Three-dimensional Reconstruction of Eruptive Prominences

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Abstract

On 2009 September 26, a dramatic and large filament (LF) eruption and a small filament (SF) eruption were
observed in the He ii 304Å line by the two EUVI telescopes aboard the STEREO A and B spacecraft. The LF
heads out into space and becomes the bright core of a gradual coronal mass ejection (CME), while the eruption
of the SF is characterized by motions of the filament materials. Using stereoscopic analysis of EUVI data, we
reconstruct the three-dimensional shape and evolution of two eruptive filaments. For the first time, we investigate
the true velocities and accelerations of 12 points along the axis of the LF, and find that the velocity and acceleration
vary with the measured location. The highest points among the 12 points are the fastest in the first half hour, and
then the points at the low-latitude leg of the LF become the fastest. For the SF, it is an asymmetric whip-like
filament eruption, and the downward motions of the material lead to the disappearance of the former high-latitude
endpoint and the formation of a new low-latitude endpoint. Based on the temporal evolution of the two filaments,
we infer that the two filaments lie in the same filament channel. By combining the EUVI, COR1, and COR2 data
of STEREO A together, we find that there is no impulsive or fast acceleration in this event. It displays a weak
and persistent acceleration for more than 17 hr. The average velocity and acceleration of the LF are 101.8 km s–1
and 2.9 m s–2, respectively. The filament eruptions are associated with a slow CME with an average velocity of
177.4 km s–1. The velocity of the CME is nearly 1.6 times as large as that of the filament material. This event is
one example of a gradual filament eruption associated with a gradual CME. In addition, the moving direction of
the LF changes from a non-radial to a nearly radial direction with a variation of inclination angle of nearly 38.2 degree.

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