THE TWO RIBBON FLARE OF MAY 14, 1981

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ABSTRACT

The flare behaviour at radio waves, X-rays and in H-alpha is described. The flare geometry is discussed and compared with the model of Heyvearts et al. (1977).

INTRODUCTION

The two ribbon flare (Importance 3N/M2) of May 14, 1981 took place at the edge of the active region Mt Wilson No. 22278. A preliminary description of the flare is given by Ruždjak et al. (1984). The flare was preceded by activation and eruption of the filament denoted as F1 in Figure 1., which disappeared at 08 05 UT, while the flare ribbons formed on both sides of the filament F2 which was parallel to F1 and stable, a behaviour not typical for two ribbon flares, Dwivedi et al (1984). Enhancement in soft X-rays started at 08 00 UT, preceding the first H-alpha bright points which appeared at 08 08 UT. The precursor maximum was reached at 08 16 UT and was followed by a slight decrease of the soft X-ray emission lasting till 08 32 UT, when the second increase started. During this first phase of the flare, from 08 00 to 08 32 UT, no increase of dm-m or hard X-ray flux

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was observed. Only in the cm range (3.2 and 5.2 GHz) a weak increase of flux at 08:05 UT was registered in Bern. During this first phase the H-alpha ribbons were elongating and brightening, but no significant lateral motion of ribbon fronts was observed. The next stage of the event started after 08:32 UT, when the second increase in soft X-rays occurred. At the same time the microwave event started, while the enhancement of the dm-m flux occurred two minutes later. At 08:40 UT the lateral motion of the ribbon fronts set on, marking the onset of fast reconnection processes. This was accompanied by appearance of spikes at 408 and 327 MHz and a group of type III bursts, while the soft X-rays attained maximal growth rate. Hard X-ray emission started at 08:44 UT and was accompanied by a type II burst. At that time the ribbon B was approaching the spot denoted as N in Figure 1, and started to extend over the umbra at 08

Figure 1. Composite sketch of the photosphere and the flare at 08:43 UT. The position of filament F1 is also indicated.
48 UT, the time of maximum in hard X-rays and the start of narrowband impulsive microwave event which peaked at 08 49 UT. The soft X-ray flux was increasing till 08 50 UT when the decaying phase of the flare begun. The development at different wavelengths is shown in Figure 2.

Figure 2. Flare development in different ranges of the spectrum. Intensities are in arbitrary units. d denotes the change in the separation of the ribbons, the arrow indicates the time of "contact" of ribbon B and spot N, the period of spikes is denoted by S.

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FLARE GEOMETRY AND INTERPRETATION

The relative positions of flare ribbons and the erupted filament suggest the flare geometry as shown schematically in Figure 3. The proposed geometry reminds one to the emerging flux model by Heyvearts et al. (1977) except that the velocity of the erupting filament is much higher than the velocity of the emerging flux considered in that model. The driven reconnection process with basically the same geometry was modelled in an numerical model by Forbes and Priest (1984). At the beginning the flare was situated in the weak field region and the flare process therefore was not violent and developing slowly. After the onset of fast reconnection phase, indicated by the lateral motion of the ribbon fronts, the event intensified, producing hard X-ray emission accompanied by an impulsive microwave event and spiky decimetric radiation.

Figure 3. Proposed geometry of the May 14, 1981 event. Letters mark features from Fig. 1., the dotted line represents the current sheet and the broken lines the shocks.
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REFERENCES


DVOVLAKNASTI BLJESAK OD 14. SVIBNJA 1981

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SAZETAK

Opisuju se značajne bljeska u području radio-zračenja, rendgenskog zračenja kao i u liniji H-alpha. Razmatra se geometrijska konfiguracija bljeska i uspoređuje se s modelom izranjajućeg magnetskog toka za bljeskove.

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