

Statistical study on generating factors of white light solar flares

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'White Light Flare' is a flare with enhancement of visible continuum and is mainly associated with energetic flares like GOES X-class flares. But it could not be always observed in energetic flares and recently it is observed in relatively weak flares like GOES C-class flares (Matthews et al. 2003; Hudson et al. 2006). Its occurring mechanism has not been well understood yet and hence a key question remains; "What is needed to enhance white light emission in solar flares?"

In this study, we chose 37 events observed with Hinode/SOT and RHESSI among M- and X-class flares from January 2011 to August 2013. Out of the 37 events, Using running difference images of SOT three continuum bands (red, green, blue), we identified 13 White Light (WL) events. Remaining 24 events are classified into No White Light (NWL) events. We compare these two groups in several parameters (e.g., duration, distance between flare ribbons, and so forth) to find a generating factor of White Light event.

We found the following characteristics of WL events. (1) Most of WL events show a short duration within 20 minutes in GOES soft X-rays. (2) WL events show high (>15MK) temperature and relatively low emission measure at the peak of GOES soft X-rays. (3) The distance between two ribbons in WL events is short as 10arcsec. (4) Assuming the thick-target model, the mean dissipation rate of non-thermal energy in WL events is larger than that of NWL events. (5) WL events do not tend to coincide with CME comparing to NWL. These results indicate that precipitation of large amount of accelerated electrons into a compact area within a short time plays a key role to generate a WL event.

Keywords: solar flare, white light, hinode