

Solar asymmetric filament eruption observed by the Solar Dynamic Observatory and related activity

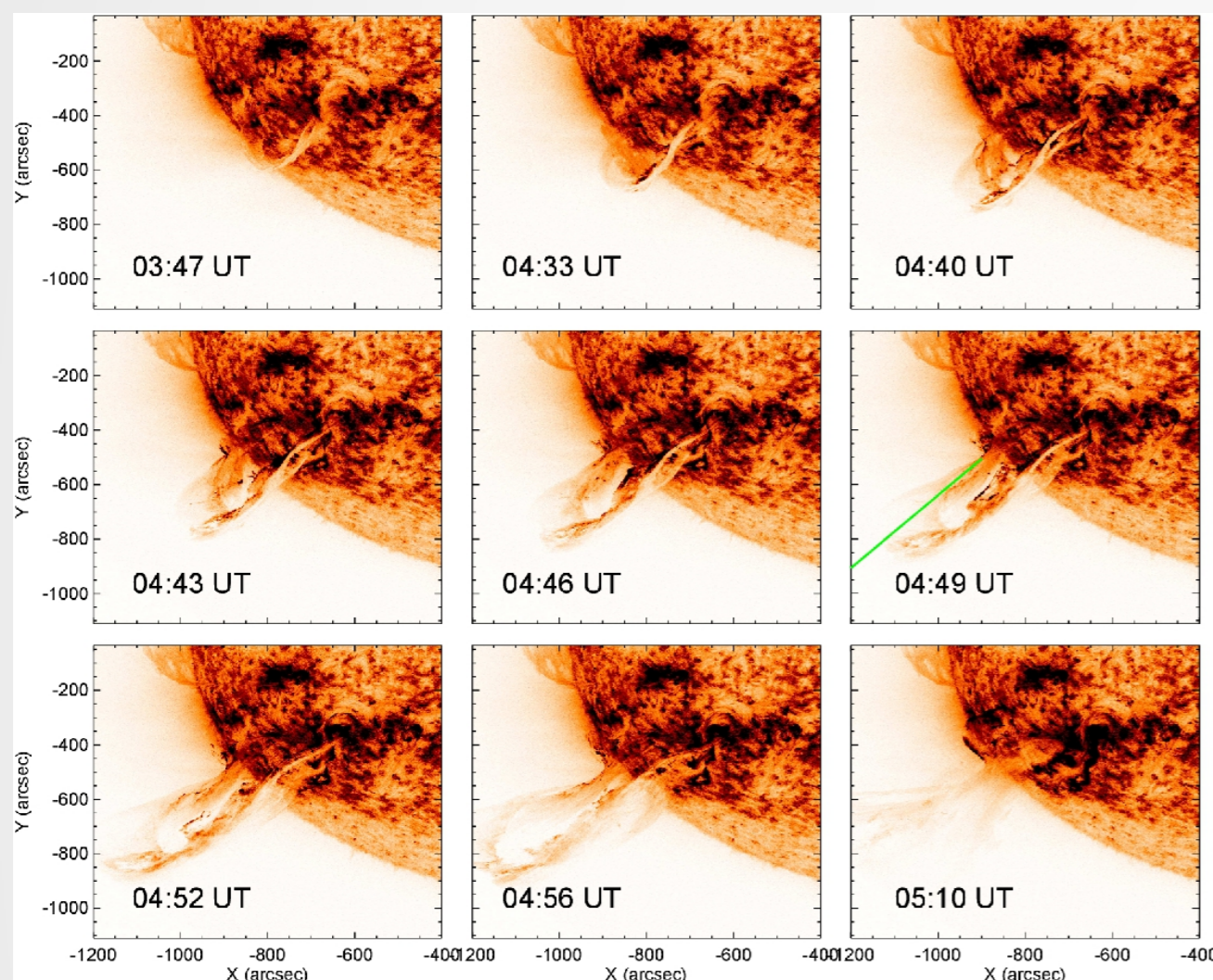
Koleva, K.¹, Dechev, M.², Duchlev, P.², Chandra, R.³

¹Space Research and Technology Institute, Bulgaria; ²Institute of Astronomy and National Astronomical Observatory, Bulgaria; ³Kumaun University, Nainital, India

