Observation of VHF Type II Solar Radio Burst on 28 May 2021

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Compared to a year ago, the Sun was very active throughout May 2021, when numerous solar radio bursts were observed around the world by the e-CALLISTO solar radio network {e-CALLISTO}. Type II bursts were observed at Cohoe Radio Observatory in Cohoe, Alaska late in the UTC day on 28 May (figure 1). Type II slow-drift radio emissions quite often accompany coronal mass ejections (CME), which, if directed toward Earth, can cause geomagnetic disturbances. For a more comprehensive discussion of Type II bursts, see {Reeve18}.

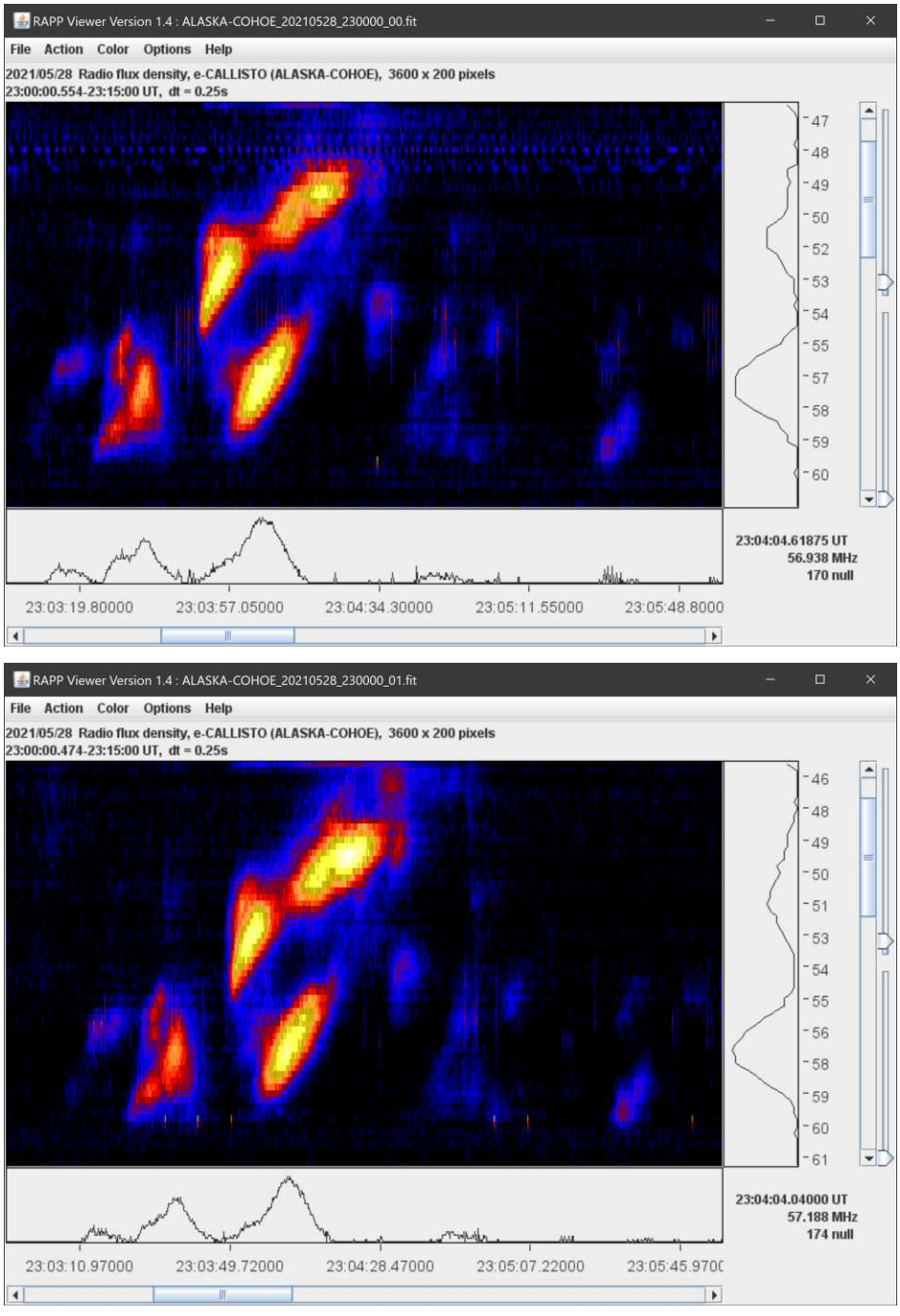

Figure 1 ~ Type II slow-drift radio bursts between 47 and 62 MHz . Upper: Right-Hand Circular Polarization (RHCP). Lower: Left=Hand Circular Polarization.

Absorption is seen as dark regions in the Type II burst on the left side of the image. The spectrograms indicate that both polarizations have approximately the same intensity. Band-splitting was present, but no harmonic structure is seen in the observed frequency range of 45 to 92 MHz (only a portion of the frequency range is shown here).

