



Complex Behavior of a Solar Prominence Eruption

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Outlines: We present a study of eruptive prominence (EP) observed on 2014 March 14 on the eastern limb by the SDO/AIA and on the western limb by STEREO A/ SECCHI. The EP source was a filament observed near the western limb in the STEREO B/ SECCHI field-of-view (FOV). The examination of SOHO/LASCO C2 and C3, as well STEREO A and B/COR1 and COR2 images show that the EP was associated with partial halo CME and it accompanied of active region, 6 eruptions and GOES C8 flare. The initial complex structure and behavior of the prominence suggest the magnetic flux rope interactions as a possible trigger for its eruption.



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Observations

The EP on 2014 March 14 was observed above the eastern limb at PA of 103° by SDO/AIA and above the western limb at PA of 258° by STEREO A/ SECCHI. This event was observed in the STEREO B/ SECCHI FOV as filament eruption near the western limb.

The observations were taken with the following instruments:

SDO/AIA 304 Å channel at 12 s cadence, STEREO A/EUVI 304 Å channel at 10 min cadence and STEREO B/EUVI 195 Å channel at 10 min cadence. Large Angle and Spectrometric Coronagraph (LASCO)/C2 ($1.5\text{--}6 R_\odot$) and C3 ($3.7\text{--}30 R_\odot$) onboard SOHO.

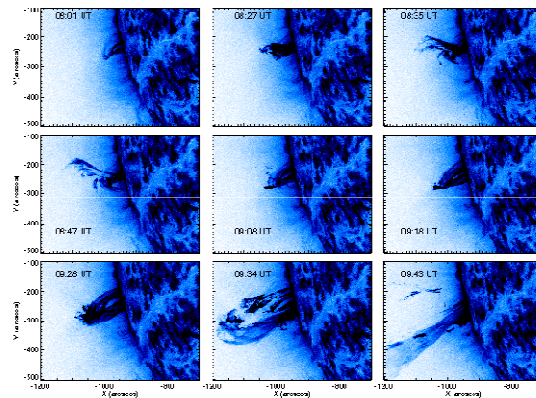


Fig. 1 - The evolution of EP on 2014 March 14 in SDO/AIA 304 Å images.

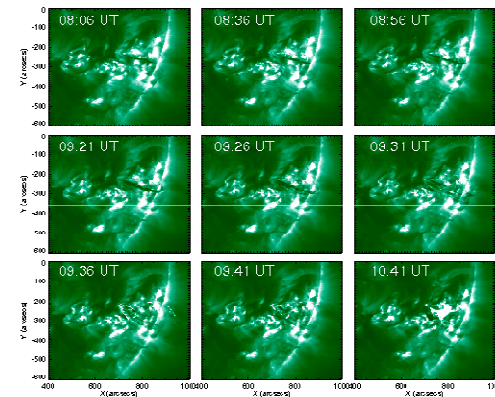


Fig. 2 - The evolution of filament on 2014 March 14 in STEREO B/EUVI 195 Å images.

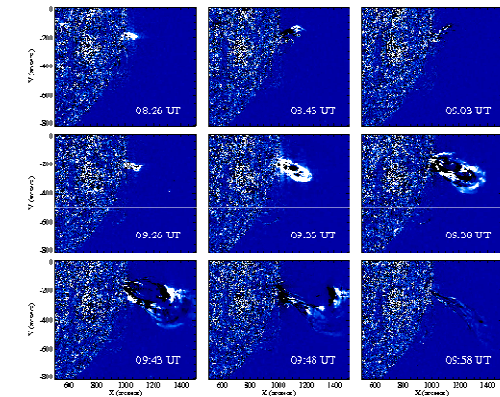


Fig. 3 - The evolution of EP on 2014 March 14 in STEREO A/EUVI 304 Å difference images.



