



Contribution ID: 12

Type: not specified

LOFAR imaging of the solar corona during the 2015 March 20 solar eclipse

Thursday, 8 July 2021 19:35 (4 minutes)

The solar corona is a highly-structured plasma which can reach temperatures of more than ~ 2 MK. At low frequencies (decimetric and metric wavelengths), scattering and refraction of electromagnetic waves are thought to considerably increase the imaged radio source sizes (up to a few arcminutes). However, exactly how source size relates to scattering due to turbulence is still subject to investigation. The theoretical predictions relating source broadening to propagation effects have not been fully confirmed by observations due to the rarity of high spatial resolution observations of the solar corona at low frequencies. Here, the LOw Frequency ARray (LOFAR) was used to observe the solar corona at 120–180 MHz using baselines of up to 3.5 km (corresponding to a resolution of ~ 1 – $2''$) during the partial solar eclipse of 2015 March 20. A lunar de-occultation technique was used to achieve higher spatial resolution ($\sim 0.6''$) than that attainable via standard interferometric imaging ($\sim 2.4''$). This provides a means of studying the contribution of scattering to apparent source size broadening. It was found that the de-occultation technique reveals a more structured quiet corona that is not resolved from standard imaging, implying scattering may be overestimated in this region when using standard imaging techniques. However, an active region source was measured to be $\sim 4''$ using both de-occultation and standard imaging. This may be explained by the increased scattering of radio waves by turbulent density fluctuations in active regions, which is more severe than in the quiet Sun.

Email

Primary authors: RYAN, Aoife Maria (Trinity College Dublin/Dublin Institute for Advanced Studies); Prof. GALLAGHER, Peter (Dublin Institute for Advanced Studies); Dr CARLEY, Eoin (Dublin Institute for Advanced Studies); Dr BRENTJENS, Michiel A. (ASTRON, The Netherlands Institute for Radio Astronomy); Mr MURPHY, Pearse c. (Trinity College Dublin/Dublin Institute for Advanced Studies); Dr VOCKS, Christian (Leibniz-Institut für Astrophysik Potsdam (AIP)); Dr MOROSAN, Diana E. (Department of Physics, University of Helsinki, P.O. Box 64, FI-00014 Helsinki, Finland.); Dr REID, Hamish (7 Department of Space and Climate Physics, University College London, London, RH5 6NT, UK.); Dr MAGDALENIC, Jasmina (Solar-Terrestrial Centre of Excellence—SIDC, Royal Observatory of Belgium, 3 Avenue Circulaire, B-1180 Uccle, Belgium. /Center for mathematical Plasma Astrophysics, Department of Mathematics, KU Leuven, Celestijnenlaan 200B, B-3001 Leuven, Belgium); Dr BREITLING, Frank (5 Leibniz-Institut für Astrophysik Potsdam (AIP), An der Sternwarte 16, D-14482 Potsdam, Germany.); Dr ZUCCA, Pietro (AASTRON Netherlands Institute for Radio Astronomy); Dr FALLOWS, Richard (ASTRON, The Netherlands Institute for Radio Astronomy, Oude Hoogeveensedijk 4, 7991 PD Dwingeloo, The Netherlands.); Prof. MANN, Gottfried (Leibniz-Institut für Astrophysik Potsdam (AIP), An der Sternwarte 16, D-14482 Potsdam, Germany.); Dr KERDRAON, Alain (LESIA, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Université de Paris, 5 Place Jules Janssen, 92195 Meudon, France.); Dr HALFWERK, Ronald (AstroTec Holding B.V., Oude Hoogeveensedijk 4, 7991 PD Dwingeloo, Netherlands.)

Presenter: RYAN, Aoife Maria (Trinity College Dublin/Dublin Institute for Advanced Studies)

Session Classification: Working Group 2: Particle acceleration

Track Classification: Working Group 2: Particle acceleration