



Workshop
"Solar Influences on the Magnetosphere, Ionosphere and Atmosphere"
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Multi-instrumental Observations of a Solar Prominence Eruption

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Outline

We analyze the morphology and kinematic evolution of a loop-like prominence eruption, observed on 2010 September 15 at the northwestern solar limb. We use observations from the Atmospheric Imaging Assembly (AIA) onboard the Solar Dynamics Observatory (SDO) taken in 304 Å EUV passband. We also analyze observations from the Extreme Ultraviolet Imager (EUVI) onboard the STEREO A and B spacecraft. Due to the position of the two STEREO observatories at the time of observations we can combine limb and on-disk observations.

The filament's behavior before the eruption is traced in a series of H α images from the Kanzelhöhe Observatory, Austria. Images obtained by the Large Angle and Spectrometric Coronagraph (LASCO)/C2 onboard SoHO are also analyzed in order to investigate the close association between the prominence eruption and a coronal mass ejection.

We examine the changes in the height and the velocity of the prominence during its eruption. The kinematic evolution suggests a full prominence eruption. The precursors of the eruption are discussed.

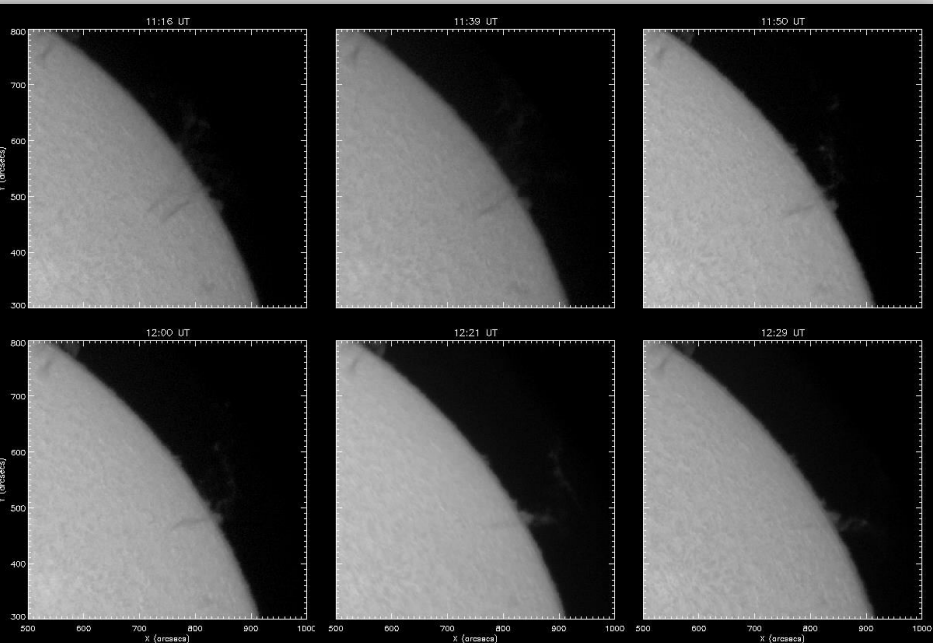
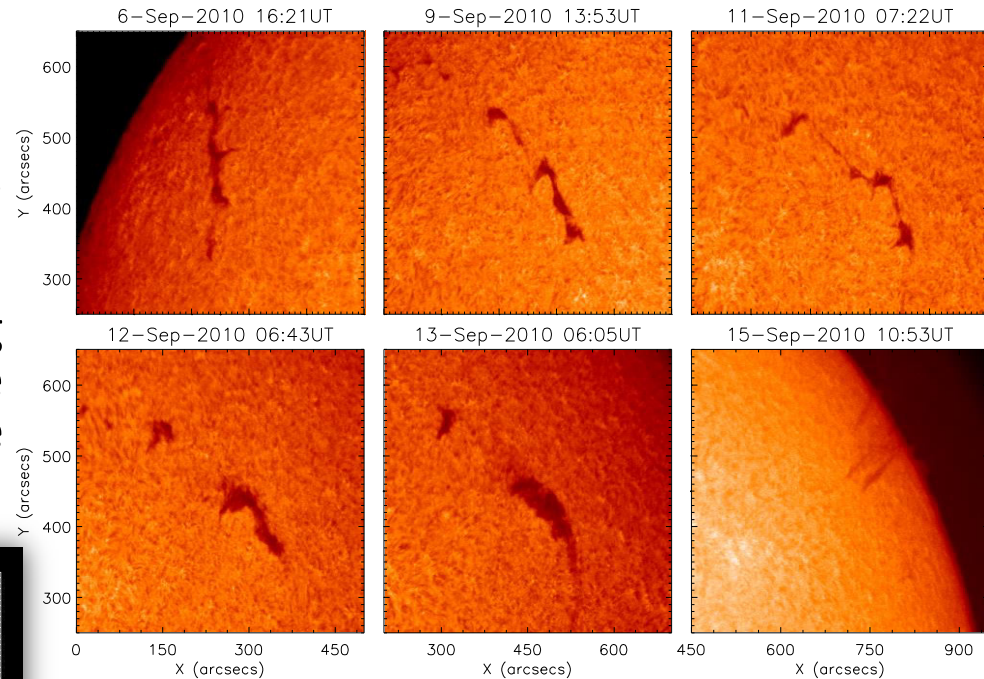
Observations