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Kinematics

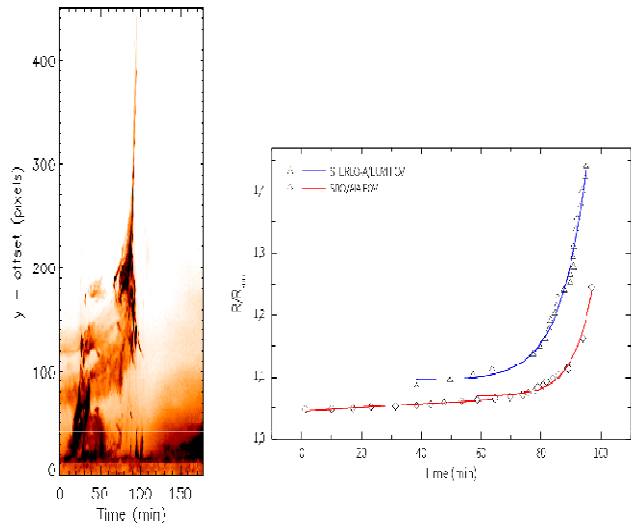


Fig. 4 - Left panel: STEREO A/EUVI 304 Å slice diagram. Right panel: Height-time profiles of the EP obtained by SDO/AIA 304 Å and STEREO A/EUVI 304 Å images.

In the SDO/AIA FOV the EP clearly show two distinctive phases: the slow rising of the prominence (08:00 – 09:02 UT) possibly triggered by the pre-flare activity in the photosphere beneath the filament (Fig. 2 and 5) and eruption (09:02 – 09:34 UT). The EP slowly rose with an average speed of ~3 km/s and then exponentially accelerated with speeds from ~3.5 km/s to ~280 km/s (Fig. 4).

In the STEREO A/ SECCHI FOV, only the end of EP slow raising was observed because the EP position behind the limb. In return, The eruptive phase was observed to bigger altitudes because the bigger EUVI FOV (1.7 R₀ vs 1.3 R₀ of AIA FOV). The EP slowly rose (08:38-09:04 UT) with speeds from 2 km/s to 12 km/s at accelerations from 1 m/s² to 11 m/s². During eruptive phase (09:04-09:35 UT), the speeds increased from 12 km/s to 470 km/s at accelerations from 23 m/s² to 890 m/s² (see Figs. 4).

Table 1. Data of the events associated with the EP on 2014 March 14

Events 2014-03-14	Location		UT	
	about AIA disk center Heli-coordinates		Start	End
Active Region (AR)	-337.51; -356.47	L247C.L14	04:48:00	09:45:12
Filament Eruption (EF)	-1054; -304	L229C.L06	07:33:03	11:48:03
Eruption 1	-1030.8; -255.6	L229C.L03	08:09:52	08:49:52
Eruption 2	-1112.54; -252.28	L229C.L03	08:16:00	08:32:00
Eruption 3	-1127; -278.6	L229C.L05	08:54:40	08:34:40
Eruption 4	-1030.02; -282.97	L228C.L05	08:06:00	08:50:00
Eruption 5	-1130.4; -290.4	L228C.L04	08:10:00	08:50:00
Flare	-660; -268.8	L228C.L05	08:32:46	12:05:58
Eruption 6	-1122; -375.6	L229C.L08	08:35:12	10:15:12
CME		PA 85	10:00:06	18:36:06

The EP accompanied of active region (SOL2014-03-14T09:33), 6 eruptions and GOES C8 flare, which occurred in the beginning of EP acceleration phase.



