taken of HI at the same galactic longitude degrees. The different Doppler shifts correspond to the Earth's position at the times of observation. A Monte-Carlo model was developed to explore the Earth orbital parameters in order to match the observed Doppler shifts with the expected model. The measured results showed that the 62-degree angle of the Earth's orbit to the galactic plane showed good correlation. This paper is an update to the February 2019 SARA Journal article. It includes the fifth measurement of HI velocity and HI measurements above the galactic plane. The b>0 measurements are to provide data to estimate the yaw of the solar system as it moves around the galaxy.



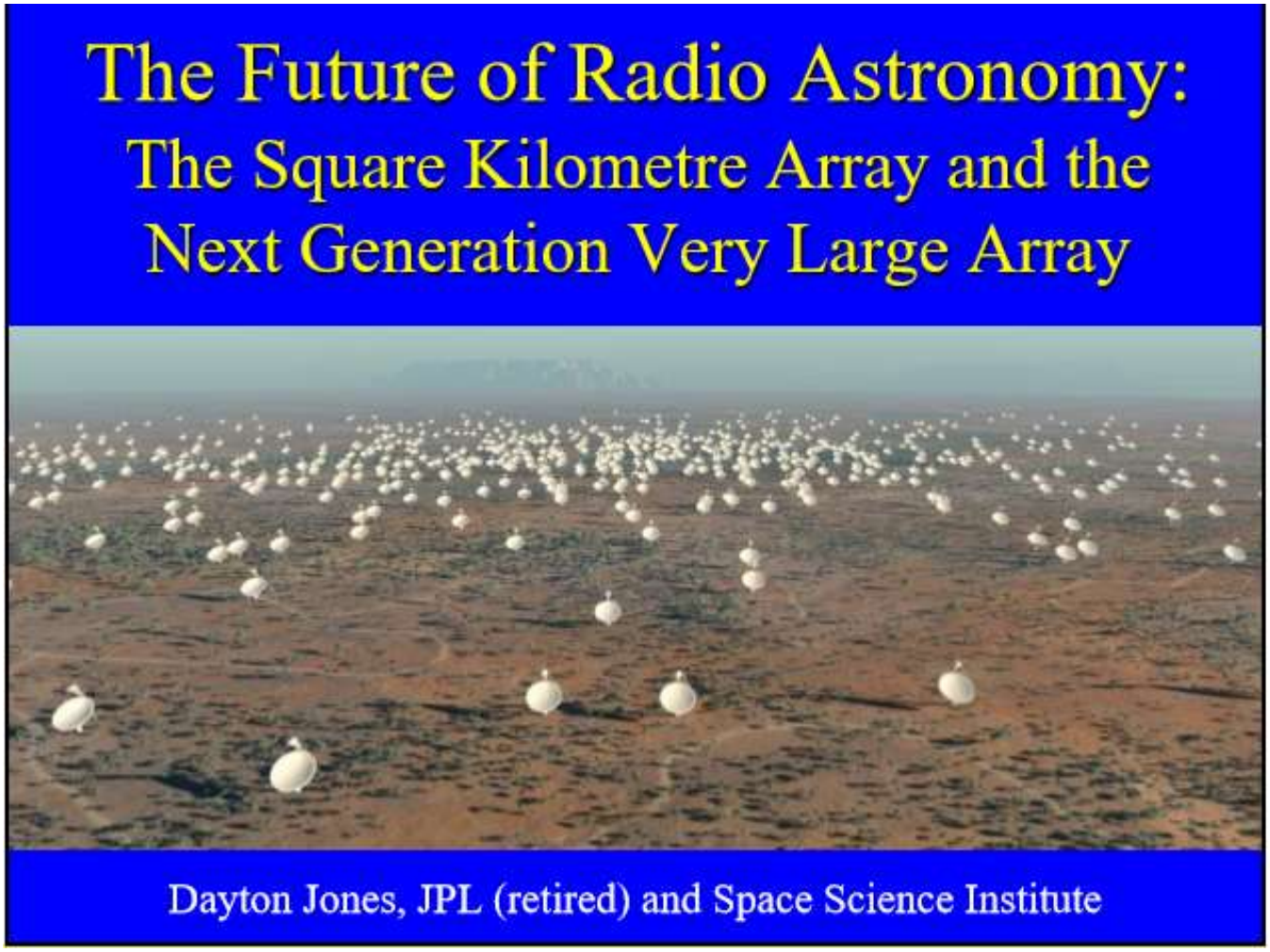
Simultaneous and Associated Pulses Observed

with Synchronized and Distant Radio Telescopes

Skip Crilly

Abstract

Radio Frequency Interference (RFI) is a confounding problem in radio SETI, as false positives are introduced into receiver signals. Various methods exist to attempt to excise suspected RFI, with a possibility that true positives are rejected, and that un-excised RFI remain as false positives. Uncertain far side-lobe antenna patterns add to the uncertainty. To ameliorate the RFI problem, a system having geographically-spaced simultaneous and synchronized reception has been implemented. A radio telescope at the Green Bank Observatory in Green Bank, West Virginia has been combined with a radio telescope of the Deep Space Exploration Society, near Haswell, Colorado to implement a spatial filter having a thrice-Moon-distance transmitter rejection. Approximately 135 hours of simultaneous synchronized pulse observations have been captured from November 2017 through February 2019. This presentation describes the problem, observation system, observed results and a proposed hypothesis to be subjected to attempts at refutation through further experimentation and RFI and ETI transmitter signal model development.