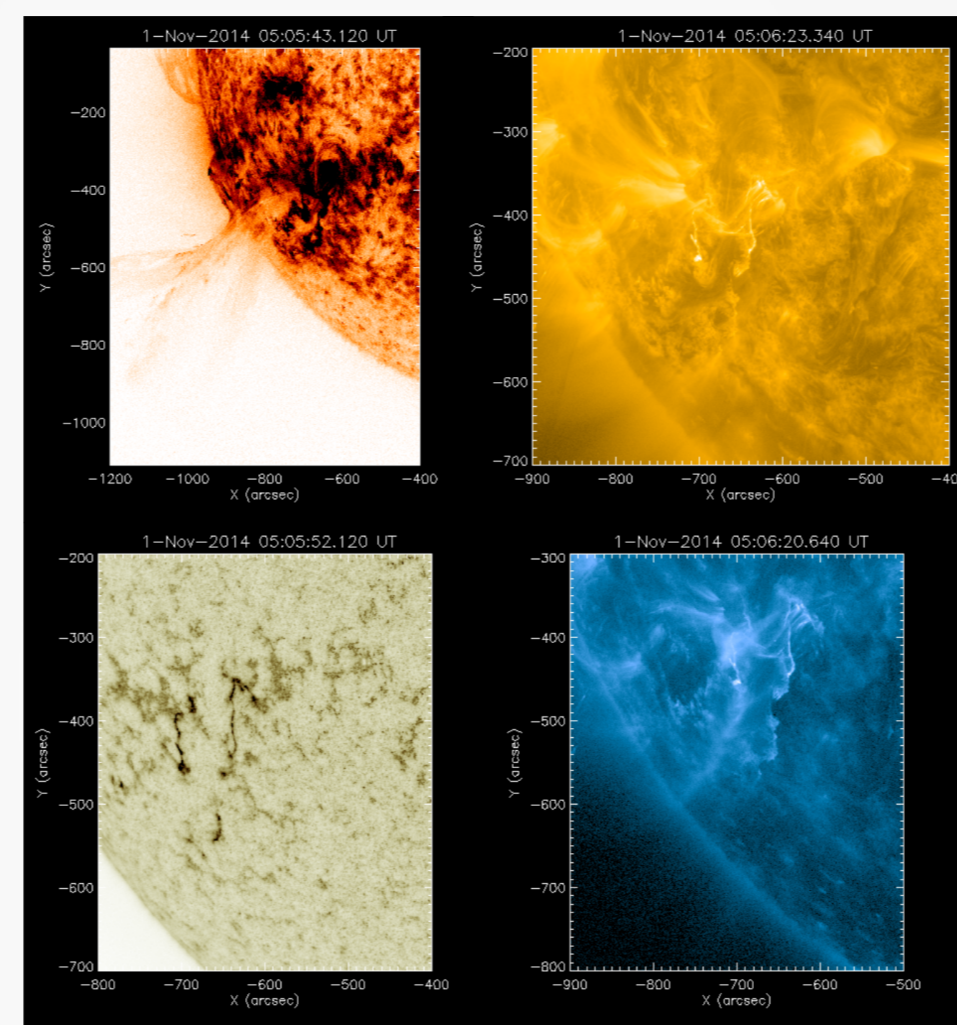
Outline:

An asymmetric eruptive prominence (EP) appeared on 2014 Nov 01 and it was followed by a two-ribbon solar flare. The ejection triggered a fast coronal mass ejection (CME) that was well visible in the LASCO C2 field of view. The morphology and kinematics of the EP and two-ribbon flare were examined by multi-channel observations from AIA/SDO and SoHO/LASCO. Initially, the EP slowly rose and then it sharply ejected up with a strong acceleration producing the CME bright core. The evolution of two-ribbon flare is morphologically characterized by separation of the two ribbons in the chromosphere. The ribbons' separation showed two-stage evolution: first one with relatively fast decelerating and very slow second one with low constant velocity. Such separating motion is believed to provide a signature of the reconnection process occurring progressively higher up in the corona.

