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Two distinct peculiar "dimming channels" observed by SDO/AIA

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Abstract. In this work, we report two distinct peculiar "dimming channels" observed in all the seven EUV wavelengths around AR 11520 by SDO/AIA on July 12, 2012. Our results show that: (1) the two dimming channels are very narrow and the intensity in them dropped fierce; (2) specially, some flare ribbons appeared at the edge and prior to the appearance of dimming channels, which is a rare phenomenon; (3) the dimming channels seem to be located at the boundaries of some magnetic networks (or supergranules).

Keywords. Sun: Dimming, Sun: Flare, Sun: Filament, Sun: Solar Eruption, Sun: CME

1. Introduction

Coronal dimming sometimes referred to as transient coronal holes are common phenomena associated with coronal mass ejections (CMEs). They are usually observed as decrease in intensity in soft X-rays (e.g., Sterling and Hudson, 1997) and extreme ultra-violet (EUV) data (e.g., Thompson *et al.*, 1998). However, dimmings are infrequent in the chromosphere (e.g., Neidig *et al.*, 1997 and Jiang *et al.*, 2003). In this paper, we report two well-confined dimmings observed from chromosphere to corona.

2. Observations and Results

On July 12, 2012, a solar eruption occurred in the active region AR 11520, which was associated with an X1.4 class flare, a partial halo CME and an EUV wave. Unusually, two distinct narrow dimming channels, marked by "Dim1" and "Dim2" in the panels c through e in Figure 1, are observed during this eruption. The "dimming channels" appeared in seven EUV wavelengths simultaneously for several hours. They came into forth gradually from the center of the solar eruption to the surrounding area. Specially, the dimming channels are embraced by bright flare ribbons at the beginning of the dimming channels appeared, which is distinctly different from the traditional dimmings.

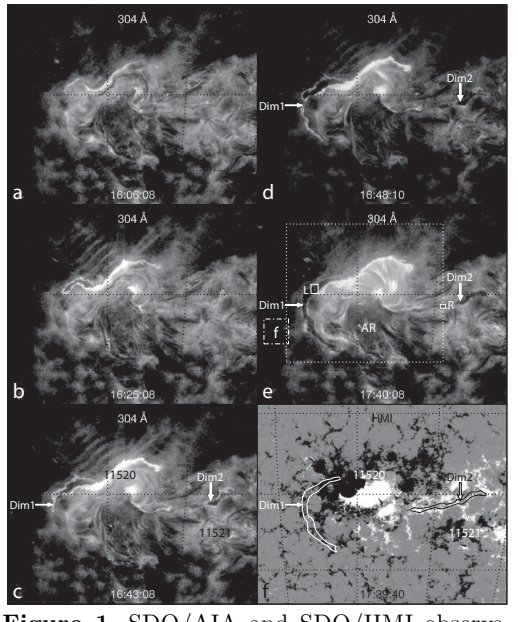

Figure 1. SDO/AIA and SDO/HMI observation showing the formation process of the two dimming channels and the surrounding magnetic field. The four boxes marked with "L", "R", "f" and "AR" indicate the areas which we chose to measure the variation in intensity.

The panel f of Figure 1 is SDO/HMI image, the white and black contours indicate the position of Dim1 and Dim2, respectively. It shows that Dim1 is located in the negative magnetic field, while Dim2 is in the positive one. Furthermore, the panel f also indicates that the dimming channels are located at the boundaries of some magnetic networks (or supergranules).

In Figure 2 are plotted intensity profiles in different EUV wavelengths in the given areas indicated by the boxes in the panel e of Figure 1. In the rising phase of the X1.4 flare, the intensities of the active region at all the seven wavelengths are increasing, especially at 94Å and 131Å , which increase suddenly like GOES flux. In the surrounding reference area, the intensity at 94Å, 131Å and 171Å showed increase while at other wavelengths decrease. The intensity in the Dim1 increased first and then decrease except in 335Å, which decrease monotonously. The intensity at 193Å, 211Å and 335Å dropped more deep, which can be dropped upto 80% of its value, than at the other wavelengths. The intensity in Dim2 displayed a distinct drop at 171Å, 193Å and 211Å as compared to other wavelengths.

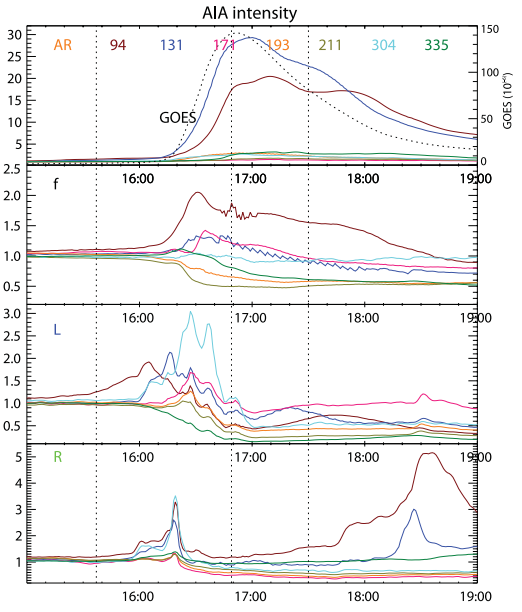

Figure 2. The time intensity profile of the dimming areas as well as with the active region and reference area at different EUV wavelengths. The dotted line in the top panel indicates GOES 1-8 Å flux and the three vertical lines represent start, peak and end time of the corresponding flare.

3. Summary

In this paper, we report two dimming channels associated with a coronal sigmoid structure eruption. Our results show that: (1) the dimming channels appeared in all the seven EUV wavelengths observed by AIA, which supports that the idea that the dimming channel are density depletion (e.g., Hudson *et al.*,1996); (2) the appearance of the dimming channels at 304Å and the appearance of flare ribbons might imply the solar eruption is strong enough to disturb or change the magnetic field in the low corona and chromosphere; (3) the borders of the dimming channels coincide with the boundaries of some magnetic networks, where the magnetic field is stronger than the surrounding areas; (4) the gradual formation of the dimming channels and flare ribbons might be due to a slipping magnetic reconnection. A detailed study is needed to establish/confirm this.

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References

Jiang, Y., Ji, H., Wang, H., & Chen, H. 2003, *ApJ*, 597, L161
Hudson, H. S., Acton, L. W., & Freeland, S. L. 1996, *ApJ*, 470, 629
Neidig, D. F., *et al.* 1997, *Sol. Phys.*, 170, 321
Sterling, A. C. & Hudson, H. S. 1997, *ApJ*, 491, L55
Thompson, B. J., Plunkett, S. P., Gurman, J. B., *et al.* 1998, *Geophys. Res. Lett.*, 25, 2465

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