The Future of Radio Astronomy:

The SKA and ngVLA

Dayton Jones

Space Science Institute, Boulder (part-time) Jet Propulsion Laboratory, California Institute of Technology, Pasadena (retired) Former US representative to the SKA Science and Engineering Steering Committee and officer of the US SKA Consortium

Abstract

The Square Kilometer Array (SKA), currently in the detailed design phase, and the Next Generation Very Large Array (ngVLA), expected to be proposed in the early 2020s, will together provide a vast increase in radio astronomy capabilities at frequencies from 50 MHz to 116 GHz. These future facilities will be sited in southern Africa, western Australia, and the southwestern US. Along with the existing Atacama Large Millimeter Array (ALMA) in Chile we will have an orders-of-magnitude increase in sensitivity, survey speed, and imaging quality at all radio wavelengths observable from the surface of the Earth. This will revolutionize a wide range of key scientific areas from our solar system to the earliest epochs of the universe and fundamental questions of cosmology. In addition, the SKA will potentially change the sociology of radio astronomy by providing, at low and mid-frequencies, a number of

simultaneous, independently steerable beams each having the full array sensitivity. This flexibility could allow a broader base of users to have access to a forefront instrument, and riskier types of observations to be attempted.

This talk will review the major science goals for the SKA and ngVLA, describe the current designs, and discuss some of the technical challenges that remain.

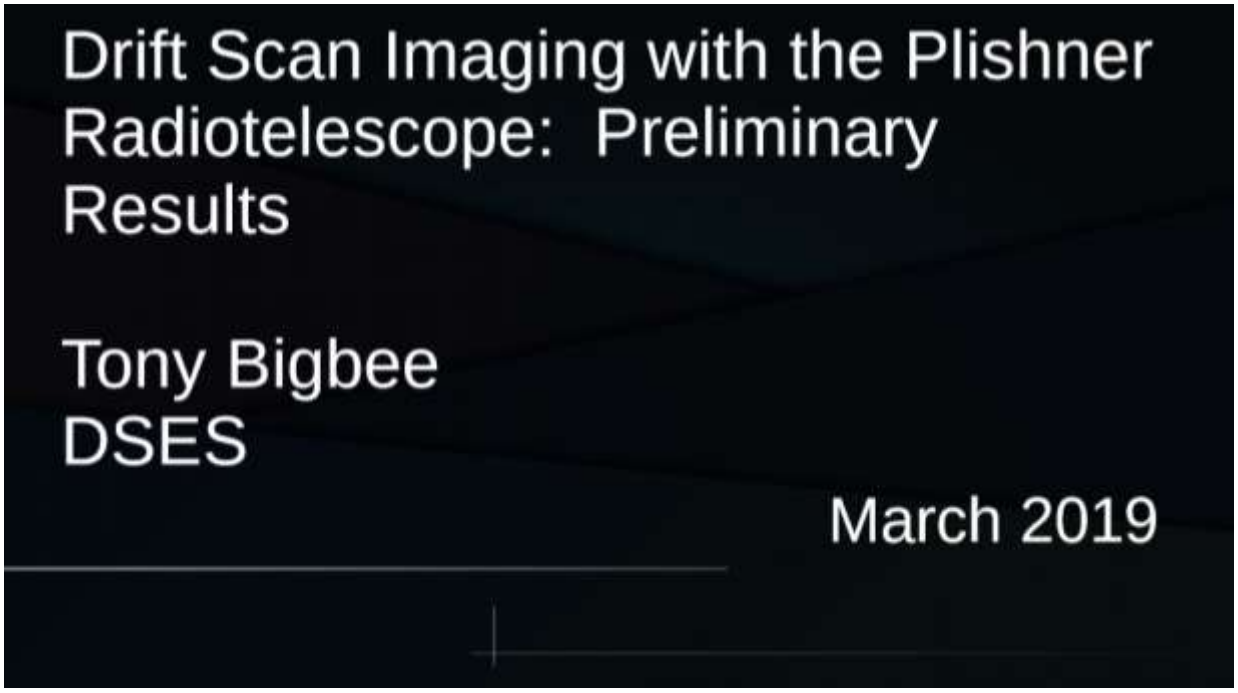
Expanding the RTL2832u SDR Dongle

Hans Gaensbauer

Deep Space Exploration Society

Abstract

Previously, several systems for radio astronomy using an RTL-SDR have been described, which allow astronomers to study galactic neutral hydrogen, pulsars and spacecraft without needing expensive equipment. While RTL-SDR offers many advantages including low cost, ease of use, and minimal setup, the limited hardware means that observations made with RTL-SDR are susceptible to errors from noise and interference, and the front-end of any RTL-SDR based system either requires expensive and messy external hardware or is limited by the simplicity of the SDR's internal circuitry. Here, we present a simple and tidy way of improving the RTL-SDR blog V3 dongle by adding supplemental hardware above the printed circuit board, inside the case. The additions do not require any serious modifications to the board, but allow for the inclusion of customizable hardware, such as tunable filters and amplifiers, motor drivers for antenna control, or noise generators for calibration.



Drift-scan imaging with the Plishner Radiotelescope:

Preliminary Results

Tony Bigbee

Deep Space Exploration Society

Abstract

This paper presents preliminary results from continuum drift scan imaging performed by the Deep Space Exploration Society Plishner 18-meter radiotelescope in Haswell, CO. The goal of the research is to explore drift scan planning, pointing, and post-processing techniques for image map construction. Since tracking services are not yet available, current collection consists of a "point and shoot" approach to build raster lines by drift scanning in right ascension, and repointing to another declination at the end of each raster line. A primary consideration of this technique is spatial (over)sampling. Right ascension collection and spatial resolution derives from the constant rate of the earth's revolution, while declination collection and spatial resolution is a function of both pointing precision/accuracy and a choice about beam pattern overlap in declination.