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Filament Eruption and Associated Partial Halo CME on 2001 September 17

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Abstract. We report the eruption of a small H_α filament and associated partial halo coronal mass ejection (CME) occurring in NOAA AR 9616. Accompanied by a M1.5 flare, the filament quickly erupted, a remote coronal dimming region far away from the eruption site was formed above quiet-sun area, and then a long H_α surge developed from the flare site. During the eruption, remote H_α and EUV brightenings appeared near the dimming, along the dimming boundary in EUV and in its interior in H_α, leaving behind EUV loops connecting the eruption source region and the remote EUV brightenings. Finnally, as a definite indication of the CME, a huge dark loop appeared to span the eruption region. These observations indicate that a much larger-scale rearrangement of the corona magnetic fields, eventually represented by the CME, was involved in the eruption of the small filament.

Keywords. Sun: activity, coronal mass ejections (CMEs), filaments, flares

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On 2001 September 17, a partial Halo CME was observed by SOHO/LASCO. Using H_α data from Yunnan Astronomical Observatory (YNAO), EUV and white-light coronagraph data from SOHO/EIT and SOHO/LASCO, we will show that a filament eruption occurring in NOAA AR 9616 (S14E04) was closely associated with the CME.

In H_α observations (Figure 1(*a1-a4*)), a small filament around the preceding end of AR 9616, 'F', started to erupt violently at about 08:11 UT, followed by an X-ray class M1.5 flare with start, peak and end times at 08:18, 08:25 and 08:34 UT, respectively. Then a long surge appeared near the eruption F after the flare maximum. The flare consisted of three ribbons, 'R', 'Rb' and 'Rc'. The Rb showed spreading motion towards the south, and the Rc was a remote brightening containing a few less bright points. The Rb and Rc were located over quiet-sun regions with opposite magnetic polarities (Figure 1(*b*)). In EIT 195 Å observations (Figure 1(*c1-c4*)), a dimming , 'D', and a brightening, 'EB', appeared around the Rc site (see their 195Å light curves in Figure 2(*a*)). The Rc was inside the D, while the EB, along its northern boundary. Then EUV loops were formed to connect the EB and Rb. Similar to the situation in a halo event reported by Wang, *et al.* (2002), it seems that the R consisted of two unresolved flare ribbons resulted from the F eruption, while the Rb, EB and EUV loops were the product of the reconnection between the erupting F and outlying coronal loops. The dimming may be due to chromosphere evaporation involved near the footpoint of the remote flare ribbon.

A partial halo CME with a width of 166^o was first seen in LASCO C2 images at 08:54 UT. The 195 Å difference images reveal that an expanding semicircular dark loop trailed the CME front. Figure 1(*d*) shows that its angular extent (see the white arrow) is approximately comparable with that of the CME front. Therefore, we believe that it is the definite indication of the CME start as a result of the F eruption. The CME front heights measured by Seiji Yashiro is shown in Figure 2(*b*), and the average velocity and acceleration from the first and second-order polynomial fits are 1010 km s^{-1} and -14.5 m s^{-2}. It is difficult to determine the true onset time of the flare-associated CME (Zhang

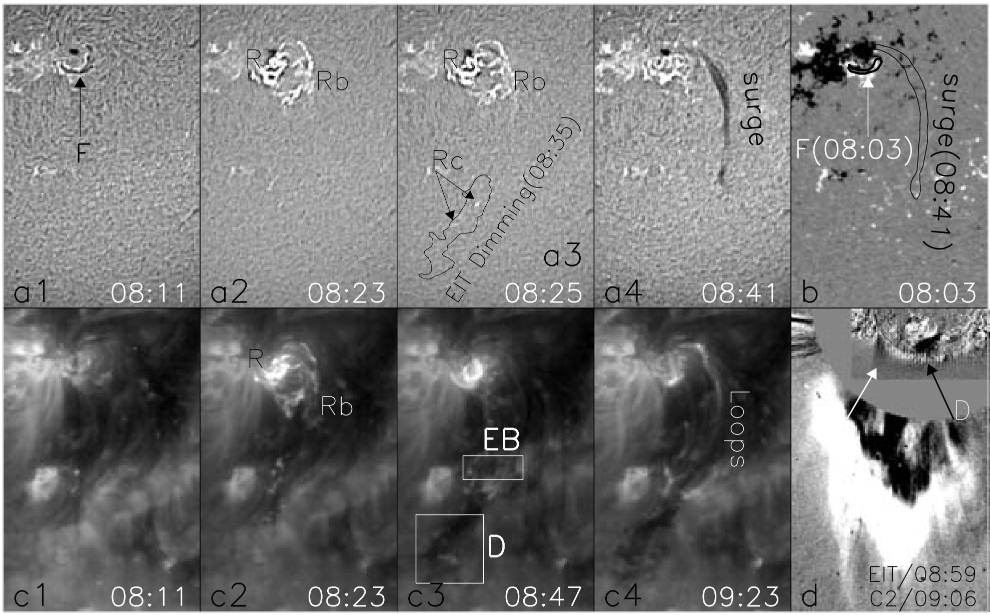

Figure 1. YNAO H_α images (a1-a4), MDI magnetogram (b), direct EIT 195 Å images (c1-c4) and a composite image of inner 195 Å with outer LASCO C2 difference images (d).

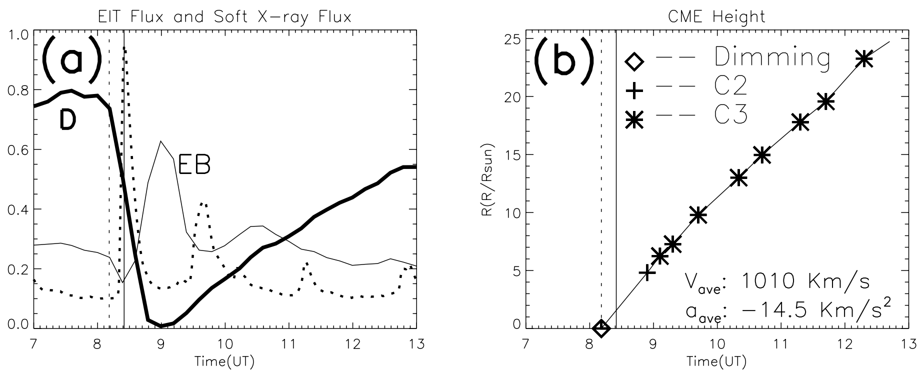

Figure 2. (a) GOES-8 soft X-ray flux (dashed line) and 195 Å light curves in the boxes (in panel c3 of Figure 1) centered on the EB and the D. (b) The CME front heights. The vertical dashed and solid bars indicate the dimming onset time and the flare maximum time.

et al., 2001), so we can only use the dimming process to infer the CME onset time since the coronal dimmings may be caused by the expansion of the coronal magnetic structure involved in the eruption. Figure 2(a) indicates that the dimming onset time was around 08:11 UT, so the CME was very likely to start to erupt at the same time.

Acknowledgements

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