Photospheric responses during the high-energy flares

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Abstract

Solar magnetic field interaction with plasma controls the most dynamical processes and topological changes in various coronal structures. Even small variations in dense photospheric plasma and/or magnetic field may lead to the most catastrophic eruptions, such as solar flares and CMEs. Moreover, plasma and magnetic field interaction has its important effect on the photosphere itself. The good example of it is the White light flare. White light flares are rare phenomena. They were believed to occur only with high energy flares. But recent high-resolution detectors revealed that they are characteristic for all flares. It is crucial to study WLFs to understand the physical and morphological changes of the solar photosphere.

We studied the evolution of the well-developed sunspot of NOAA Active Region 11429. The active region hosted two X 5.4 and X 1.3 flares on March 7, 2012. They occurred in one hour interval with starting times 00:02 and 01:05 respectively. The first flare lasted 40 minutes and the second - 17 minutes. We studied flare related white light emission, calculated the movement of WLFs, and suggested the model which may explain the movement of the WL emission. Time-Distance diagram of HMI continuum shows that an average speed of WLFs in continuum is 12-18 km/s. The flaring region was observed by STEREO A as well. The average upward velocity of the flaring loops detected by STEREO A is 14 km/s. This speed can be correlated to the footpoint propagation speed.

The movement of the WLFs can be explained withing standard flaring model; the observed WL motion in the photosphere is the effect and the consequence of both the particle propagation along the magnetic field lines and the upward motion of the X-point.