URSI - RCRS 2022, IIT (Indore), India, 1 - 4 December, 2022

Source Sizes of Fine Structures in Type II Radio Bursts with LOFAR Interferometric Observations

Anshu Kumari * (1), Diana E. Morosan (1), Emilia K. J. Kilpua (1) and Pietro Zucca(2)
(1) University of Helsinki, Finland, e-mail: anshu.kumari@helsinki.fi;
(2) ASTRON, The Netherlands

The magnetic field dominates the structure and dynamics of the solar corona and it is the primary driver of Space weather. Radio observations are one of the most common approaches to diagnosing the magnetic field in the solar atmosphere [1]. One of the direct signatures of explosive solar phenomena, such as coronal mass ejections (CMEs) in radio wavelengths, is called metric type II radio bursts. Type II bursts originate from plasma waves converted into radio waves at the local plasma frequency and its harmonics. These radio bursts can be considered as a direct diagnosis of MHD shocks in the solar atmosphere. These bursts can be used to study the kinematics, energetics, and dynamics of the associated eruptive events very close to the Sun [2]. With state-of-the-art radio instruments such as LOw Frequency ARray (LOFAR), it has now been possible to study these bursts and the structures within them in great spectral, temporal and spatial resolutions. We studied the source sizes and shapes of the fine structures of type II radio bursts observed with LOFAR and their variation with frequency in metric wavelengths.

In this paper, we will discuss the intrinsic radio source sizes and their shapes for three type II bursts observed with LOFAR in interferometric mode observations between 10-200 MHz. The type II bursts were recorded on i) 2014 Aug, 25 at 15:03 UT; ii) 2015 Oct, 16 at 12:50 UT; and iii) 2015 Oct, 16 at 13:25 UT. We inferred the sizes and shapes (ellipticities) of these radio sources using 2D Gaussian approximation. This is the first time the sizes and shapes of fine structures in a type II solar metric emission and their variation with low frequencies is studied with interferometric LOFAR observations.

1. Carley, E. P., Vilmer, N., and Vourlidas, A., "Radio observations of coronal mass ejection initiation and development in the low solar corona", *Frontiers in Astronomy and Space Sciences*, **vol. 7,** 2020. doi:10.3389/fspas.2020.551558.

2. Kumari, A., Ramesh, R., Kathiravan, C., Wang, T. J., and Gopalswamy, N., "Direct Estimates of the Solar Coronal Magnetic Field Using Contemporaneous Extreme-ultraviolet, Radio, and White-light Observations", *The Astrophysical Journal,* **vol. 881**, no. 1, 2019. doi:10.3847/1538-4357/ab2adf.