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Kinematics and shock locations of a spatial resolved solar type II radio burst with LOFAR.

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Type II radio bursts are evidence of shocks in the solar atmosphere emitting radio waves ranging from metric to kilometric lengths. These shocks may be associated with coronal mass ejections (CMEs) reaching super-Alfvènic speeds. Radio imaging of the decameter wavelengths is now possible with the Low Frequency Array (LOFAR), opening a new radio window to study coronal radio shocks leaving the inner solar corona and entering the interplanetary medium and understand their association with CMEs.
Here, we study a coronal shock associated with a CME and type II radio burst to determine the location where the shock is triggered in relation to the propagating CME, the ambient medium Alfvèn speed and the orientation of the coronal magnetic field. The type II shock imaging and spectra were obtained using 91 simultaneous tied-array beams of LOFAR while the CME was observed by the Large Angle and Spectrometric Coronagraph (LASCO) on board the Solar and Heliospheric Observatory (SOHO).
Using the tied array beam observing mode of LOFAR we were able to locate the type II radio shock position between 45 and 75 MHz and relate it to the expanding flank of a CME leaving the inner corona. The radio emission associated with the type II shock was found to be located at the flank of the CME in a region where the mach number is between 1.5 to 2.0 and the shock geometry is quasi-perpendicular.