Moving magnetic features, loop-loop interactions and repeated flaring

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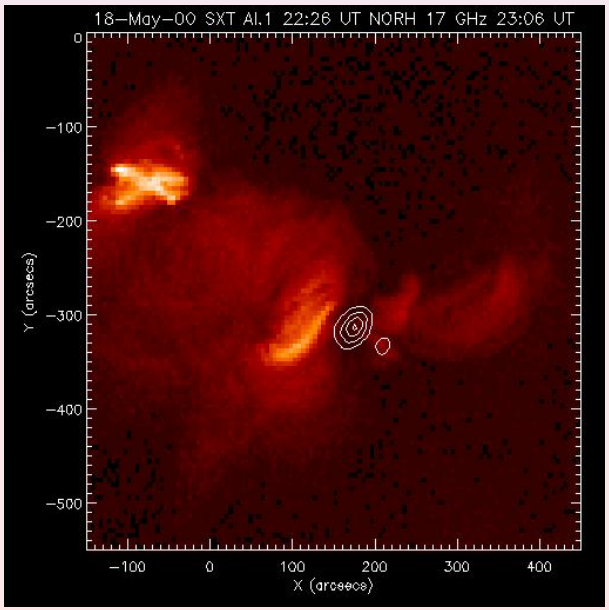
Tuorla Observatory, Finland

NBYM04, Kiyosato Oct 26-29, 2004



Homologous solar flares

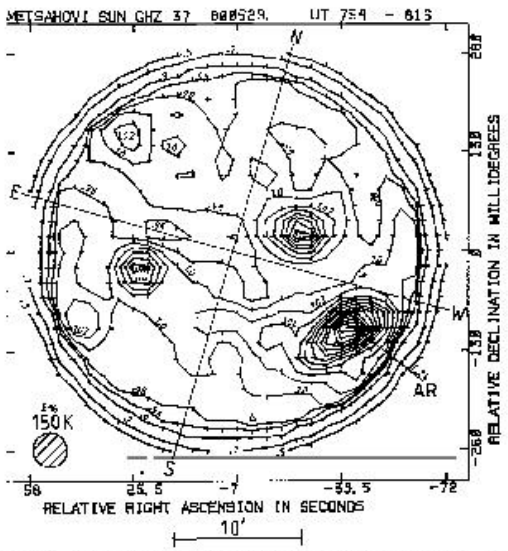


Figure 1. Solar map at 8 mm on May 29, 1980. Contours are 150 K, i.e. two percent of the mean quiet Sun level.

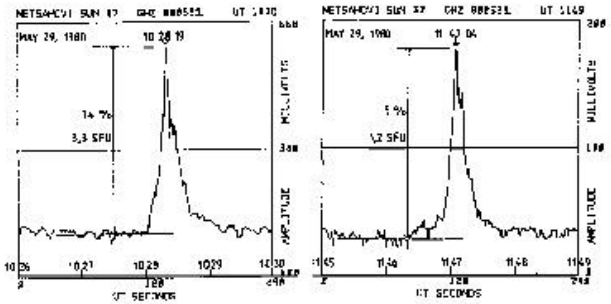


Figure 2. Two microwave bursts at 1028 UT and 1147 UT from the Hale region 16864.

The Hale region 16864 had also produced several optical homologous flares before May 29, 1980, but at Metsähovi the Sun was not observed at that time. On May 29 optical flares were reported at 0757 UT and 1030 UT [2].

The elementary spikes can be interpreted as contributions from different magnetic loops. The same complex magnetic loop structure can be assumed to be present just before both microwave bursts. It is proposed that some instability, i.e. an emerging new magnetic loop, triggered

- Similar impulsive evolution at microwaves/millimeter waves
- Same footpoints (= same location)
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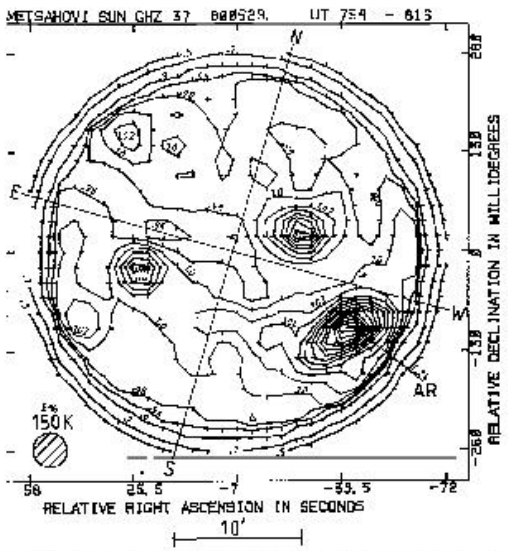

