HamSCI

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FOR IMMEDIATE RELEASE:

HamSCI Announces Initial Observations From 14 October Annular Solar Eclipse—

Encourages Amateur Participation in Upcoming 8 April 2024 Total Solar Eclipse QSO Party

Dr. Nathaniel Frissell W2NAF, Lead Organizer for HamSCI (The Ham Radio Science Citizen Investigation) and assistant professor of physics and engineering at The University of Scranton W3USR, has announced initial observations from the October 14th annular solar eclipse across North America.

"The October 14th celestial event has provided some very interesting early data *for* ionospheric research" Frissell noted in working with the HamSCI scientific team. "While we are only in the early stages of analysis and looking ahead to the total solar eclipse across much of North America on April 8th, we are encouraged that our planned experiments with data contributed largely by amateur radio operators will yield a wealth of new discoveries in the next year or so."

Hundreds of amateurs participated in the HamSCI event by getting on the air. Combining *their* data with contacts from other amateur contest activities, citizen-science cooperation contributed to one of the largest participatory days ever in amateur radio history.

This project is studying the ionospheric response to the 2023 annular and 2024 total solar eclipse through a series of large-scale citizen science experiments known as the HamSCI Festivals of Eclipse Ionospheric Science (FoEIS), which includes the Solar Eclipse QSO Parties (SEQPs). The data for these experiments are generated by amateur radio operators communicating with each other over and around the eclipse paths using medium and high frequency signals that are refracted back to Earth by the ionosphere, and therefore sensitive to eclipse-induced ionospheric changes. These Festivals are coordinated by the Ham Radio Science Citizen Investigation (HamSCI) in collaboration with volunteers from across the amateur radio community.

The FoEIS consists of six primary components—The Solar Eclipse QSO Party (SEQP), the Grape High Frequency Doppler Experiment, WSPRdaemon observations, the Medium Wave AM Doppler Experiment, the High Frequency Time Difference of Arrival Experiment (TDOA), and the Very Low Frequency (VLF)/Low Frequency (LF) Experiments.

The SEQP was well represented with amateurs contributing 300 logs. Dr. Phillip Gladstone noted that, at noon Eastern Daylight Time on October 14th, his data collection service (pskreporter.org) was capturing spots at a rate of 3,600 contacts per second. The combination of the SEQP with other contests during that day contributed to a high volume of overall activity - well over 7 million spots were recorded during the SEQP period.

The WSPRdaemon.org experiment, led by Rob Robinett AI6VN and Gwynn Griffiths G3ZIL, successfully deployed new GNSSDO-stabilized FST4W beacon transmitters that captured eclipse HF Doppler curves using their custom decoding software. Initial wsprdaemon.org results are available at http://wsprdaemon.org/technical.html.

Over thirty Grape Personal Space Weather Stations submitted an estimated 26,700 observations from across North America. Originally designed by John Gibbons N8OBJ and team at Case Western W8EDU, the Grape receivers for this experiment were built by individuals and with volunteer efforts of the New England Grape Group. As an example, Figure 1 shows observations of the 10 MHz carrier transmitted by WWV in Colorado and received by a Grape receiver near Scranton, PA. The positive frequency shifts from 10 to 14 UTC are associated with the dawn transition. The S-shaped curve in the 1500-1800 UTC time window results from the solar eclipse effects. Grape-DigitalRF observations are available for download from http://psws.hamsci.org, a database developed by Bill Engelke AB4EJ and team at The University of Alabama.

