



Low-frequency (15-85 MHz) Solar Radio Spectro-Polarimeter

C. Kathiravan^{*(1)}, G.V.S. Gireesh⁽¹⁾, Indrajit V. Barve⁽¹⁾ and R. Ramesh⁽¹⁾

(1) Indian Institute of Astrophysics, Bangalore, India; e-mail: kathir@iiap.res.in

Simultaneous observations from the space and ground are important to, (i) have continuous coverage of the radio spectrum, particularly at low-frequencies, and (ii) identify the emission regions since large radio imaging antenna array are practically difficult in space platforms at present. In view of these, we have developed a prototype radio low-frequency spectro-polarimeter at the Gauribidanur radio observatory to observe the total and circularly polarized intensities of transient non-thermal radio emission from the sky in the 15-85 MHz band. This prototype is timely because the low-frequency limit of the present ground based observing systems is ~ 25 MHz and the upper-frequency limit of observations from space platforms is ~ 14 MHz. Observations in the 10-35 MHz band are important to understand the spectral nature, turnover, and emission mechanism of the astronomical sources like the Sun and other transient non-solar sources like the pulsars, Fast Radio Bursts (FRBs), etc. In principle ground based observations can be carried out till frequencies as low as 10 MHz depending upon the local ionospheric conditions. But radio astronomical observations at frequencies below ~ 35 MHz with ground based radio facilities is a challenging task due to high levels of Radio Frequency Interference (RFI). Furthermore, variation (~ 20 -30 dB) in the amplitude of the sky background radio emission over the frequency range 10-35 MHz should also be taken care. So, careful attention must be given to the design and construction of the antenna and receiver system. In our setup, the analog frontend consists of two linearly-polarized Log-Periodic Dipole Antennas (LPDAs – 15-85 MHz) mounted in mutually orthogonal orientation (0° & 90° , with respect to the terrestrial North, respectively) and a combination of different indigenously designed and fabricated RF filters (band-stop, low and high pass). A quadrature power combiner is used to obtain the total and circularly polarized intensities. Note that linearly polarized emission from the Sun and other celestial sources get cancelled out over the typical observing bandwidths (~ 100 kHz) due to the differential Faraday rotation in the intervening medium. Presently trial observations are being carried out with the system. A group of fast drifting (type-III) radio bursts from the Sun were detected on 22/06/2022 (Fig. 1) with high signal-to-noise ratio. Observations of circularly polarized radio emission helps (Fig. 2) to minimize the effect of RFI since man-made RFIs are linearly polarized in general. The fact that Fig. 1 is nearly RFI free is in support of the latter.

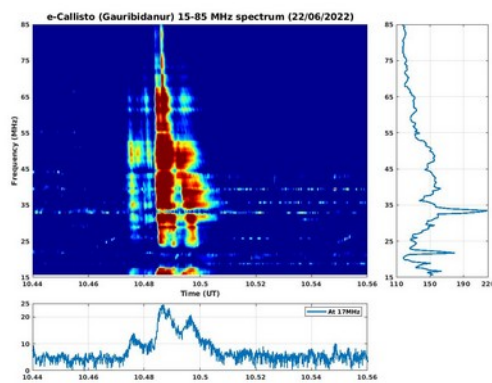


Fig. 1: Type-III burst observed on 22/06/2022 with the prototype.

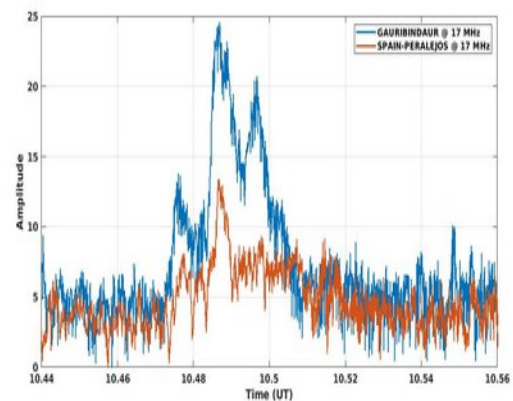


Fig. 2: Comparison of light curves obtained at 17 MHz using Gauribidanur and Spain spectrographs.