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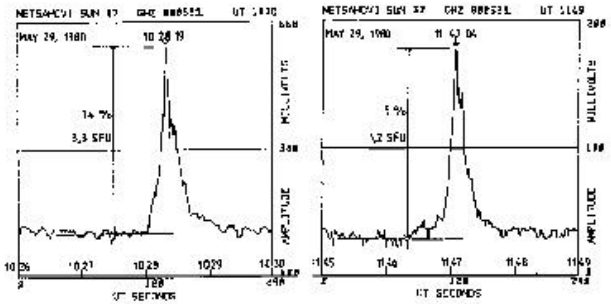

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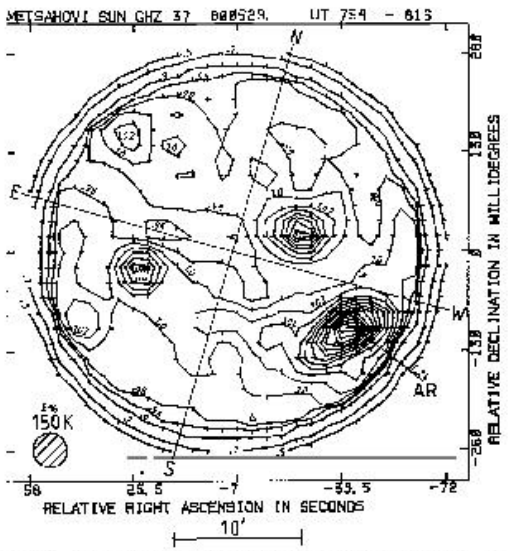

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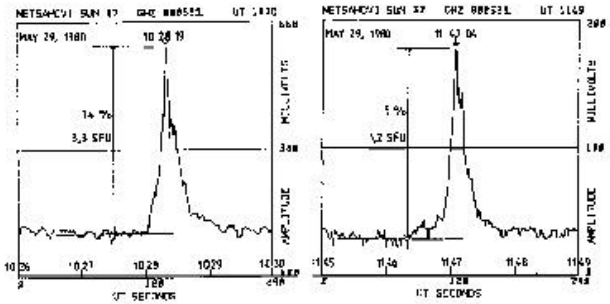

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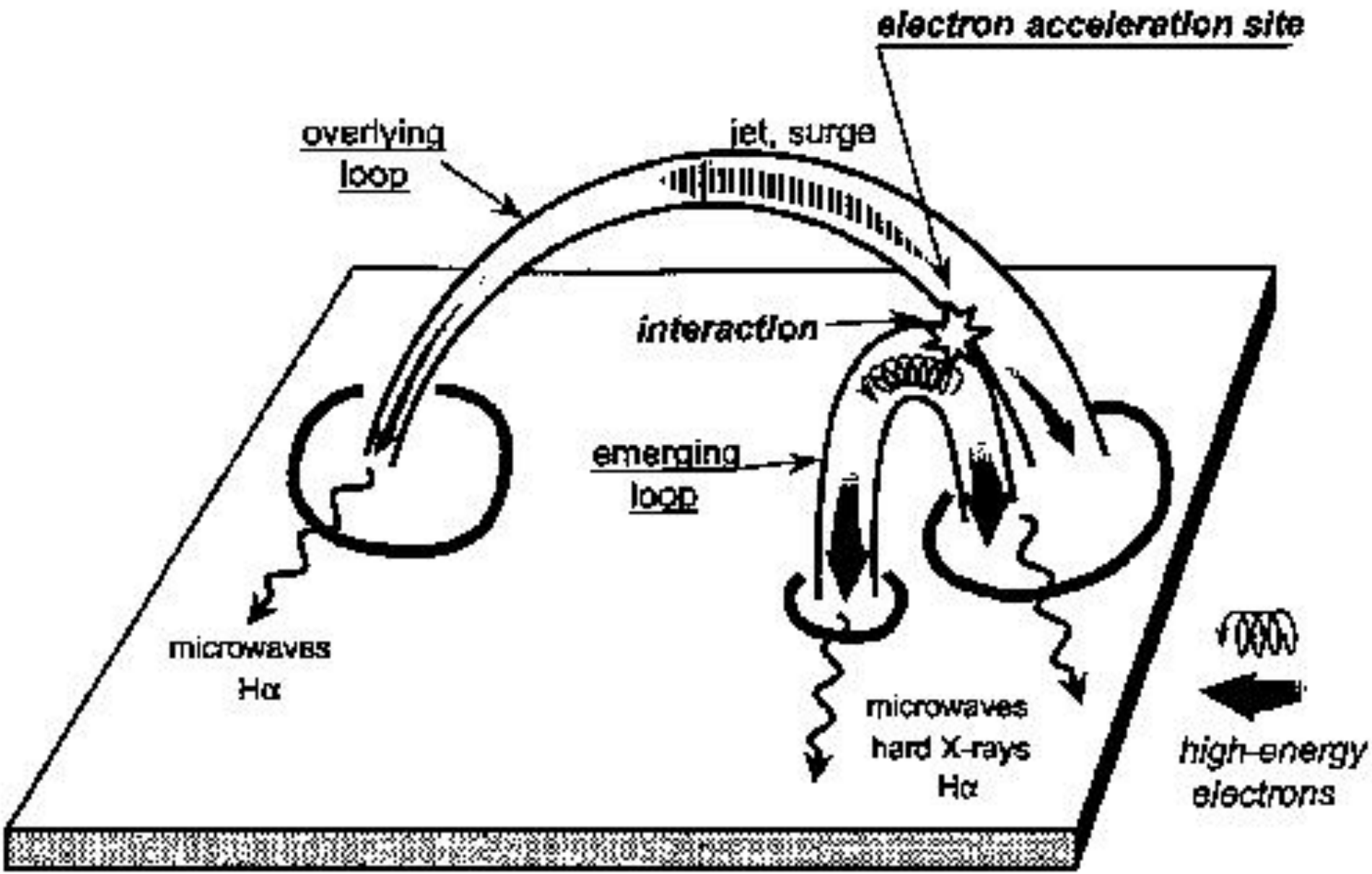
Emerging flux (Hanaoka, 1997)



