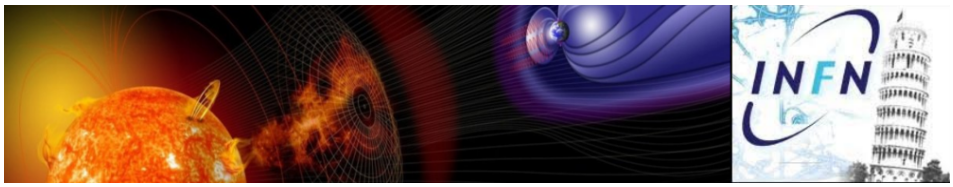

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LOFAR Observations of Radio Burst Source Sizes and Scattering in the Solar Corona

Thursday, 8 July 2021 19:31 (4 minutes)

Low frequency radio wave scattering and refraction can have a dramatic effect on the observed size and position of radio sources in the solar corona.
The scattering and refraction is thought to be due to fluctuations of electron density caused by turbulence. Hence, determining the true radio source size can provide information on the turbulence in coronal plasma.
However, the lack of high spatial resolution radio interferometric observations at low frequencies such as with the LOw Frequency ARray (LOFAR) have made it difficult to determine the true radio source size and level of radio wave scattering.
Here we directly fit the visibilities of a LOFAR observation of a Type IIIb radio burst with an elliptical Gaussian to determine its source size and position. This circumvents the need for imaging of the source followed by deconvolution, which can introduce spurious effects on source size and shape.
For a burst at 34.76~MHz, we find a full width at half maximum height (FWHM) along the major and minor axes to be $18.8' \sim \pm\ 0.1'$ and $10.2' \sim \pm\ 0.1'$ respectively at a plane of sky heliocentric distance of 1.75~$R_\odot$.
Our results suggest that the level of density fluctuations in the solar corona is the major cause of the scattering of radio waves, resulting in large source sizes. However, the magnitude of ε may be smaller than previously derived in comparison to observations of radio wave scattering in tied-array images.

Email

Primary author: MURPHY, Pearse (Trinity College Dublin/Dublin Institute for Advanced Studies)

Co-authors: CARLEY, Eoin; RYAN, Aoife Maria; ZUCCA, Pietro; GALLAGHER, Peter

Presenter: MURPHY, Pearse (Trinity College Dublin/Dublin Institute for Advanced Studies)

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