A prominence eruption occurred above the northwestern solar limb between 7:12 UT and 12:52 UT on 2010 September 15. The EP appeared on heliographic latitude $\approx 35^\circ$ N at mean PA 305° as a large rising loop structure with feet, rooted in the solar chromosphere during the entire eruptive process.

We analyzed images obtained in the He II 304 Å channel of *AIA/SDO* taken with an average cadence of about 1 min. Data from the two *STEREO A and B* spacecraft was also used. The separation angle of 157° between them allowed us to observe the eruption both above the limb and on-disk. The H α images (6563 Å) from the ground-based H α -telescope, *Kanzelhöhe Observatory, Austria* were also inspected in order to study the precursors of the eruptive process. To search for a possible association of the eruptive prominence with coronal mass ejections, the *LASCO/SoHO C2* coronagraph (covering the distance range of 1.5 to 6 solar radii) data was also used.

Precursors in H α

The quiescent filament first appeared in the H α images on 2010 September 4. The changes in the shape and size, such as a *darkening*, a *thickness increase* and an *apparent breaking* occurred during its on-disk passage. All these can be considered as precursors of the upcoming eruption.

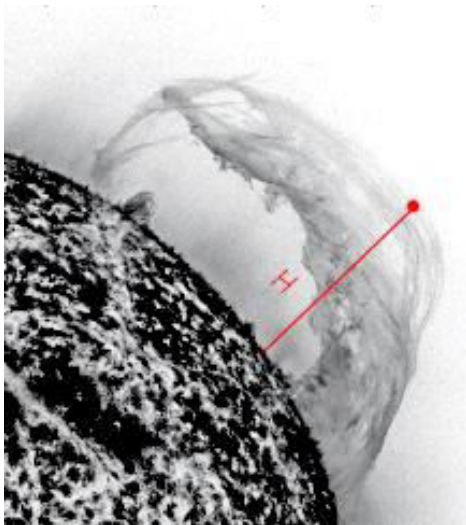


The filament evolution prior to the eruption, traced from H α -telescope, Kanzelhöhe Observatory, Austria.

The eruption seen in H α .