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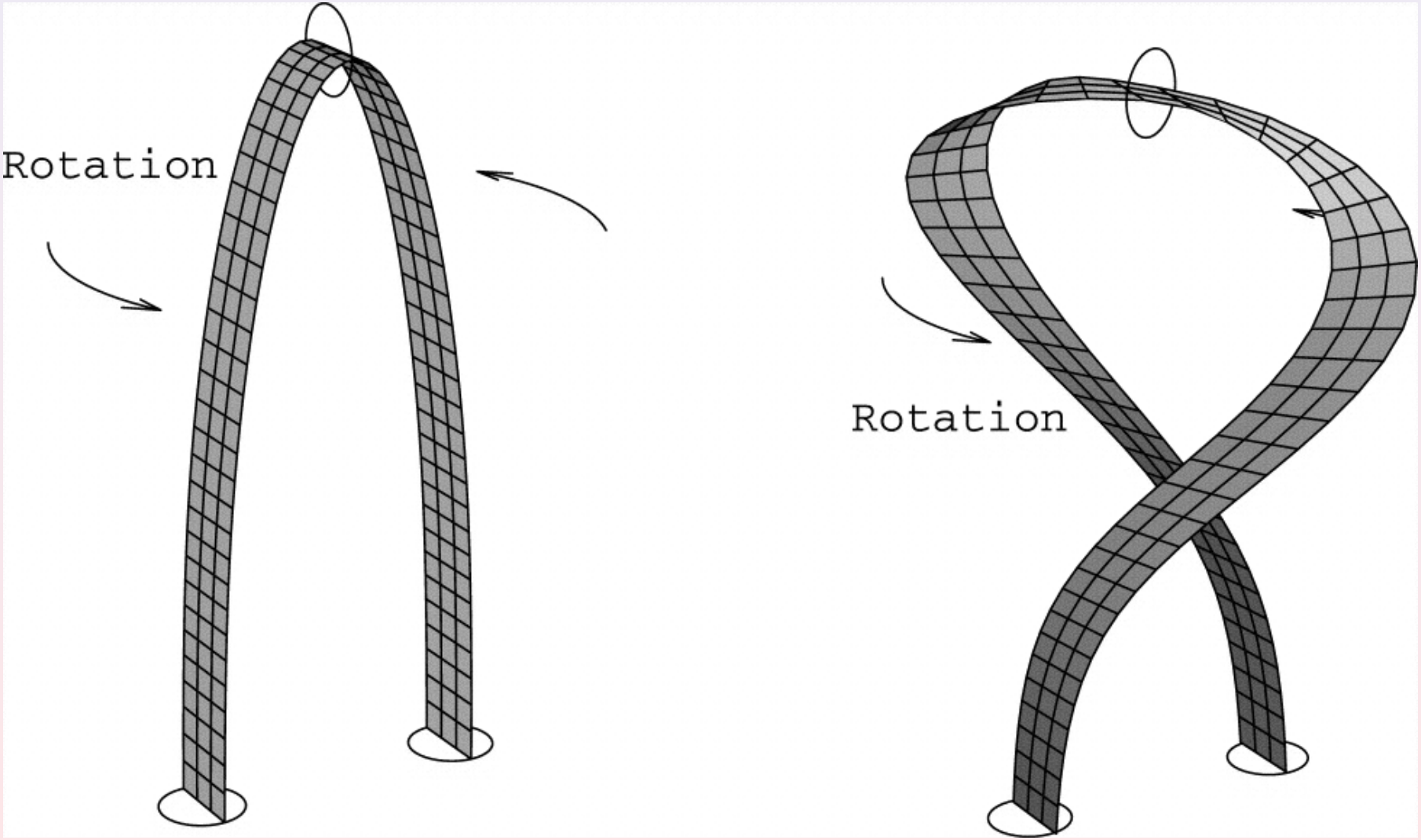