Observations:



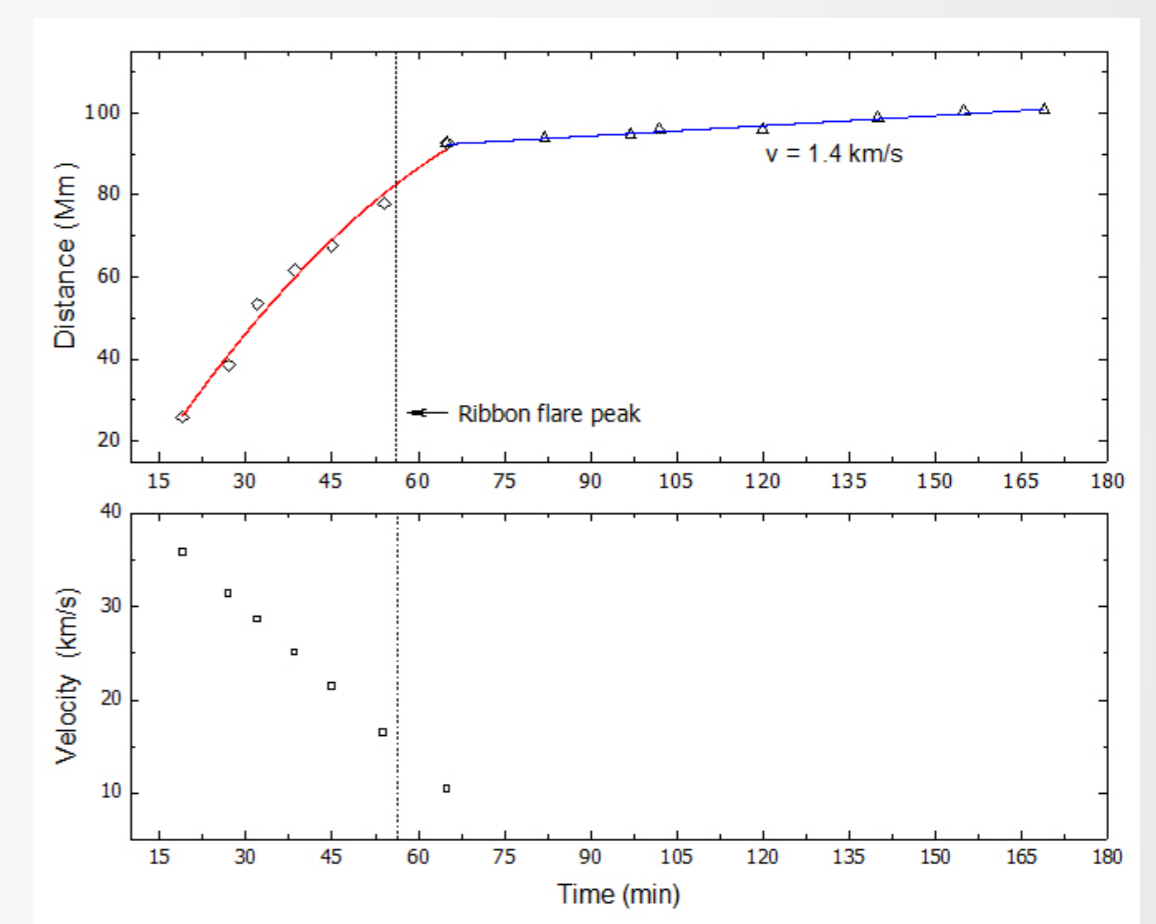
The EP evolution in AIA/SDO 304 Å images in reversed colors. The green line in the frame on 04:49 UT marks the slice position used for obtaining the height-time evolution.



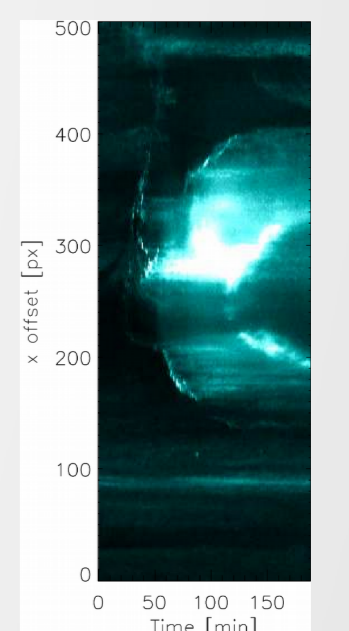
Goes class: C2.7; Position: S22E52
Two ribbon flare as viewed in AIA 304 Å, 171 Å, 1600 Å and 131 Å channels at temperature formation 4.7, 5.8, 5.0 and 7.2 log (T), respectively.

