



Contribution ID: 336

Type: **Poster**

LOFAR observations of a jet-driven piston shock in the low solar corona

Monday 6 September 2021 16:22 (13 minutes)

The Sun produces highly dynamic and eruptive events that can drive shocks through the corona. These shocks can accelerate electrons, which result in plasma emission in the form of a type II radio burst. Despite the large number of type II radio bursts observations, the precise origin of coronal shocks is still subject to investigation. Here we present a well observed solar eruptive event that occurred on 16 October 2015, focusing on a jet observed in the extreme ultraviolet (EUV) by the Atmospheric Imaging Assembly (SDO/AIA), a streamer observed in white-light by the Large Angle and Spectrometric Coronagraph (SOHO/LASCO), and a metric type II radio burst observed by the LOw Frequency Array (LOFAR). LOFAR interferometrically imaged the fundamental and harmonic sources of a type II radio burst and revealed that the sources did not appear to be co-spatial, as would be expected from the plasma emission mechanism. We correct for the separation between the fundamental and harmonic using a model which accounts for scattering of radio waves by electron density fluctuations in a turbulent plasma. This allows us to show the type II radio sources were located $\sim 0.5 R_{\odot}$ above the jet and propagated at a speed of $\sim 1000 \text{ km s}^{-1}$, which was significantly faster than the jet speed of $\sim 200 \text{ km s}^{-1}$. This suggests that the type II burst was generated by a piston shock driven by the jet in the low corona.

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Session Classification: Poster Session 2.5

Track Classification: Session 4 - From Radio to Gamma Rays: Near-Sun Manifestations and Triggering of Solar Flares and Coronal Mass Ejections