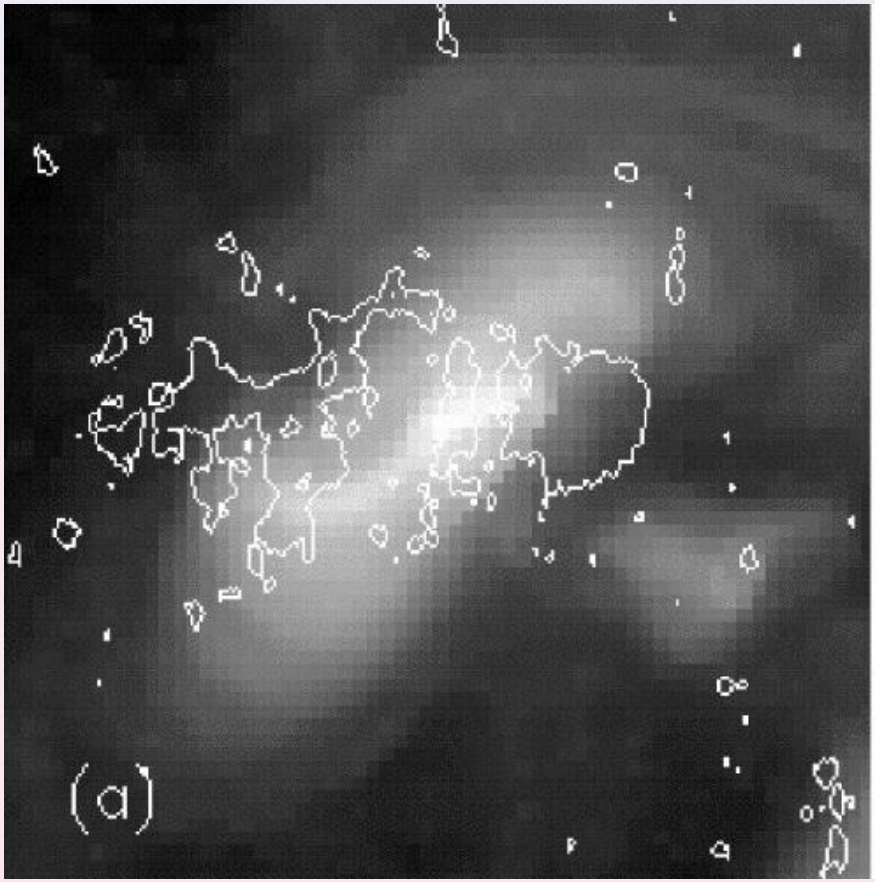
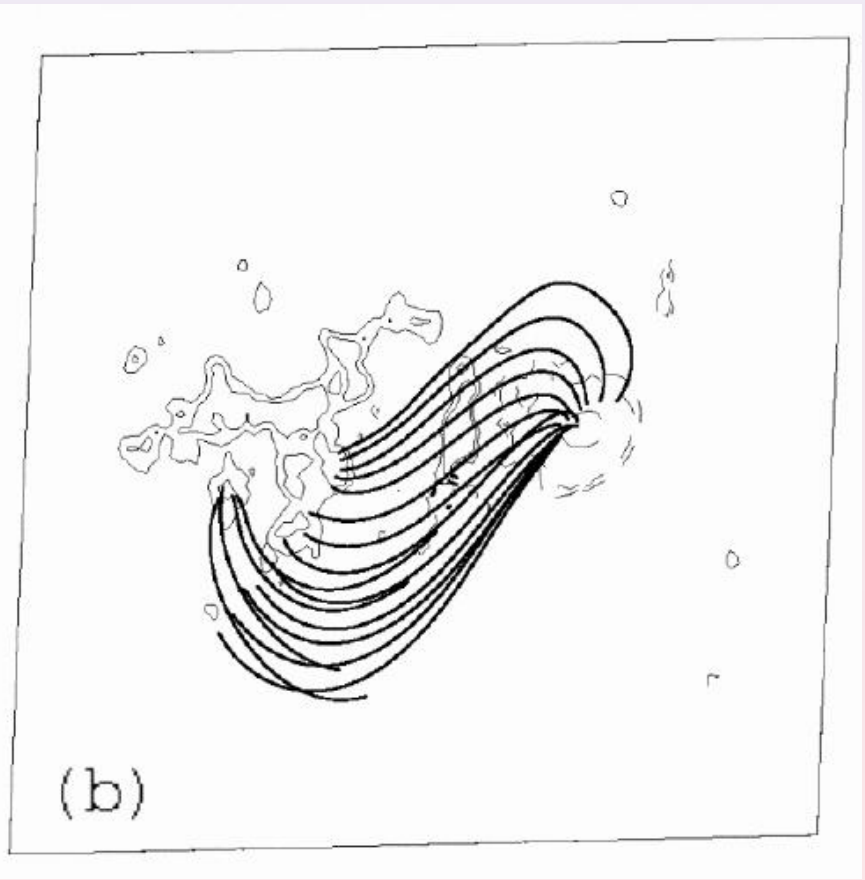
Twist and shear and writhe: rotation