Flare ribbon kinematics:

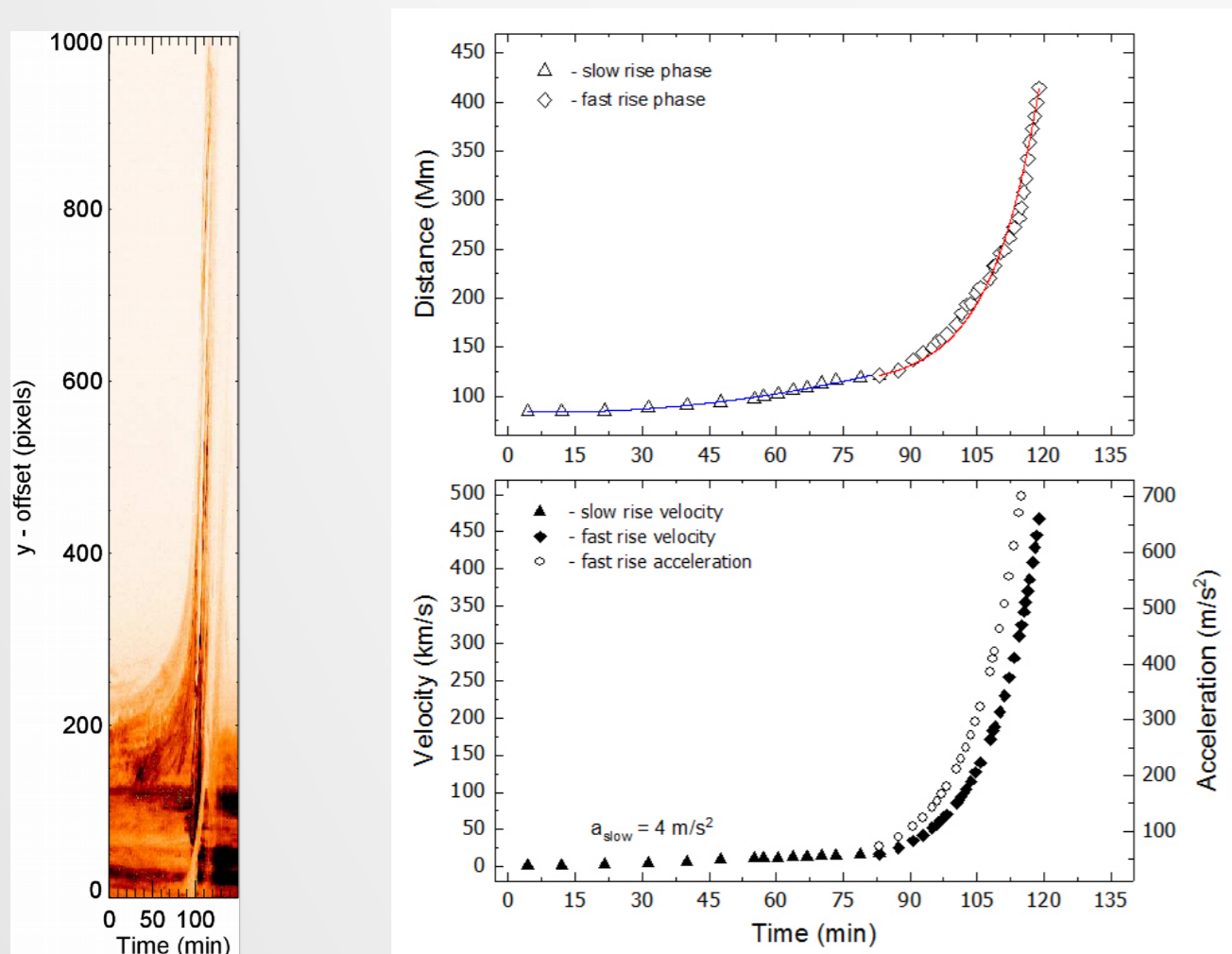
The distance between flare ribbons (top panel) and the separation velocity (bottom panel):



Time-slice diagram, used for the ribbons separation determination. The start time is: 2014-Nov-01 03:00 UT.



