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ECLIPSE 2017: NEW RESULTS ON THE DYNAMICAL INNER-CORONA

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Abstract.

The total solar eclipse of 21 Aug. 2017 was observed by our teams in excellent conditions for almost 1 hour (from Oregon at 17h12, Idaho 17h27, see Fig. 1, Wyoming 17h36 and Missouri, 18h12 U.T.). Excellent images were recorded in white-light (W-L), including a very high spatial-temporal resolution (HR) sequence covering faint dynamical phenomena related to an exceptionally slow CME that evolved over the E-limb. In addition:

i) The overall polarized K-corona, from linearly polarized images taken in 12 positions with a green filter, was analyzed, to be compared to the latest quantitative magnetic dynamical coronal modeling of the Mikic team (Mikić et al. 2018). The complex fine scale structure reflecting the magnetic field topology is analyzed using specially designed algorithms with suggestion of a more turbulent field in the outer corona above r= 2Rs.

ii) The more simple Polar- cap Regions are considered to compare the impressive fine- scale more linear W-L plumes with the EUV plumes simultaneously observed in the lower corona with the AIA filtergrams of the SDO mission; we integrate 60 successive AIA images taken with the 171, 193, 211 Å filters to improve the S/N ratio of EUV frames. The new view of dynamical polar plumes is illustrated at different temperature regimes, including a high temperature regime. Some evidence of fast propagating transverse waves is obtained by comparing deep spatially Fourier- filtered W-L images of plumes and jets separated by typically 1 min of time; amplitudes are larger for larger radial distances, suggesting that they reflect the propagation of alfvenic disturbances and possibly their dissipation.

iii) The most notable dynamic phenomenon is analyzed at the E- limb: it is a slow CME that shows a constant 250 km/s velocity from the LASCO (SoHO) observations. It is analyzed here in W-L with HR eclipse images and with images from the SECCHI EUV filtergrams of the STEREO mission and from the AIA of the SDO mission. Very small scale and faint moving and curved W-L features at r= 1.7 Rs, possibly owning to high disrupted loops, are analyzed for the 1st time with a 20 sec temporal resolution movie; falling back remnants of the erupted high latitude polar crown filament- prominence found at the feet of the CME are detected in W-L, well after the eruption. It is suggested that such processes are a component of the slow wind that is more easily demonstrated at time of this minimum corona using eclipse images in the r = 1.5 to 2 Rs region where instabilities grow and outwardly propagate.(Boulade et al. (1997) Tavabi et al. (2018))

Keywords: Total Solar Eclipse, Solar Corona, CME

References

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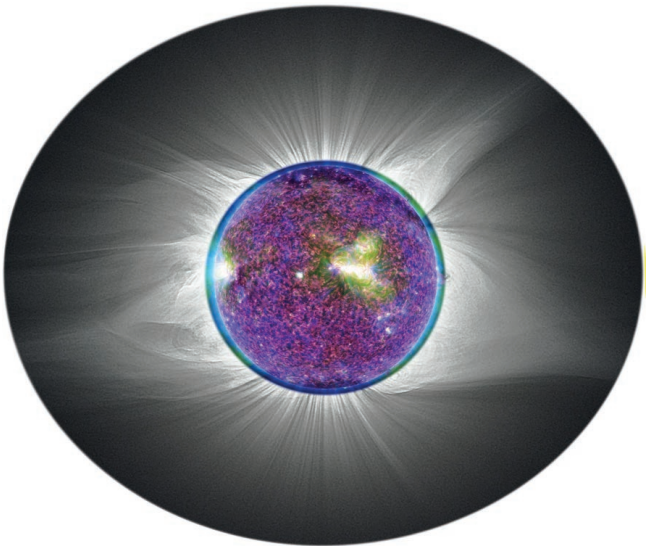
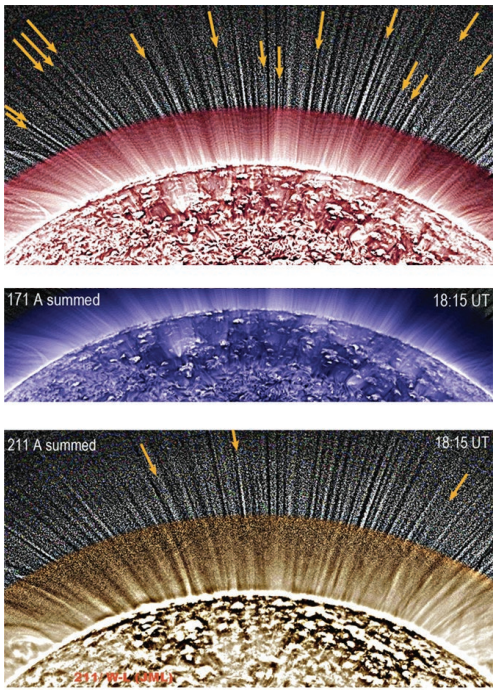


