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Evolution of a Group of Coronal Holes Associated with Eruption of Nearby Prominences and CMEs

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Abstract. We present the results of detailed study of a set of activities developed on one of three enclosed sectors of solar region during the period of February 07–13, 2012. We found the sequence of certain topological perturbations of whole coronal holes (CHs) and their surroundings associated to the eruption of nearby prominence and subsequent Coronal Mass Ejections (CMEs). Especially, we observe the emergence of small bright points (BPs) and the formation of dimming regions (DRs) close to the filament's channel associated with a pre–evolution of filament/prominence eruption, whereas BPs disappearance and the shrinkage of CH we found associated with the post-eruption evolution of prominence and of CME.

Keywords. coronal hole, prominence, magnetic field, CME.

1. Description of Event

This study is based on multispectral analyze of images provided by Observatory of Paris–Meudon, GONG, WSO, STEREO and SDO linked to a set of activities observed during Feb. 07–13, 2012. This set of activities involves: a) the evolution of group of CHs, b) two active regions, c) the disappearance of filaments, located $< 20°$ distance from the boundary of CHs, d) pre-/post-evolution of associated CMEs (Figure 2,3). We analyzed this set considering its development along three sectors (Figure 2) as well as a system of inter–correlated activities, but in present study we concentrate only on the sector 1 (S1).

2. Discussion and Preliminary Results

The starting processes of F1 and F2 eruptions are associated with the formation of BPs, and DR1 and DR2 (respectively) close to the filament's channels (Figure 2). After ∼2 h from the start-time of F2 eruption first CME1 and after additional ∼2 h the second CME2 formed (both CMEs related with only F2 eruption). Additionally, the disappearance of BPs, DR1 and DR2 correspond to the post–eruption evolution of F1 and F2. BPs formation/disappearance is related with the interchange reconnection (Fisk (2005)) near to CH1 boundaries, topological changes of CH1 and reorganization of magnetic field, contributing in this way to it destabilization and eruption (Taliashvili *et al.* (2009), Gutiérrez *et al.* (2013)). Post–eruption evolution of F1 and post–CME2 are also related with the topological changes and shrink of CH1. However, in case of F1 eruption there is no subsequent formation of CME, probably due to the few material that constitutes F1 body and its maximum height attained (Gopalswamy *et al.* (2006)). Therefore, the CME1 formation is a direct consequence of F2 eruption, while CME2 is related with

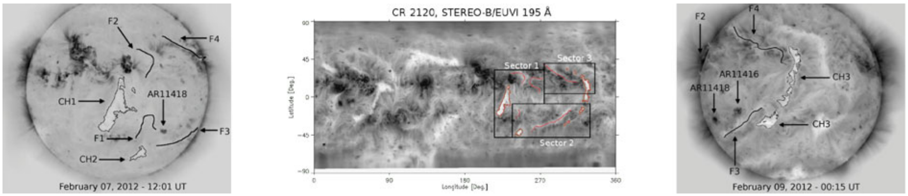

Figure 1. STEREO-B/EUVI-195Å (left) and SDO/AIA-193Å (right) images. STEREO /EUVI-195Å map with three sectors (central). The activities are indicated by arrows. CH boundaries are enhanced, filaments are hand-drawn and the colors are inverted for clarity.

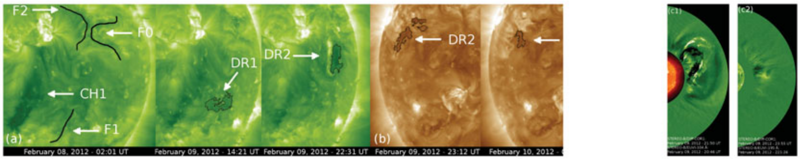

Figure 2. (a)STEREO-B/EUVI-195Å and (b)SDO/AIA-193Å images sequence (Feb. 08-13); filaments (hand–drawn). (c) Compositions of STEREO images: (c1)CME1 (COR1 diff/EUVI-304Å), (c2)CME2 (COR1diff/EUVI-195Å). We enhanced the DRs boundaries.

the evacuated material of F2 (that appears after F2 eruption) and with DR2 formation, which decreases and finally disappears after CME2.

Three activity sectors are inter-related in time, space and magnetically. The whole region that encloses these sectors is negative and delimited mainly by filaments. The possibility of magnetic reconnection between the field lines associated with BPs and the magnetic field lines close to CH1 boundaries, triggers the reconfiguration of magnetic field around CH1 (and CH1 topological changes too), including the foot points of filaments ($< 20°$), contributing in this way to their perturbation, eruption and subsequent formation of CME. DRs that formed after the onset of eruption of filaments disappear and CH adjacent to the filament shrinks after eruption of filaments and formation of CME. The association between DR and CME could be related with this magnetic reconfiguration (Jiang *et al.* (2011)) with BPs as indicators of this reconfiguration. In this study we gave the results regarding of primary evolution of the large region, starting mainly from S1. Based on WSO magnetograms we conclude that a small-scale magnetic reconfiguration associated with the set of activities starts also mainly from S1. This conduces to the large–scale magnetic reconfiguration through magnetic diffusion after filaments eruption, which converts the whole region in magnetically disintegrated sectors, persisted over the next CR 2121. Continuous magnetic observations are important to conclude regarding the magnetic evolution of CHs and filaments that conduces the formation of CMEs.

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References

Fisk, L. A. *ApJ* 626, 563, 2005.

Gopalswamy, N., Mikić, Z., Maia, D., Alexander, D., Cremades, H., Kaufmann, P. Tripathi, D., Wang, Y.-M. *Space Science Rev.* 123, 303, 2006.

Gutiérrez, H., Taliashvili, L., Mouradian, Z. *Ad. Space Res.* 51 , 1824, 2013.

Jiang, Y., Yang, J., Hong, J., Bi, Y. and Zheng, R. *ApJ* 738, 179, 2011.

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