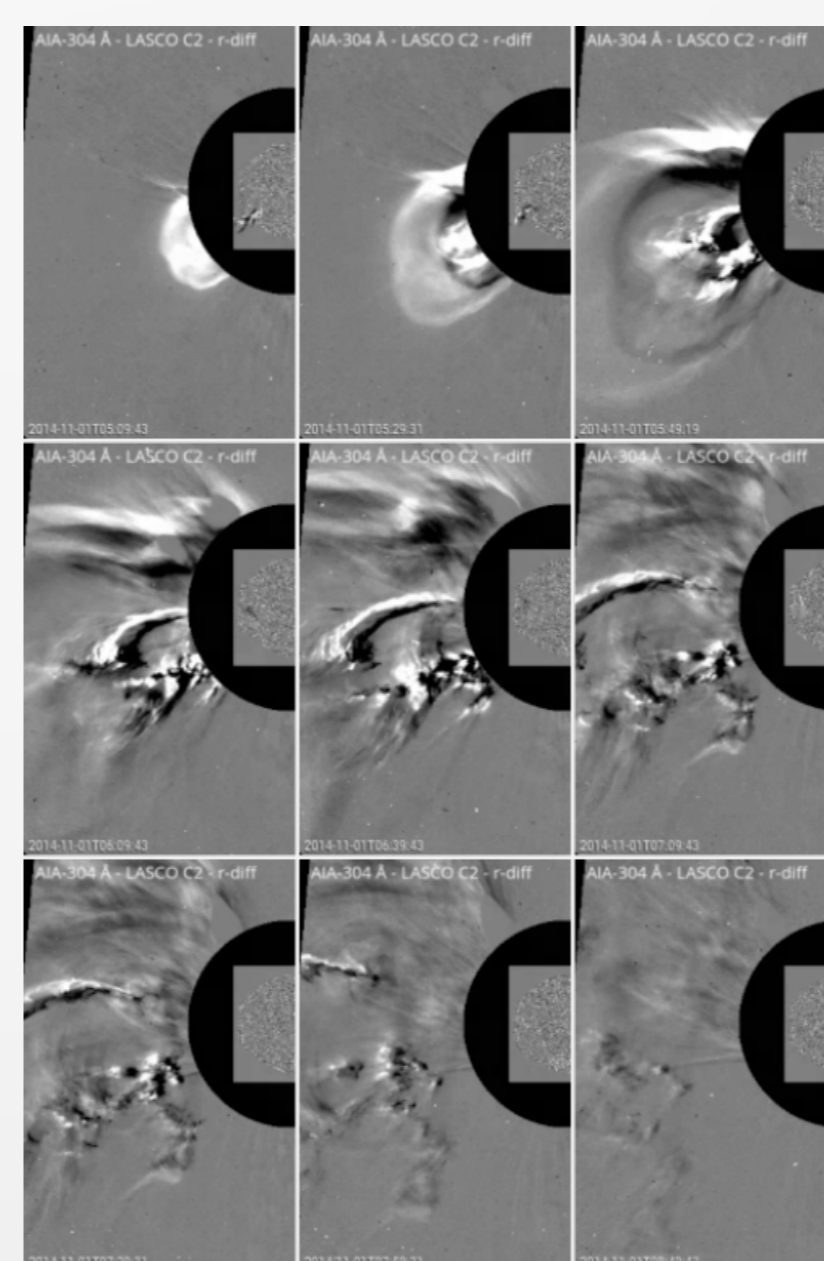
Prominence kinematics:



