Small-scale solar wind evolution detected by interplanetary scintillation with the MEXART radio telescope

J. C. Mejía-Ambriz[1], *E. Aguilar-Rodríguez*[2], J. *A. González-Esparza*[2], *P. Villanueva-Hernandez*[2], *E. Andrade-Mascote*[2], *A. Espinosa-Jimenez*[3], *J. L. Godoy*[4]

[1] *LANCE, Instituto de Geofísica, CONACyT, Universidad Nacional Autónoma de México, Morelia,* [2] *LANCE, Instituto de Geofísica, Universidad Nacional Autónoma de México, Morelia,* [3]*Universidad Autónoma de Querétaro, Querétaro,* [4]*Tecnológico Nacional de México, Morelia.*

Abstract: The interplanetary scintillation (IPS) is the twinkling of compact (< 1 arcsec) astronomical radio sources observed at radio wavelengths. This effect is caused when the radio signals, coming from these sources, cross by solar wind small-scale density fluctuations producing a diffraction pattern at Earth. An approach to understand the evolution of these scales is by the analysis of the IPS diffraction pattern. The movement of the pattern on the ground also give us ways to develop methods to calculate solar wind speeds. Here we show the evolution of the scale-size of the diffraction pattern of IPS at 140 MHz with MEXART. We recorded scintillation of two quasars completing near 200 observations for different days. The observations were carried out in 2019. We find an average scale near to 220 km, which is close to be constant, and decays slowly from around 245 km for short solar elongations (23 degrees) to 180 km at far solar elongations (90 degrees). We also show that the calibration of the evolution of the diffraction pattern scale-sizes can provide estimation of solar wind speeds. The back-end of MEXART was upgraded [1] during the years 2020-2021 improving quality of observations. We include the above analysis with observations of the year 2021.

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References: [1] A. Magro, R. Chiello, D. Cutajar, J. Borg, K. Zarb-Adami, A. Gonzalez-Esparza, J. Mejía-Ambriz. E. Aguilar-Rodriguez, A. Espinosa-Jimenez, J. L, Godoy-Hernandez, Ernesto Andrade-Mascote, "A New Digital Backend for the Mexican Array Radio Telescope", IEEE, 24, 2019, pp. 0185-0189, doi: 10.1109/ICEAA.2019.8878959.

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