Time Development of an X-Class Flare on 1992 June 28
(Extended Abstract)

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1. Introduction

Microwave observations at high spatial resolution can provide information on acceleration and heating of electrons and magnetic field structures relevant to those electrons. In this paper, we present observations of an X-class flare (X1.8) with the Nobeyama Radioheliograph with the operating frequency at 17 GHz. The flare occurred on the west limb (N11, W90) on 1992 June 28 and was associated with intense microwave and millimeterwave emissions with duration more than 1 hour.

2. Observation

The weak plasma heating was observed during the extended preflare phase at the apparent height of 2.5×10^4 km, near and clearly separated from the microwave source in the flash phase. This preflare source is located at the higher part of a large soft X-ray loop which were able to be seen in SXT full-disk images.

The microwave weak enhancement in the pre-flash phase was initiated at the apparent height of 0.7×10^4 km around the intersection of the footpoint of the large soft X-ray loop and an adjacent arcade-like region, and then, expanded to the whole arcade-like region, resulting in an elongated, double-peak structure.

The strong microwave emission in the flash phase is essentially located around the southern part of the elongated structure seen in the pre-flash phase.

The microwave-millimeterwave spectrum in the pre-flash phase has rather a narrow bandwidth, a low turn-over frequency of 5 GHz, and a soft spectrum index of 4.1 in the high frequency part. On the other hand, the spectrum in the flash phase has a wider bandwidth extending well in the millimeterwave frequency, a higher turn-over frequency of 9 GHz, and a harder spectrum index of 2.1 with soft-hard-soft time evolution. Both spectra in the pre-flash and flash phases can be explained by gyrosynchrotron emission due to nonthermal electrons.

In the post-burst increase phase, the microwave source has an elongated structure extending along the limb showing rising motion at a speed of 3.5 km/s. This elongated microwave source, in the initial stage when the elongated structure begins to be seen, almost exactly coincides in both extension and position with the microwave source seen in the pre-flash phase.

SXT partial-frame images, available in the post-burst increase phase, show a hot post-flare loop system accompanied by rising motion with the same speed as the microwave post-burst increase source, corresponding to a cold H-alpha prominence system. The H-alpha loop system is composed of double arcades which are slightly separated in series. Corresponding to the H-alpha double arcades, the soft X-ray loop system shows a double-peak structure. Note that the double-peak structure is also seen for the microwave source in the pre-flash phase. Overlay of microwave and soft X-ray images shows that the elongated microwave structure in the post-burst increase phase roughly coincides with the corresponding soft X-ray structure, including the double peak structure, suggesting both emissions from the same thermal plasma trapped in the post-flare loop system.

3. Conclusion

The above observations suggest that there already exists in the pre-flash phase almost the same magnetic field structure as the arcade structure seen in the early post-burst increase phase. At the onset of the pre-flash phase, there is morphological evidence of loop-loop interaction which is followed by the source expansion into the whole arcade region.

The weak nonthermal emission in the pre-flash phase is followed by the much more intense and harder nonthermal emission in the flash phase. The present observations suggest that the microwave emission in the flash phase originates from a part of the same arcade structure as that in the pre-flash phase.