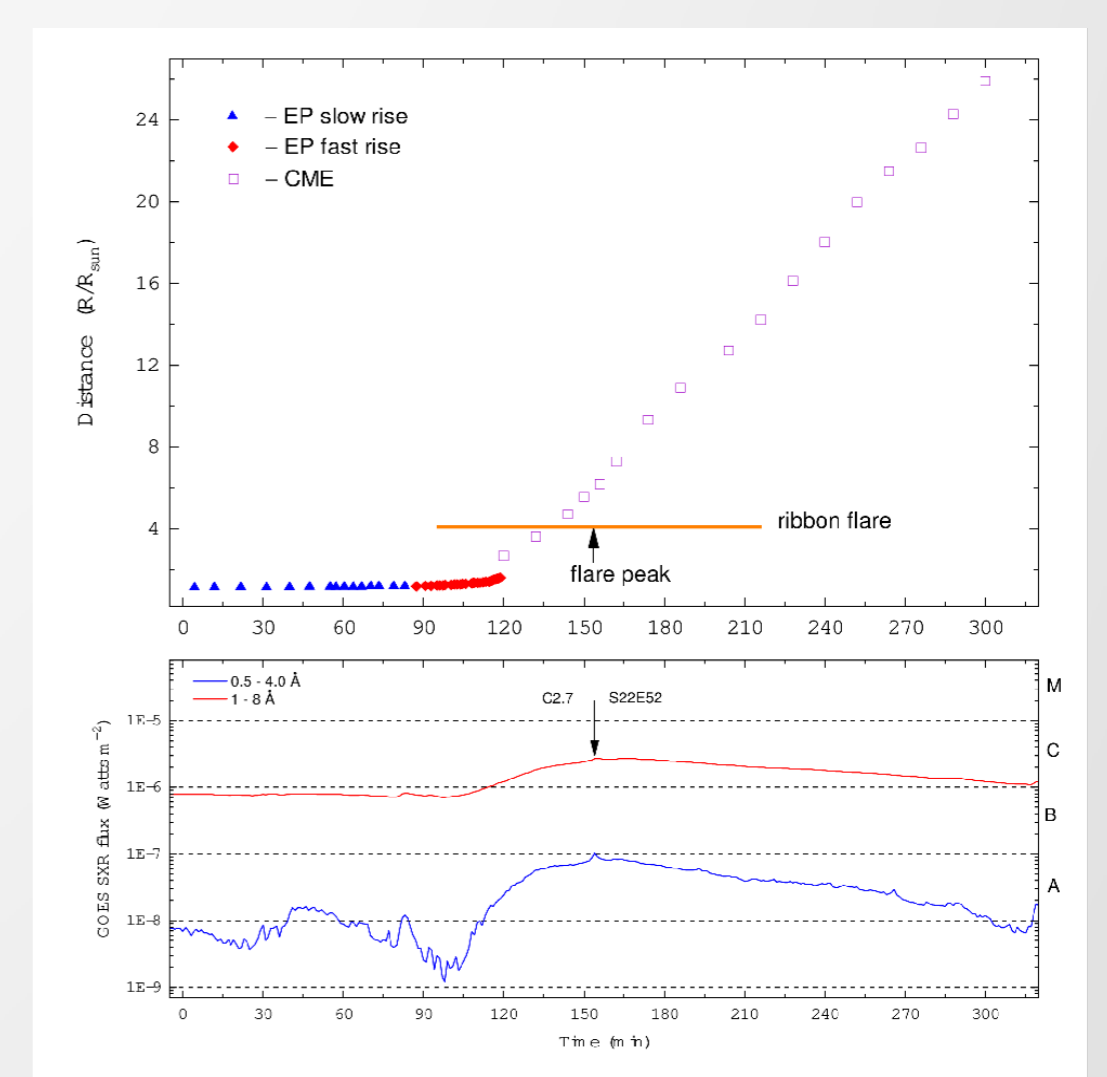
Time-slice diagram, used for height determination (left); height-time of prominence evolution (right-top) and eruption velocities and eruptive phase acceleration (right bottom). The start time is: 2014-Nov-01 03:00UT.

CME:

The prominence eruption was associated with a fast partial halo CME, which first appearance in LASCO/C2 FOV was at about 05:00 UT. CME properties: Position angle: 74° degrees; linear speed: 1624 km/s; acceleration: 7.3 m/s²



CME evolution sample in LASCO C2 field of view.



Height-time evolution of EP and associated CME (top panel) and Goes SXR flux (bottom panel). The start time is 03:00 UT. The time of flare peak is marked with black arrow.

Summary

The whipping-like asymmetric EP on 2014 Nov 01 slowly rose with velocities from 1.2 km/s to ~18 km/s and then it underwent a strong acceleration and rose with velocities from 20 km/s up to 468 km/s in the SDO/AIA field of view.

The two-ribbon flare underneath the EP most probably occurred due to reconnection processes in the coronal magnetic field in the wake of the prominence eruption. The ribbons' separation kinematics clearly shows two stages: first decelerate one with velocities from 35 km/s to several km/s and second very slow one with velocity of 1.4 km/s.

The whipping-like EP later produces a very fast partial-halo CME, which propagates with velocity of 1624 km/s. The CME core formed by the EP can be traced up to 16 solar radii in the SOHO/LASCO C3 field of view.

Acknowledgements: This research is funded by the Bulgarian National Science Fund under grant KP-06-India/14 (19-Dec-2019). K.K. acknowledge the support of Bulgarian Science Fund under grand No KII-06-H44/2 27.11.2020