Lopez Fuentes et al. (2000)

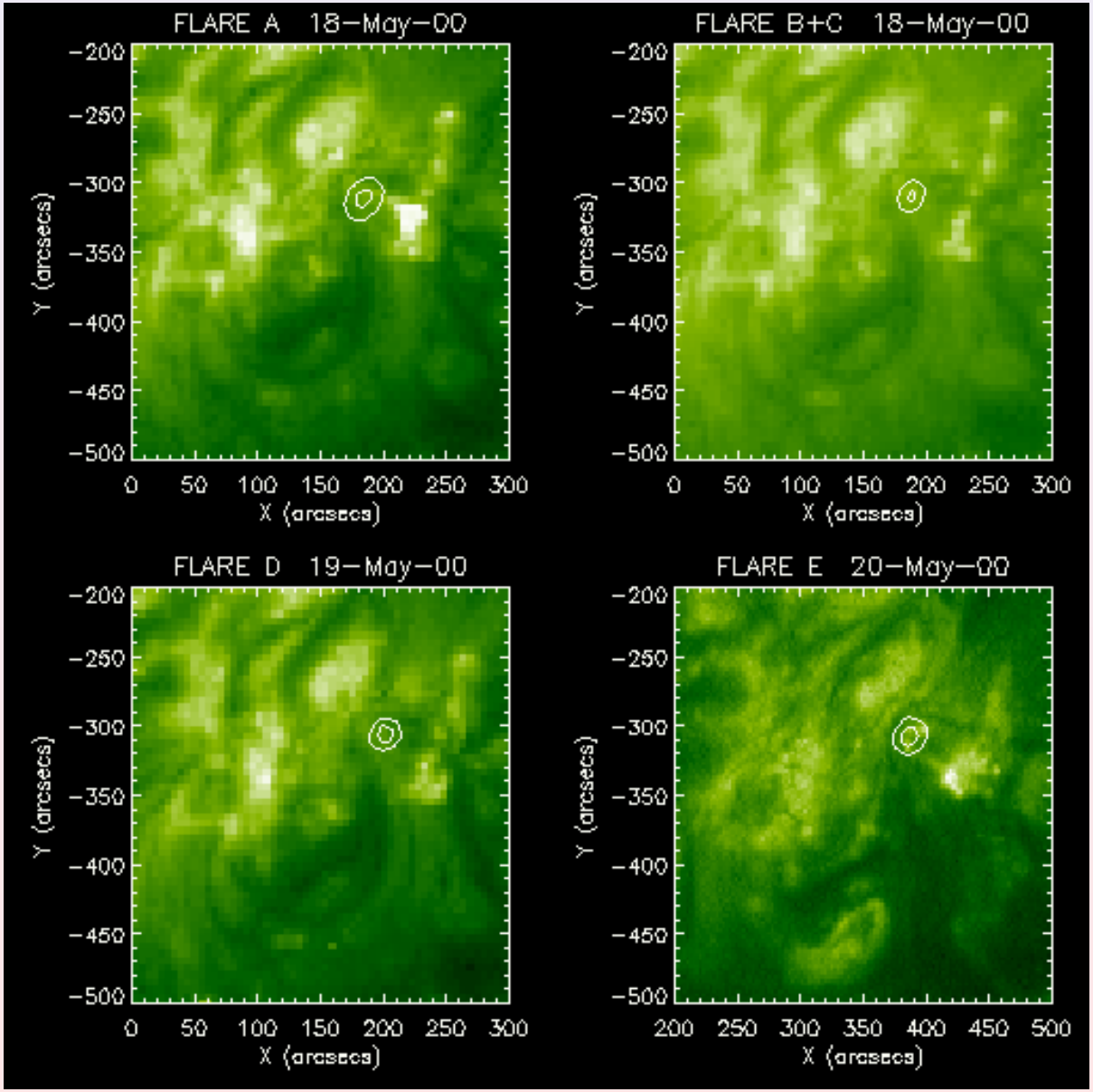
Twist and shear and writhe: from shear to sigmoid