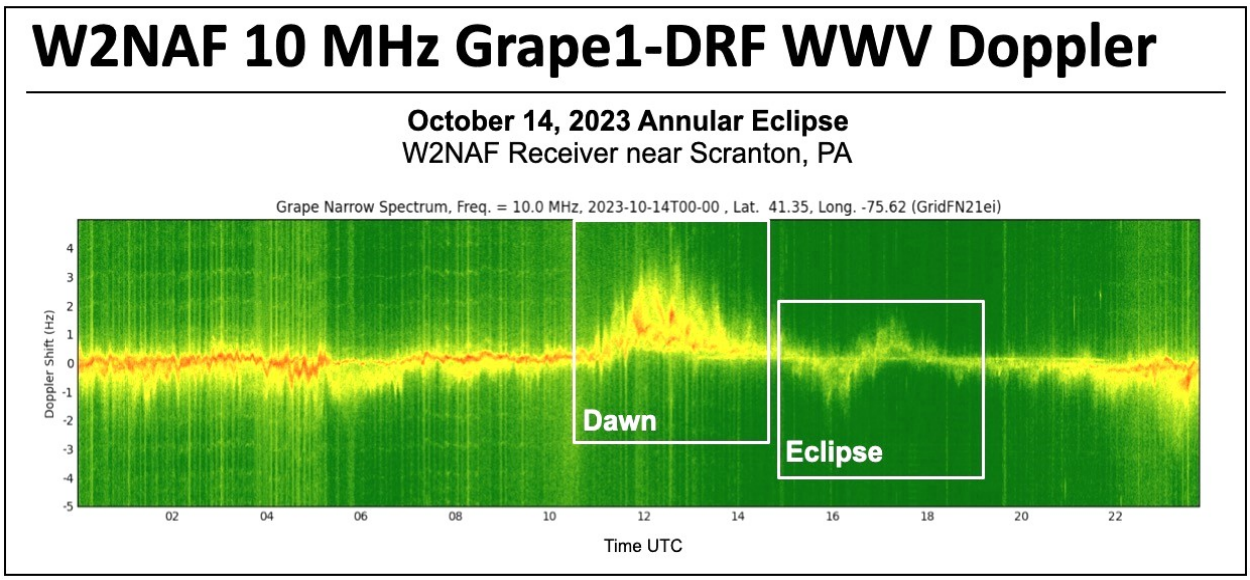

Figure 1

The AM Broadcast Medium Wave (MW) experiment, coordinated by volunteer Nick Hall-Patch VE7DXR also yielded positive initial results from twelve submitted logs. Observations include those submitted by Richard Cook KE6EE in Central California (Figure 2). His observations show that signals from MW AM stations located to his north across the annular eclipse path showed significant signal strength enhancements associated with the eclipse, whereas signals from AM stations to the south did not.

