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# Circular Polarisation: a Key Parameter in Solar Radio Weather Characterisation

Mauro Messerotti[(1)(2)]
(1) INAF-Astronomical Observatory of Trieste, Loc. Basovizza 302, 34149 Trieste, Italy
(2) Department of Physics, University of Trieste, Via A. Valerio 2, 34127 Trieste, Italy

## Extended Abstract

Plasma processes occur on the Sun at different spatial and time scales during the evolution of the solar activity cycle, which originate radio waves. Hence, the Sun is a source of directional and non-directional, broad- and narrow-band radio emissions generated by incoherent and coherent processes. Solar Radio Weather refers to the physical state of the Sun as an ensemble of radio sources. Solar radio noise can increase by several orders of magnitude during outbursts, and it can persist at high levels for minutes to hours. Therefore, Solar Radio Weather spans from quiet to highly perturbed conditions, according to the characteristics of the originated solar radio noise. As the time of flight of solar electromagnetic radiation to the Earth is 8.3 minutes, the impact of these emissions onto radio assets is prompt and direct, and it manifests as radio frequency interferences (RFI) of radio system receivers. In particular, solar RFIs affect HF (High Frequency) communications, cellular communications, GNSS (Global Navigation Satellite Systems), WAAS (Wide Area Augmentation Systems), radars, and SATCOM (Satellite Communications). These impacts are relevant both to civilian activities and to military operations. The diachronic monitoring of solar radio noise can provide comprehensive diagnostics, which are fundamental in characterising Solar Radio Weather for a variety of applications in Space Weather operations (see, e.g., [1]).

In this work, we briefly review the relevant key parameters which solar radio observations can provide, which are used both as proxies of other geoeffective processes and as direct geoeffects by RFIs. In particular, we will stress the relevance of Left- (LHCP) and Right-Hand Circular Polarisation (RHCP) information in characterising radio waves from the source to receivers on earth. This is fundamental e.g. when assessing the geoeffectiveness of solar radio bursts for GNSS receivers, which are sensitive to RHCP signals (see, e.g., [2]). Figure 1 provides an example.

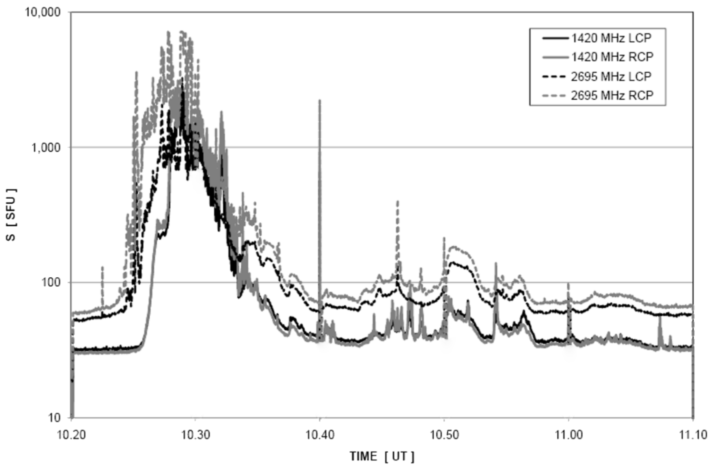


**Figure 1.** RHCP and LHCP solar radio outburst time profiles recorded at 1420 (light and dark grey continuous line) and 2695 MHz (light and dark grey dashed line) by the Trieste Solar Radio System on 5 December 2006.

## References

[1] M. Messerotti, "Solar Radio Spectrography: Comprehensive Diagnostics for Space Weather Applications," *2018 2nd URSI Atlantic Radio Science Meeting (AT-RASC), Meloneras*, 2018, pp. 1–4, doi:10.23919/URSI-AT-RASC.2018.8471360.

[2] M. Bilal, V. Alberti, A. Marassi, E. Cianca, and M. Messerotti, "Performance assessment of GPS receivers during the September 24, 2011 solar radio burst event," *Journal of Space Weather and Space Climate*, **5**, id. A32, 2016, 16 pp., doi:10.1051/swsc/2015034.