Frequency in MHz is shown on the right vertical scale and time in UTC is on the horizontal scale at the bottom. The colors indicate relative intensity with black being lower and yellow being higher. The text in the lower-right corner indicates the time, frequency and relative power of the cursor location when the image was taken (the cursor is not visible in these images).

The faint blue band near the top of the upper image is interference.

These images are screenshots of the RAPP Viewer software.

According to Space Weather Prediction Center {SWPC-EVNT}, the event involved solar active region 2824 and also produced Type IV radio continuum and Type VI radio emissions (series of Type III fast-drift bursts), a coronal mass ejection (CME) and a proton event. The CME was observed as a transient on the Anchorage SAM-III magnetometer at 1332 UTC on 2 June. The initiating agency was a long-duration C9.4 x-ray event with optical flare observed in Hydrogen-α. Although not shown in the truncated spectrograms above, the 2300 to 2315 time period included Type III bursts and some weak polarized continuum (probably the Type IV mentioned by SWPC). See {SOLAR} for information on the types and characteristics of solar radio emissions.

An LWA crossed-dipole antenna and two Callisto instruments were used for these observations (figure 2). The Callistos have an observation bandwidth of 300 KHz and an integration time of 1 ms per pixel. The Callisto software collects data as Flexible Image Transport System (FITS) files, which are stored locally. The files also are uploaded automatically to Fachhochschule Nordwestschweiz (FHNW) University of Applied Sciences & Arts website {FHNW} for permanent storage.

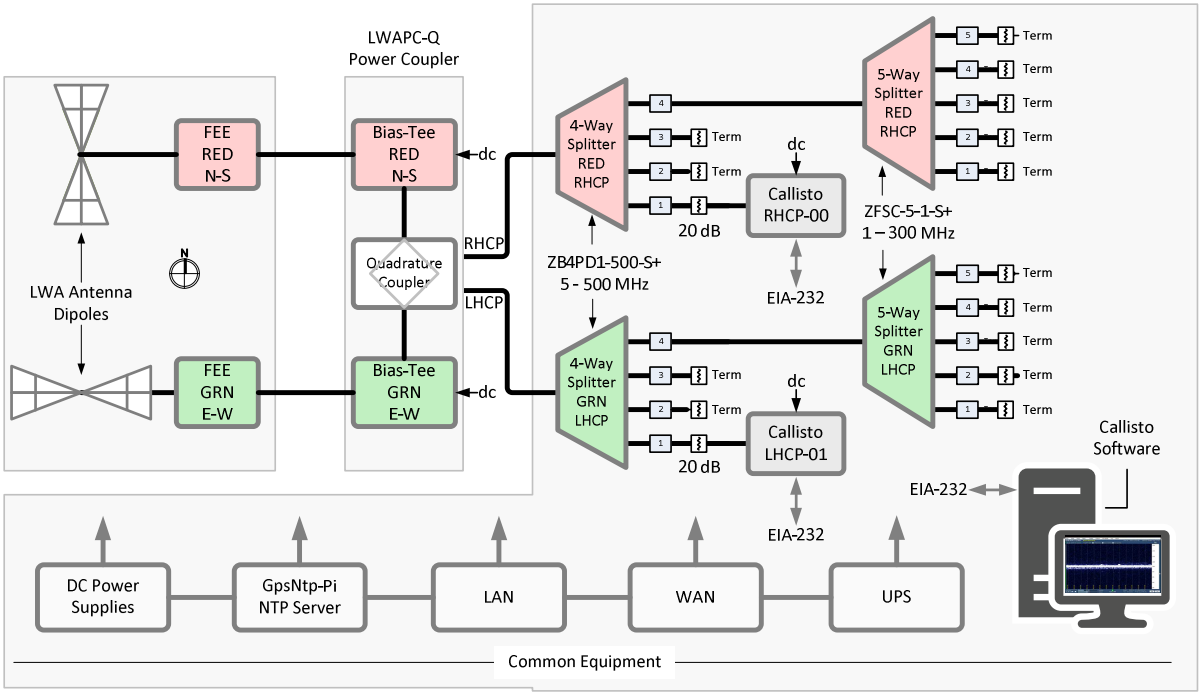

Figure 2 ~ System block diagram shows the components associated with the LWA Antenna and Callisto instruments and the common equipment shared across the observatory. Polarizations are color-coded. The Callistos are frequency agile and programmed to sweep through 200 channels between 45 and 92 MHz every 250 ms; the channel resolution is 250 kHz. The data are collected by the Callisto software through EIA-232 serial interfaces and formatted as FITS files for archiving.

References & Weblinks:

{e-CALLISTO} http://soleil.i4ds.ch/solarradio/data/BurstLists/2010-yyyy_Monstein/2021/e-CALLISTO_2021_05.txt

{FHNW} http://soleil.i4ds.ch/solarradio/callistoQuicklooks/

{SWPC-EVNT} ftp://ftp.swpc.noaa.gov/pub/indices/events/

{Reeve18} http://www.reeve.com/Documents/CALLISTO/Reeve_TypeII-Burst.pdf

{SOLAR} http://www.reeve.com/Solar/Solar.htm