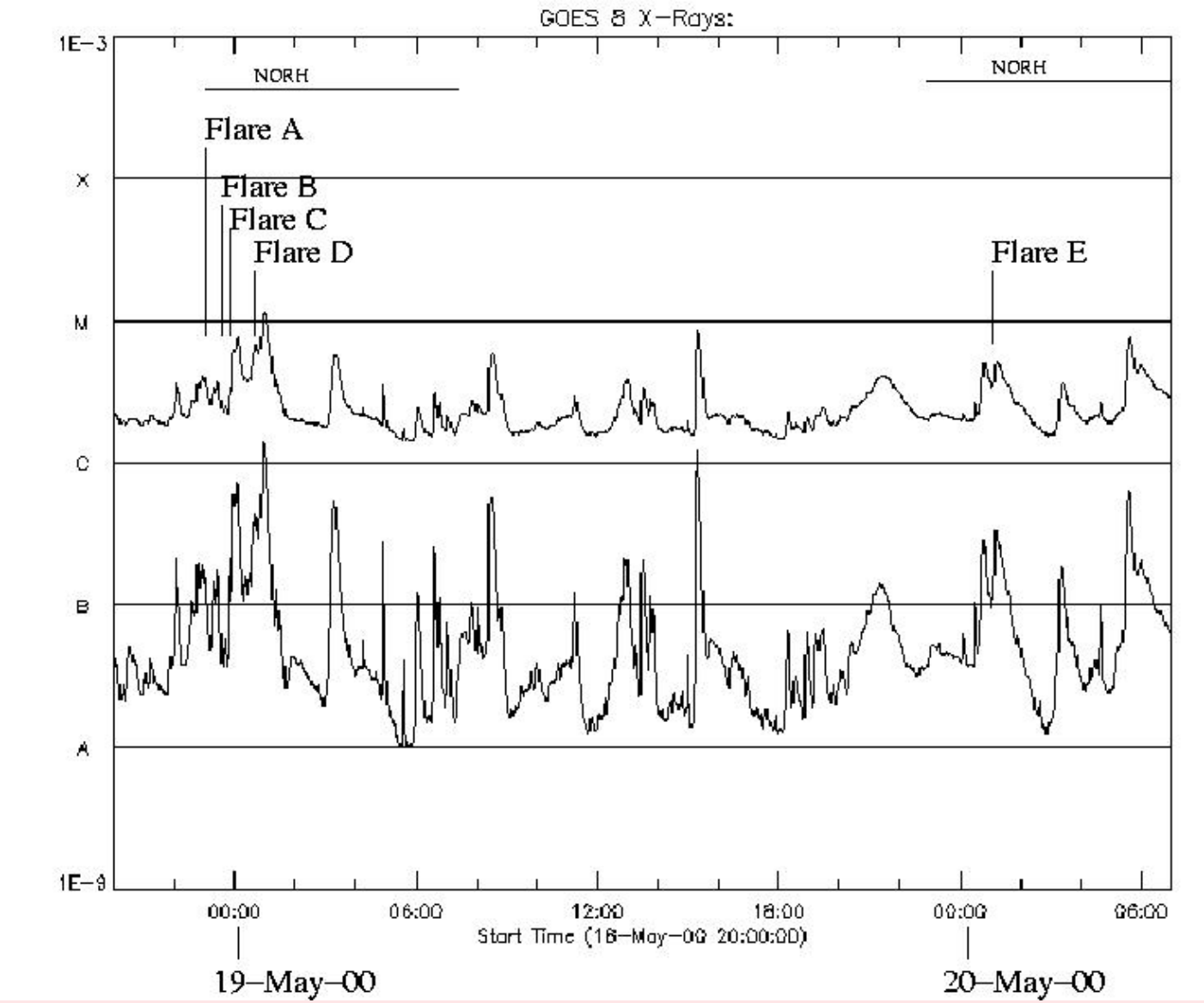


Lopez Fuentes et al. (2000): This leads to kink instability and eruption

5 radio flares from the same location AR 8996 (S20 W10...25)