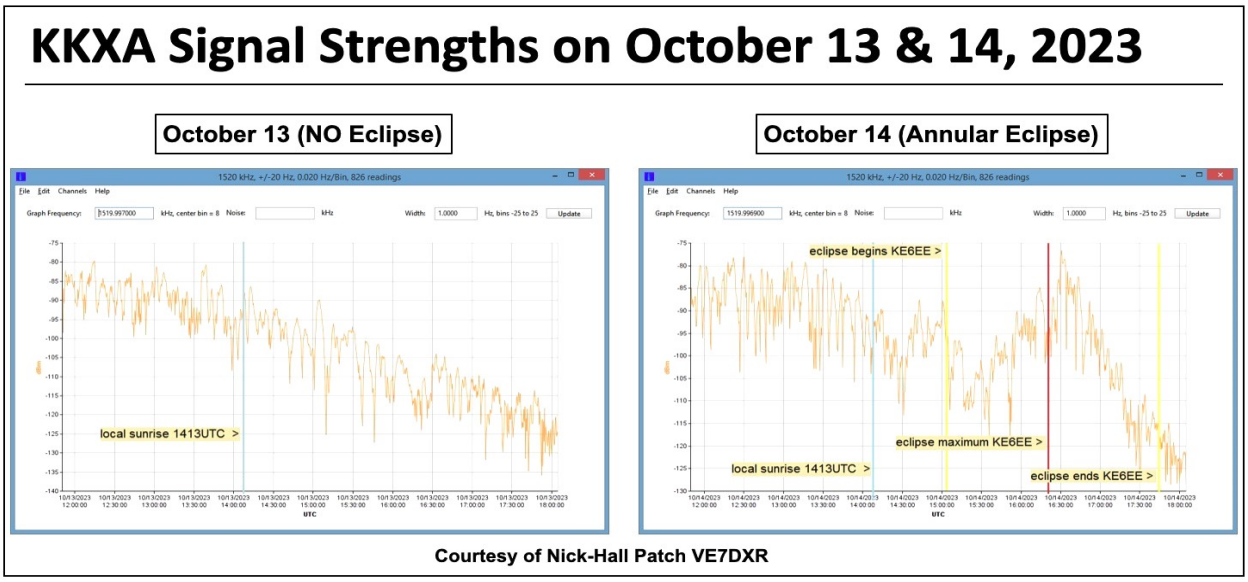

Figure 2

A Low Frequency (LF) experiment showed a dramatic enhancement for 60 kHz WWVB signals from near Ft. Collins, CO received by Steve Cerwin WA5FRF in Mico, TX. He noted that the response to the eclipse at such very low frequencies is an increase in signal strength because of lessening of ionized absorption. These observations are consistent with WWVB observations made during the August 21, 2017 Total Solar Eclipse. (Figure 3). Onset and decay rates are also shown (Figure 4).