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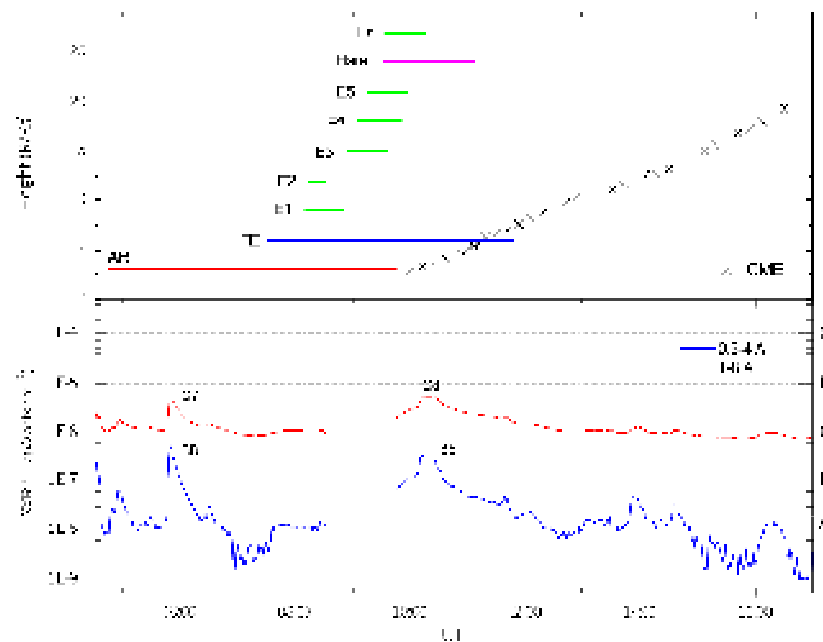


Fig. 6 - Top: Height-time profile of the partial halo CME and the durations of accompanying activity events. Bottom: GOES15 SXR flux in 1–8 Å (red) and 0.5–4 Å (blue) channels.



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Summary:

- The EP show two phases: a slow raise one with an average speed of ~ 3 km/s and exponentially accelerating phase with increasing speeds from ~ 3.5 km/s to ~ 470 km/s.
- The regions beneath the filament observed in SECCHI-B FOV represents a cluster of several ARs (Fig.5 left panel). In fact, on 2014 March 17 a cluster of NOAA ARs 12008, 12010, 12012, 12015, 12019 and 12023 were observed very close to eastern limb in AIA FOV. The light curve in the right panel of Fig. 5 show a local low maximum coinciding with EP slow raising that could be considered as signature of pre-flare activity beneath the filament.
- Another flare (SOL2014-03-14T09:33) occurred at the eastern limb in the beginning of the EP eruptive phase and it was associated with GOES C8 flare (Table 1 and Fig. 5)
- The associated partial halo CME had centroid PA of 85° , width of 192° and speed of 469 m/s². It reached a maximal height of $19.2 R_\odot$. The first appearing of the EP as CME bright core was at 10:08 UT and it reached a maximal height of $4 R_\odot$ at 13.38 UT. After 13:38 the CME bright core gradually faded.

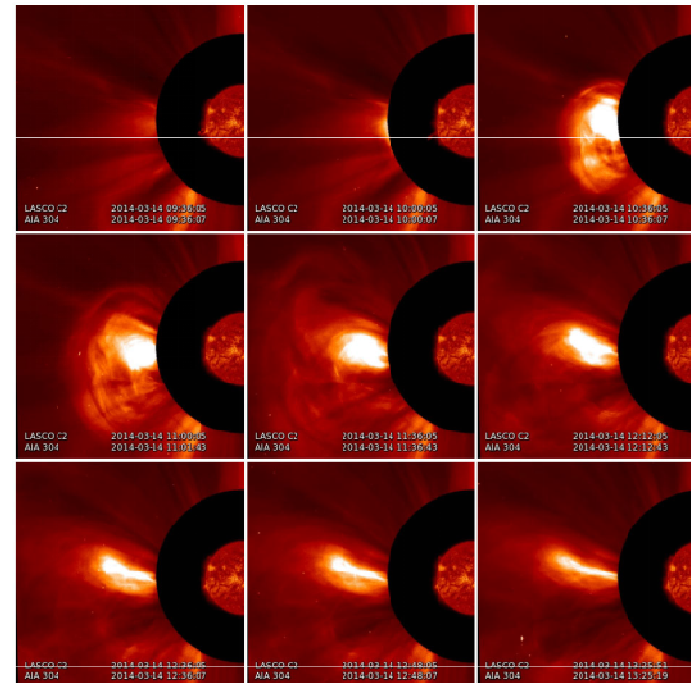


Fig. 7 - Partial halo CME evolution in the SOHO/LASCO C2 images.

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