[박SE-07] STUDY OF MAGNETIC HELICITY IN SOLAR ACTIVE REGIONS AND ITS RELATIONSHIP WITH SOLAR ERUPTIONS

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It is generally believed that eruptive phenomena in the solar atmosphere such as solar flares and coronal mass ejections (CMEs) occur in the solar active regions with complex magnetic structures. Magnetic helicity has been recognized as a useful parameter to measure the complexity such as twists, kinks, and inter-linkages of magnetic field lines. The objective of this study is to understand a long-term (a few days) variation of magnetic helicity in active regions and its relationship with the energy buildup and instability leading to flares and CMEs. Statistical studies of flare productivity and magnetic helicity injection in about 400 active regions were carried out. The temporal variation of magnetic helicity injected through the photosphere of active regions was also examined related to 46 CMEs. The main findings in this study are as follows: (1) the study of magnetic helicity for active regions producing major flares and CMEs indicates that there is always a significant helicity injection through the active-region photosphere over a long period of 0.5 - a few days before the flares and CMEs; (2) for the 30 CMEs under investigation, it is found that there is a fairly good correlation (linear correlation coefficient of 0.71) between the average helicity injection in the CME-productive active regions and the CME speed. Beside the scientific contribution, a major impact of this study is the observational discovery of a characteristic variation pattern of magnetic helicity injection in flare/CME-productive active regions which can be used for the improvement of solar eruption forecasting.

[박SE-08] Cancelling Magnetic Features on the Sun

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A cancelling magnetic feature (CMF) is believed to be a result of magnetic reconnection in the low atmosphere of the Sun. In this work, we investigate the physical properties of CMFs, focusing on the rates of flux cancellation in CMFs and the dynamics of chromospheric phenomena coupled with CMFs. First, we have determined the specific rates of flux cancellation using the magnetograms taken by the Solar Optical Telescope (SOT) aboard the Hinode satellite. The specific rates determined with the SOT turned out to be systematically higher than those based on the data taken by the Michelson Doppler Imager (MDI) aborad the SOHO. Second, we analyzed transient Ca II brightenings associated with small-scale CMFs using the SOT/Hinode. We found that in most Ca II brightenings related to CMFs, and the Ca II intensity peaks after magnetic flux cancellation proceeds. Moreover, brightenings tend to appear as pairs of bright points of similar size and similar brightness overlying magnetic bipoles. To further study the brightening and dynamics of chromospherie features associated with CMFs, we have analyzed Fast Imaging Solar Spectrograph (FISS) data. From this data the Doppler motion of chromospheric features above a CMF changed from redshift to blueshift. The duration of such dynamics is very short being less than 2 minutes. These results are unexpected one and can not be explained by any pre-existing pictures of CMFs.