Observations: May 18–20, 2000

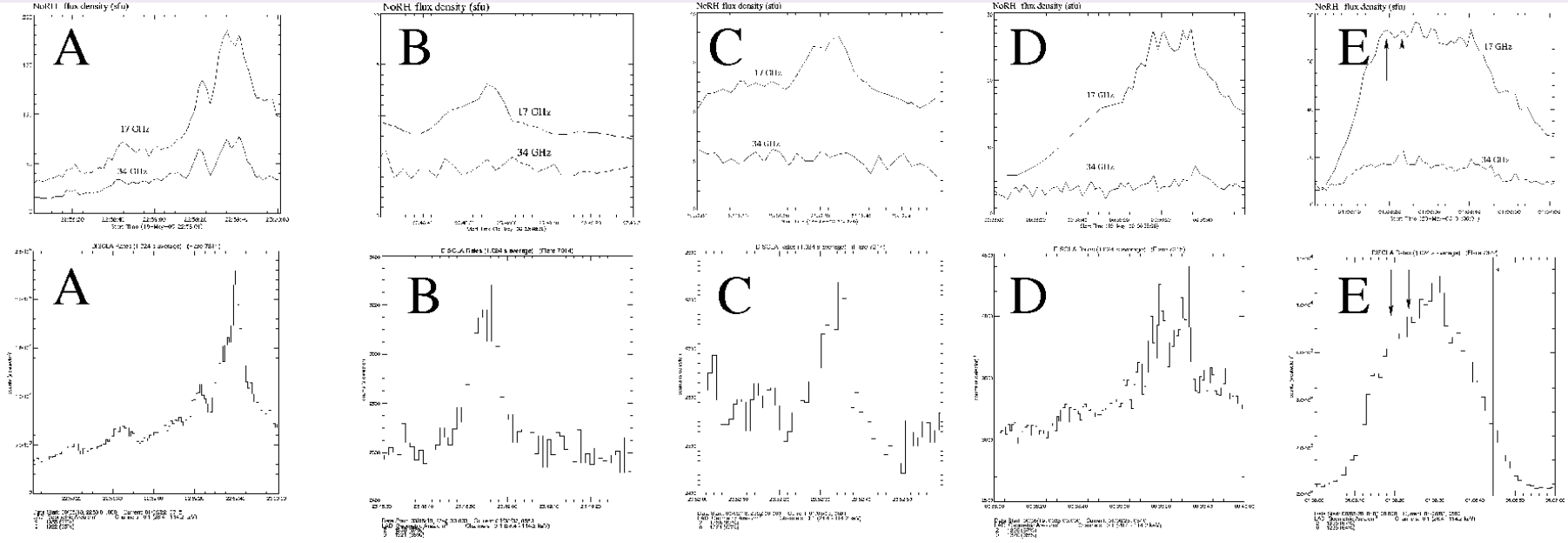


Observations: May 18–20, 2000

Table: Summary of flares in AR 8996 during 2000 May 18–20

Name	Time of maximum at 17 GHz	Maximum flux 17 GHz	BATSE peak count c/s/2000 cm2
Flare A	2000 May 18 22:59:35	150 sfu	42417
Flare B	2000 May 18 23:48:56	15 sfu	1466
Flare C	2000 May 18 23:52:34	15 sfu	710
Flare D	2000 May 19 00:39:16	25 sfu	2839
Flare E	2000 May 20 01:06:27	80 sfu	19663

Radio and hard X-rays



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- Total duration of each flare 1...2 minutes, two-peak structures

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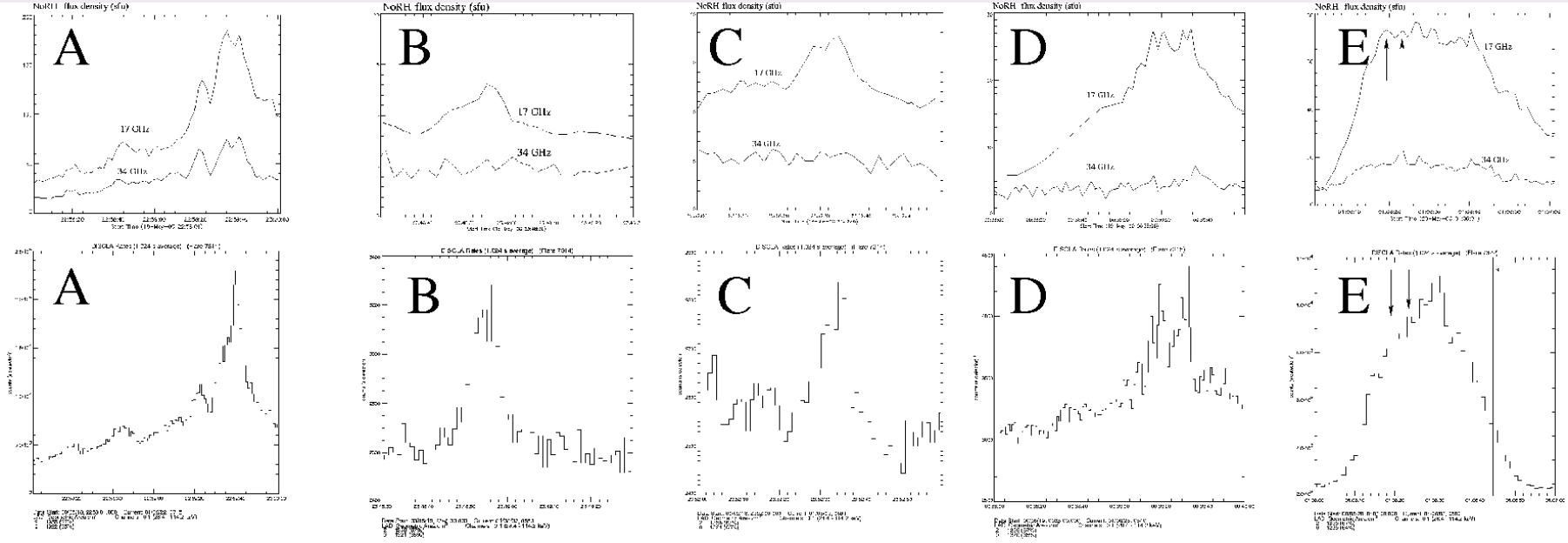