Fig. 1. Reconstructed image (J. Mouette) of the W-L corona observed in Idaho (17h 27 UT) using a sequence made for producing a full movie of the totality, with the AIA (SDO) composite coronal image put instead of the Moon image to show the correlated coronal line emissions just above the solar limb. Note the bright "point" at the South pole seen right above the limb and the strong long polar plume rising above in W-L, with several quasi- radial components.



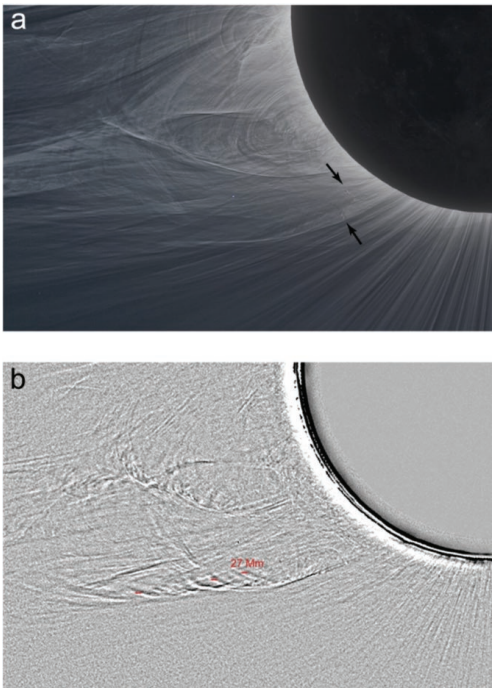


Fig. 2. Left: Analysis of the N- pole region with polar plumes and jets: search for correlations in position and intensities using the highly processed W-L image of J-M. Lecleire (18:12 UT) reflecting i) small- scale density variations (shown in the outer B&W parts of the composites); ii) temperature variations (indeed Emission Measures) as visualized using processed and integrated over 10 min filtergrams from AIA (SDO). Top parts are for 171 Å emissions at $T^\circ < 1\,MK$ and the bottom part, for 211 emissions with $T^\circ > 2.5\,MK$. Arrows show AIA plumes and jets with obvious correlation with the W-L density structures. The analysis suggests a dominance of plumes of low coronal T° and also, of linear jets/plumes of high T° (best ex. is the central linear jet not existing in 171). For the most inner corona W-L parts see the image at left. **Right:** Analysis of the E- limb slow CME: a- the W-L K-corona image at 17:24 UT (Observation and processing by N. Lefaudeux) to show fine coronal structures everywhere; b- difference image of the corona with a time lapse of 2 min. Black arrows in a) point to eruptive prominence remnants observed as reddish features owing to $H\alpha$ and D3 emissions. Red arrows in b) indicate the displacement in 2 min of coronal structures giving 200 km/s in proper motion, in agreement with the values deduced after from the LASCO space- born (SoHO) movie analysis. (Nicolas Lefaudeux : https://hdr-astrophotography.com/high-resolution-2017-total-solar-eclipse/)