Kinematics

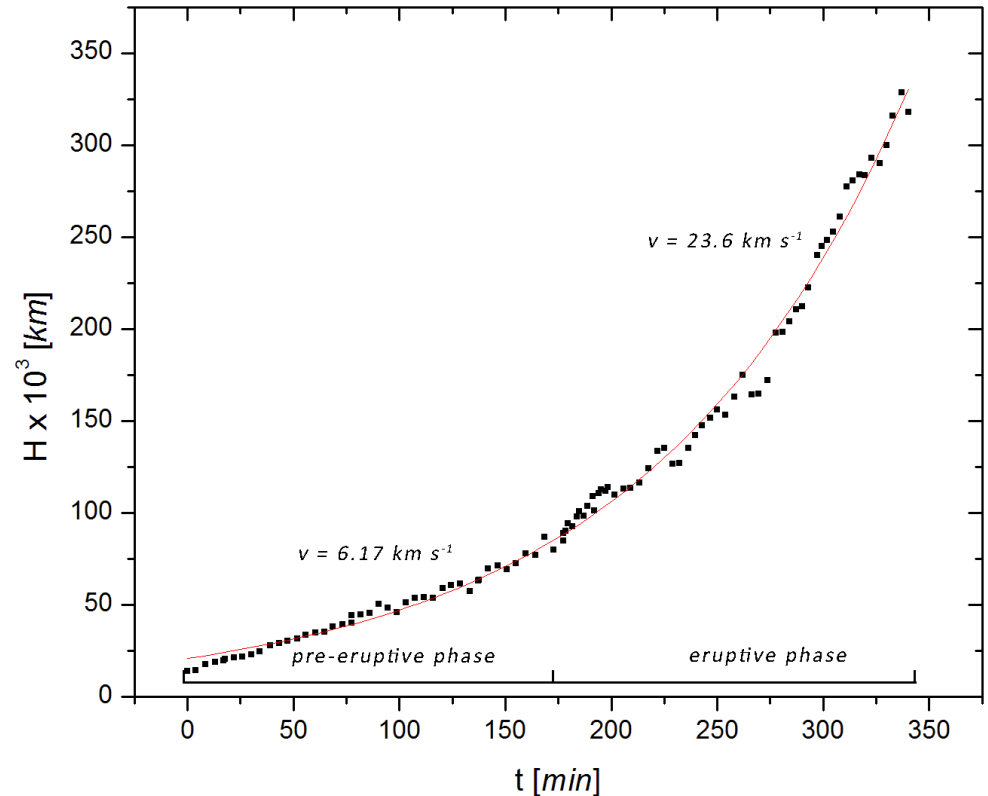
The height of the prominence above the limb was determined from AIA (He II 304 Å) images, as the height of the loop summit. The observed eruption is relatively slow as the height of the EP changes from 14×10^3 km to 318×10^3 km for about 5.5 hours of observations.



Edge detection processed AIA 304 Å image at 12:42 UT. The point, used to measure the height of the EP is shown.

Kinematics

The height-time profile of the eruptive process shows 2 phases: *pre-eruptive*, when the prominence slowly rises, and *eruptive*, during which the prominence material slightly accelerates.