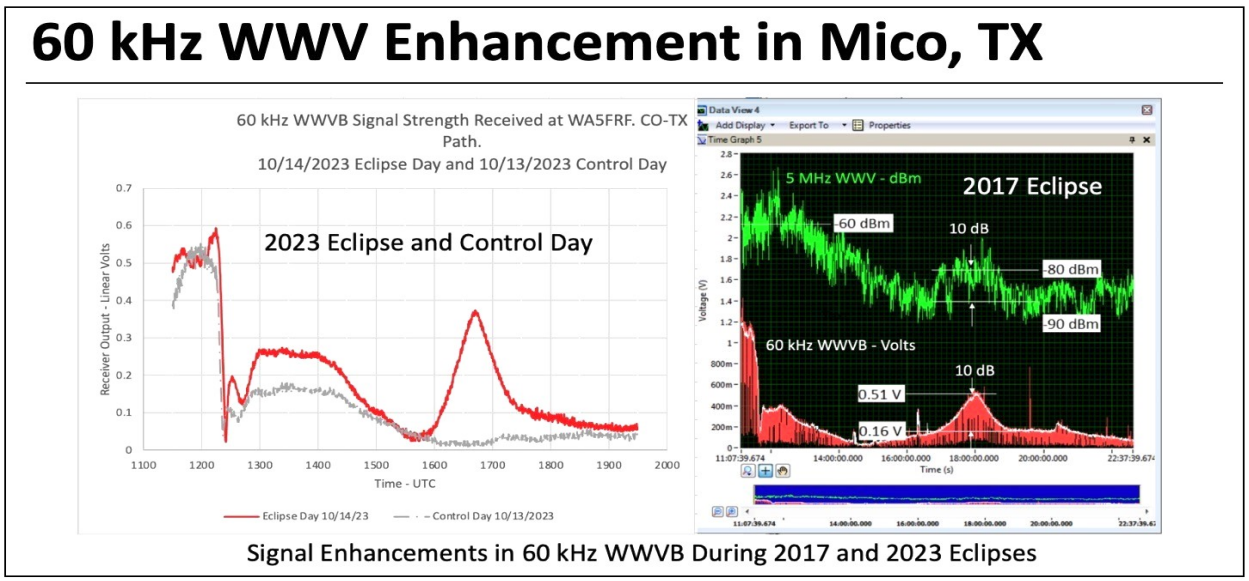

Figure 3

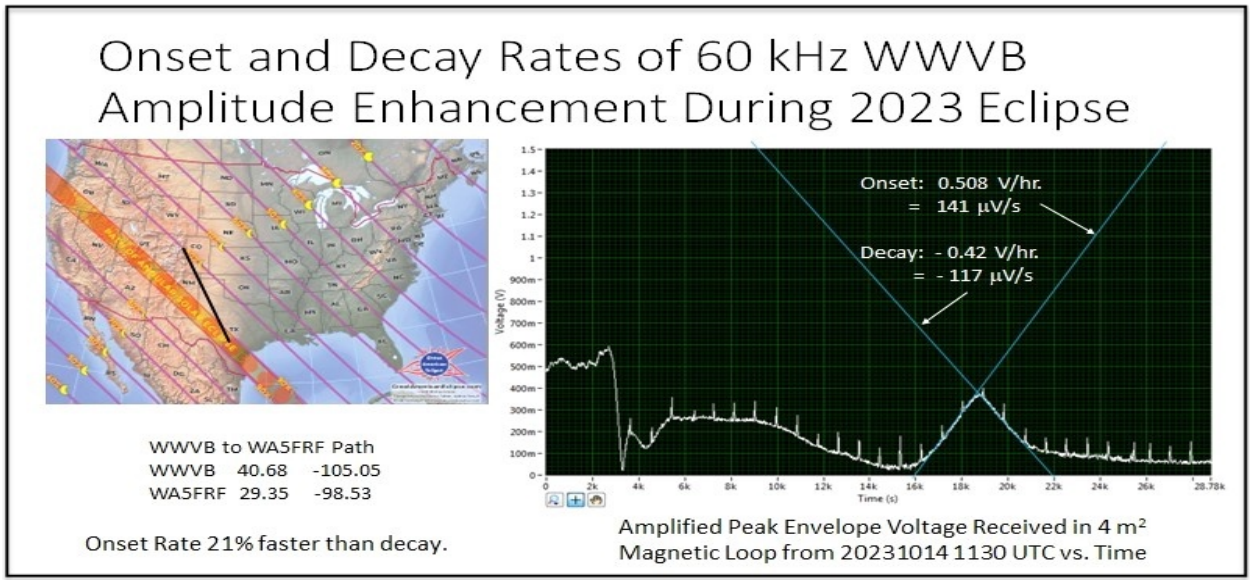

Figure 4

The Time Delay of Arrival (TDOA) experiment, also led by Steve Cerwin WA5FRF, has shown promising early results using conventional, non-GNSS disciplined amateur radios. This experiment seeks to measure eclipse-induced changes in the F2 layer height by sensing and analyzing the time difference of arrival between 1-hop and 2-hop propagation modes. TDOA sensing methods Include short pulses, frequency chirps, and pseudorandom noise (PN) bursts.

Dr. Frissell noted that participation and early outcomes were very successful at this annular eclipse. He is anticipating that the support by the amateur community and the collaboration among scientists on April 8th during the total solar eclipse will be even greater.

HamSCI serves as a means for fostering collaboration between professional researchers and amateur radio operators. It assists in developing and maintaining standards and agreements between all people and organizations involved. Its goals are to advance scientific research and understanding through amateur radio activities and encourage the development of new technologies to support this research. October 14th was a perfect example of that collaboration, and many events were reported by clubs and individual hams. A short selection of photos from individual events is linked below.

The Monday, April 8th total solar eclipse will be the last in North America for nearly twenty years. HamSCI again encourages participation by amateurs to take part in the SEQP, the WSPR Challenge and the other scientific experiments to be conducted that day. Eclipse-specific information can be found at www.hamsci.org/eclipse.

The HamSCI Community is led by The University of Scranton Department of Physics and Engineering W3USR, in collaboration with Case Western Reserve University W8EDU, the University of Alabama, the New Jersey Institute of Technology Center for Solar Terrestrial Physics K2MFF, the MIT Haystack Observatory, TAPR in Arizona, additional collaborating universities and institutions, and volunteer members of the amateur radio and citizen science communities. We are grateful for the financial support of the United States National Science Foundation, NASA, and Amateur Radio Digital Communications (ARDC).

Pictures of the day's activities across the country can be found here.

For more information about HamSCI, please visit the HamSCI website. For more information about the Festivals of Eclipse Ionospheric Science and educational opportunities for the amateur community and the public please visit our information pages.

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