CHARACTERIZATION OF EUV EMISSION DURING A X8.2 SOLAR FLARE OCCURRED AT THE SOLAR LIMB

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Abstract:

Flares are defined observationally as a sudden enhancement of emission in different wavelengths that may last several minutes. They are associated to the release of large amounts of energy by magnetic reconnection. In this work we investigate the characteristics of emission in the Extreme UltraViolet (EUV) range during a X8.2 flare that occurred on September 10 2017 and was located at the solar limb. To do so we have used the data from the Atmospheric and Image Assembly (AIA) instrument, on board of Solar Dynamic Observatory (SDO) satellite, in seven EUV wave bands: 94, 131, 171, 193, 211, 304 and 335 angstrons. This event was associated with active region NOAA 12673 and appears in the HEK database as having the onset at 15:35:00 UT and emission peak at 16:06:00 UT. We have analyzed the EUV data for a period that starts at 13:00:00 UT and ends at 19:00:00 UT. The observations indicate that the plasma is confined in a complex magnetic structure with the presence of an narrow and elongated emission pattern appearing at 94 and 131 angstrons, indicating what seems to be the presence of a hot current sheet plasma. At around 15:46:00 UT the current sheet goes unstable due to the ejection of a flux rope that gives rise to a Coronal Mass Ejection. This triggers the X8.2 solar flare investigated in this work and the EUV emission associated to the flare peaks at the top of the loop system located bellow the current sheet. The analysis of the EUV light curves show that the emission in the hot lines increases abruptly, consistent with the sudden energy deposition due to flare reconnection, while the emission in the warmer lines increases monotonically before the flare occurrence, indicating the presence of a slow and steady heating process. Wavelet analysis of the light curves also indicates that a short period oscillations appear during the flare, which we interpret as being associated with the existence of a pulsated energy release mechanism acting on top of a steady one. The statistical analysis of the pixel value distribution in the images show that before the flare the distribution is close to a normal one, while it changes to a long tail distribution when the flare approaches. This behavior is expected since the flare involves the appearance of outliers which we conclude that are best detected using skewness and kurtosis statistical metrics. We also have investigated the height dependence of the EUV source with time by calculating the vertical average emission profile. We verified that the emission starts in the chromosphere/lower corona and moves to higher altitudes with time, reaching heights of about 42 Mm at the end of the

observed period. This work corroborates many of the previous results obtained from observations of limb flares in the EUV range.

Acknowledgment: We thank the NASA/SDO and the AIA science teams for making the data publicly available and the UTFPR for the support for this research work.

References:

Session: Solar Physics, heliosphere, cosmic rays

Oral or Poster: Oral