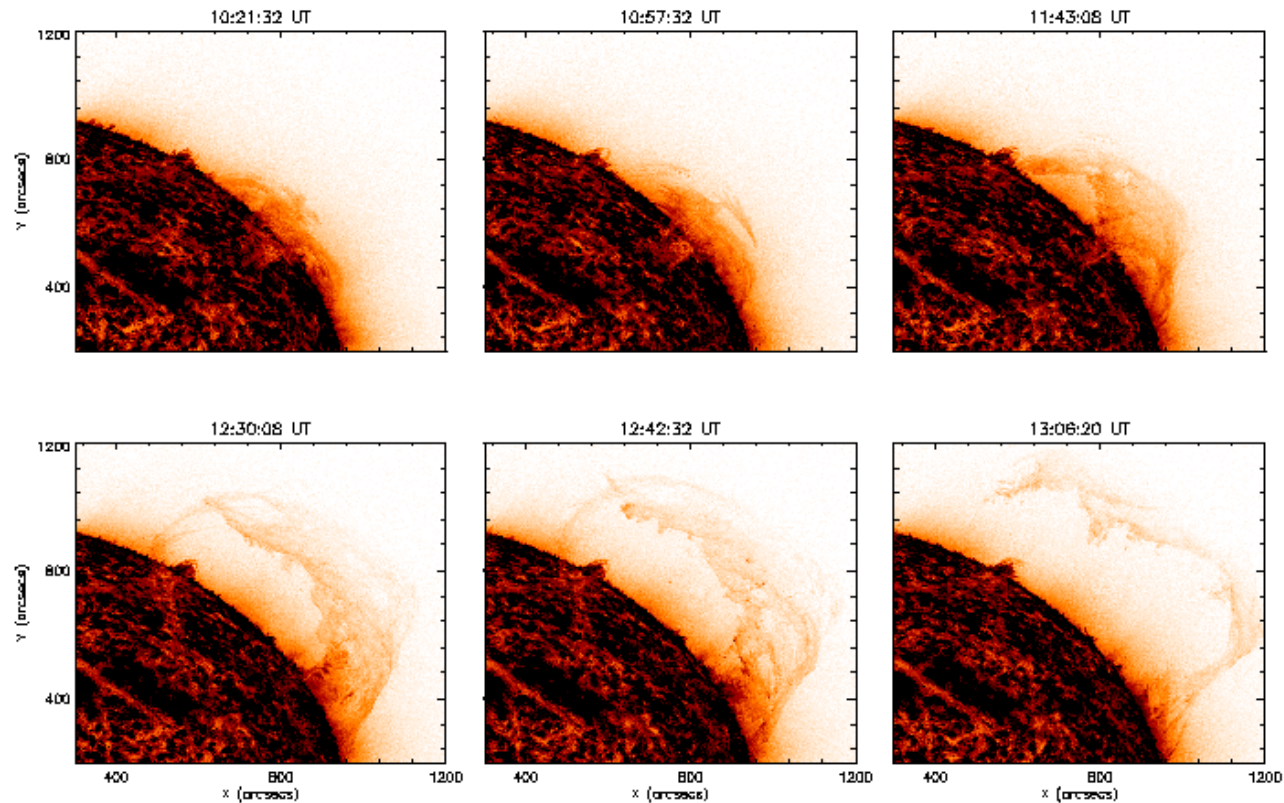


Phase	UT	T [min]	H [Mm]	V [km s ⁻¹]	a [m s ⁻²]
pre-eruptive	7:12 – 10:05	173	14 - 80	2.84-11.52	0.38-1.55
eruptive	10:05 – 12:52	167	80 - 318	11.93-44.60	1.61-6.02

Morphology from different POV

Before the eruption, the EP could be observed as a dense object above the solar