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Investigation of filament eruptions and related coronal disturbances associated with solar flares using data of CHAIN

Investigation of filament eruptions and related coronal disturbances associated with solar flares using data of CHAIN

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Coronal mass ejection (CME) is one of very important sources of disturbances in geospace. The knowledge of structures, velocities and their evolutions of CMEs are crucial for understanding variations of space weather.

On the other hand, coronal disturbances associated with solar flares, such as H-alpha Moreton waves, X-ray waves, EIT/EUV waves, have been discussed in relation to MHD fast mode waves or shocks in the corona. Therefore, it is also very important for space weather researches.

To solve the mechanism of occurrences of CMEs and coronal disturbances, full disk observations with high temporal resolutions in multi-wavelengths are required.

For the purpose of forming the international ground-based solar observation network and enhancing space weather researches, we are promoting "Continuous H-Alpha Imaging Network (CHAIN)" project that is led by Kwasan and Hida Observatories, Kyoto University.

Under the international collaboration of the CHAIN project, the Flare Monitoring Telescope (FMT) was relocated from Hida Observatory to Ica University in Peru.

We selected two typical filament eruptions associated with solar flares that occurred on 2011 March 8 at the active region NOAA11165 and on 2011 February 16 at NOAA11158. The H-alpha full disk images of the flares were taken by the FMT at Ica, Peru.

As for the first event, we obtained 3-D velocity field of erupting filament on the solar limb. According to images obtained with the SoHO/LASCO, a few hours after the flare occurred, a clear CME also appeared.

The time-evolution of the velocity of the filament shows a large change of the direction of the eruption. Just after the change, coronal loops that can be seen in images obtained with the Atmospheric Imaging Assembly (AIA) on board the Solar Dynamic Observatory (SDO) also begin to expand to higher atmosphere.

For the second event, we obtained 3-D velocity field of erupting filament on the solar disk and its time-evolution. Though the Moreton wave was not detected in H-alpha images, we identified oscillations/activations of H-alpha filaments (winking filaments) at distant locations. In the extreme ultraviolet data taken by the SDO/AIA, we could indeed see coronal waves clearly as well as the filament eruption.

In this paper we present the results of the detailed examination of the filament eruptions, expanding coronal loops, winking filaments and the coronal waves.

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