limb. The fine structure couldn't be resolved. Later it evolved to a rising loop with legs, anchored in the chromosphere.

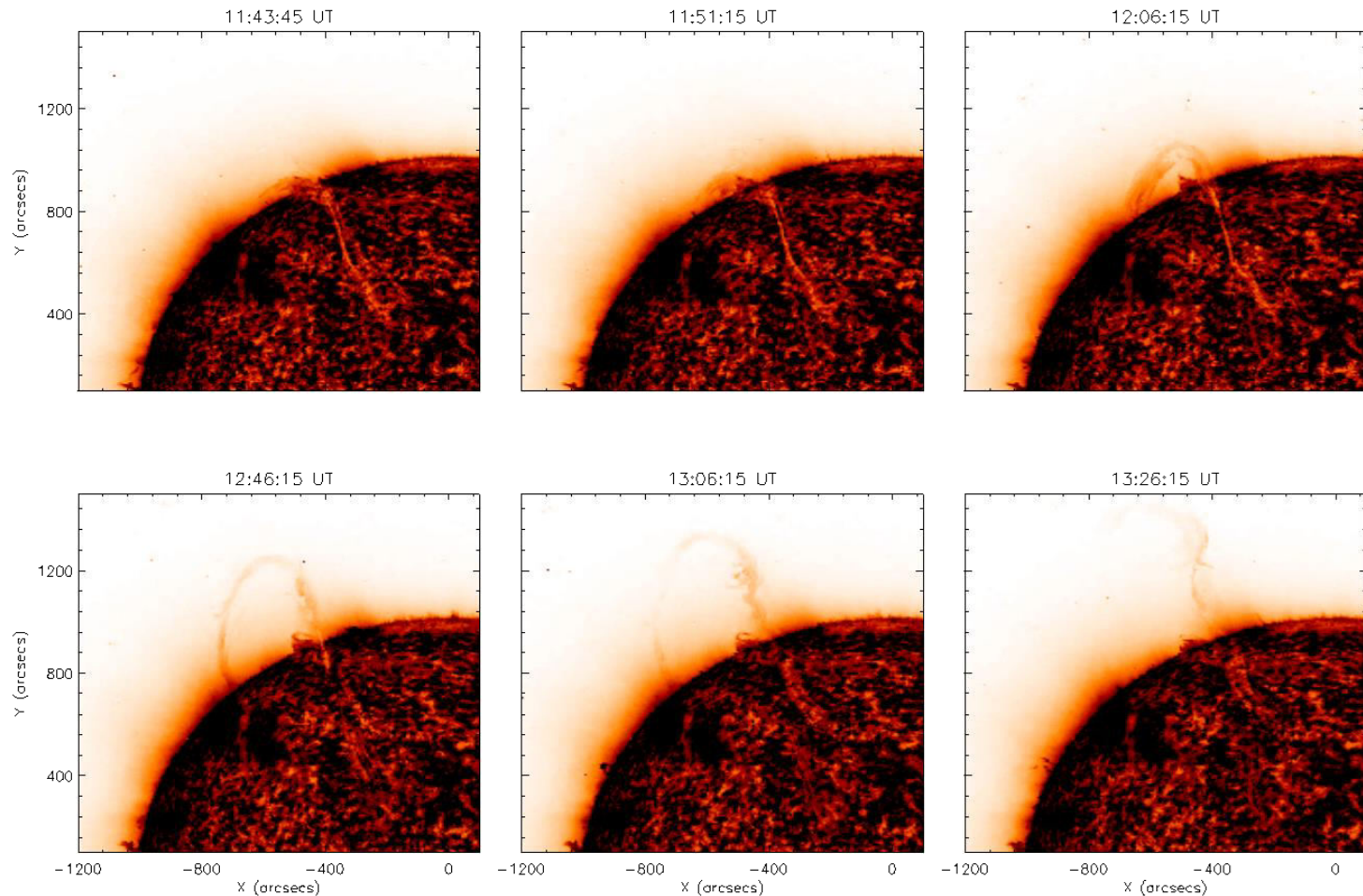
The main prominence body represents helically twisted arch. At the end of the observed eruption the prominence faded and disappeared from the AIA FOV.



Color inverted images, showing morphological evolution of the EP (AIA, 304 Å).

Morphology from different POV

The prominence seen from the STEREO A point of view appears as an erupting filament on the solar disk.



Reversed color table images registered by EUVI/STEREO A in the 304 Å channel.

Morphology from different POV

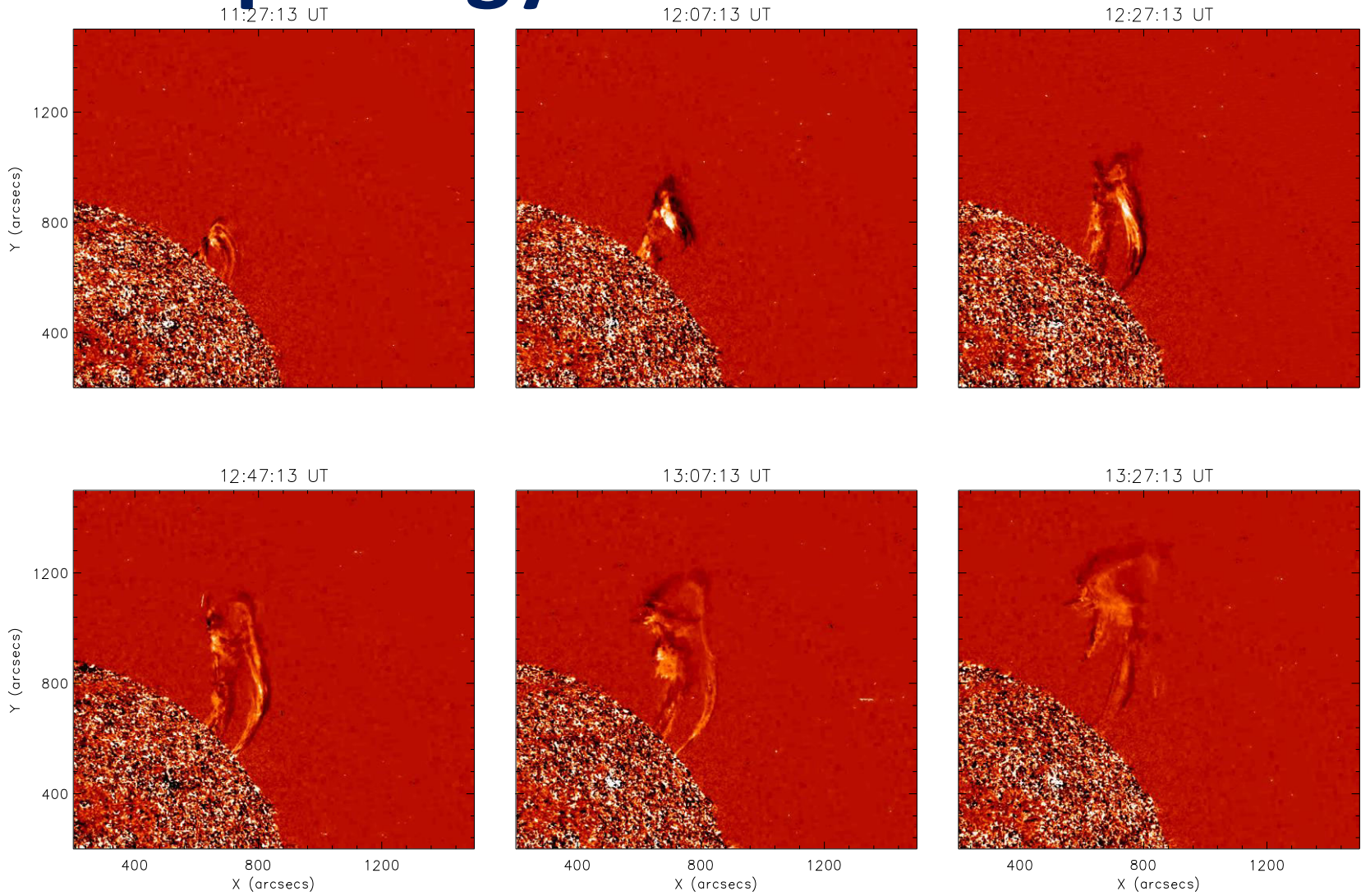
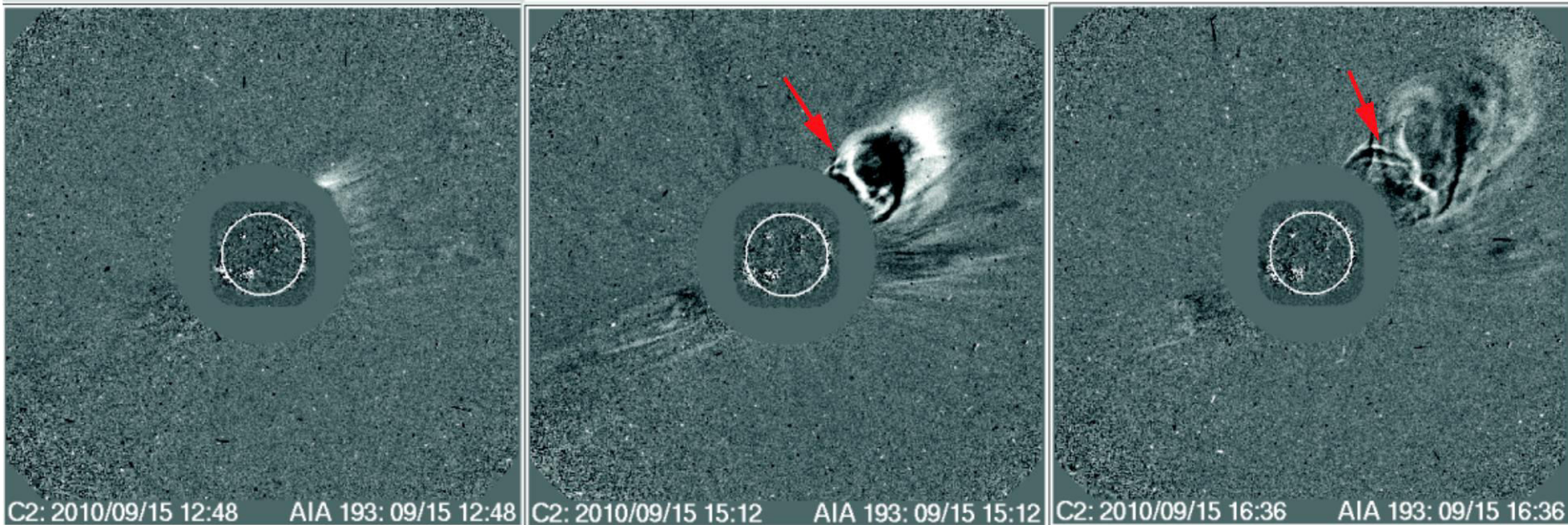


Image differences, taken in 304 Å by EUVI/STEREO B.

The different point of view of STEREO B spacecraft allows us to observe
writhe twisting after 12:30 UT.

Related activity

LASCO C2 images registered between 12:48 UT and 16:36 UT on 2010 Sept 15. The CME was first observed in the C2 FOV at 12:48 UT with a central PA of 309° . The coronagraph images show the prominence material at the CME base (marked with an arrow). We roughly estimated the height of the prominence to around 4 solar radii.



Results and Conclusions

- Three days before the eruption the first precursors were observed as changes in the shape and size of the filament.
- The height-time profile of the EP determined by the AIA data reveals two phases: a pre-eruptive phase of slow rising and an eruptive phase when the prominence accelerates until it becomes invisible in the AIA FOV.
- The prominence was associated with a CME observed by LASCO C2 and C3 coronagraphs. The prominence material appears as a loop-like structure in the CME cavity. This is an evidence for the full eruption of the prominence.