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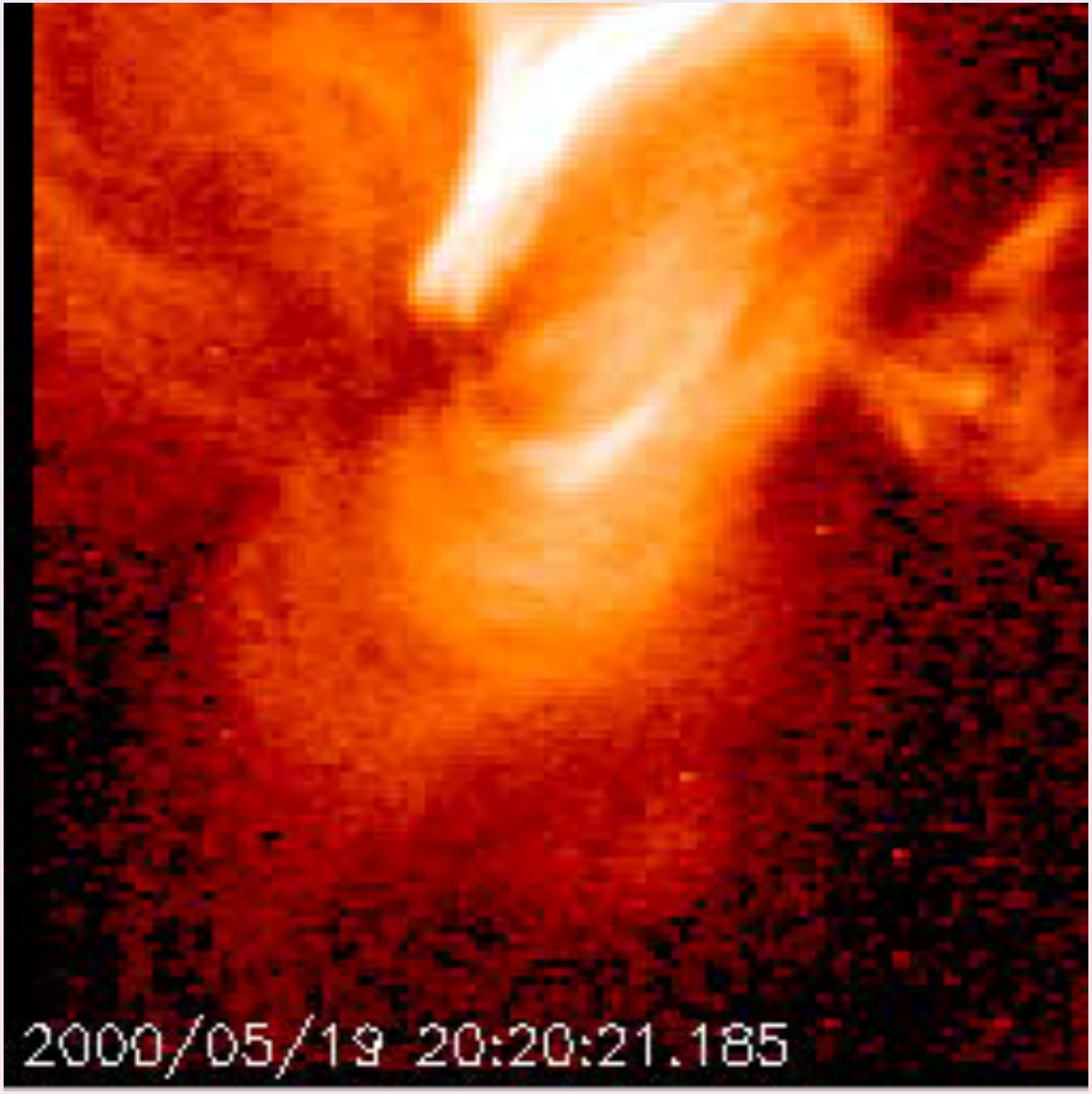
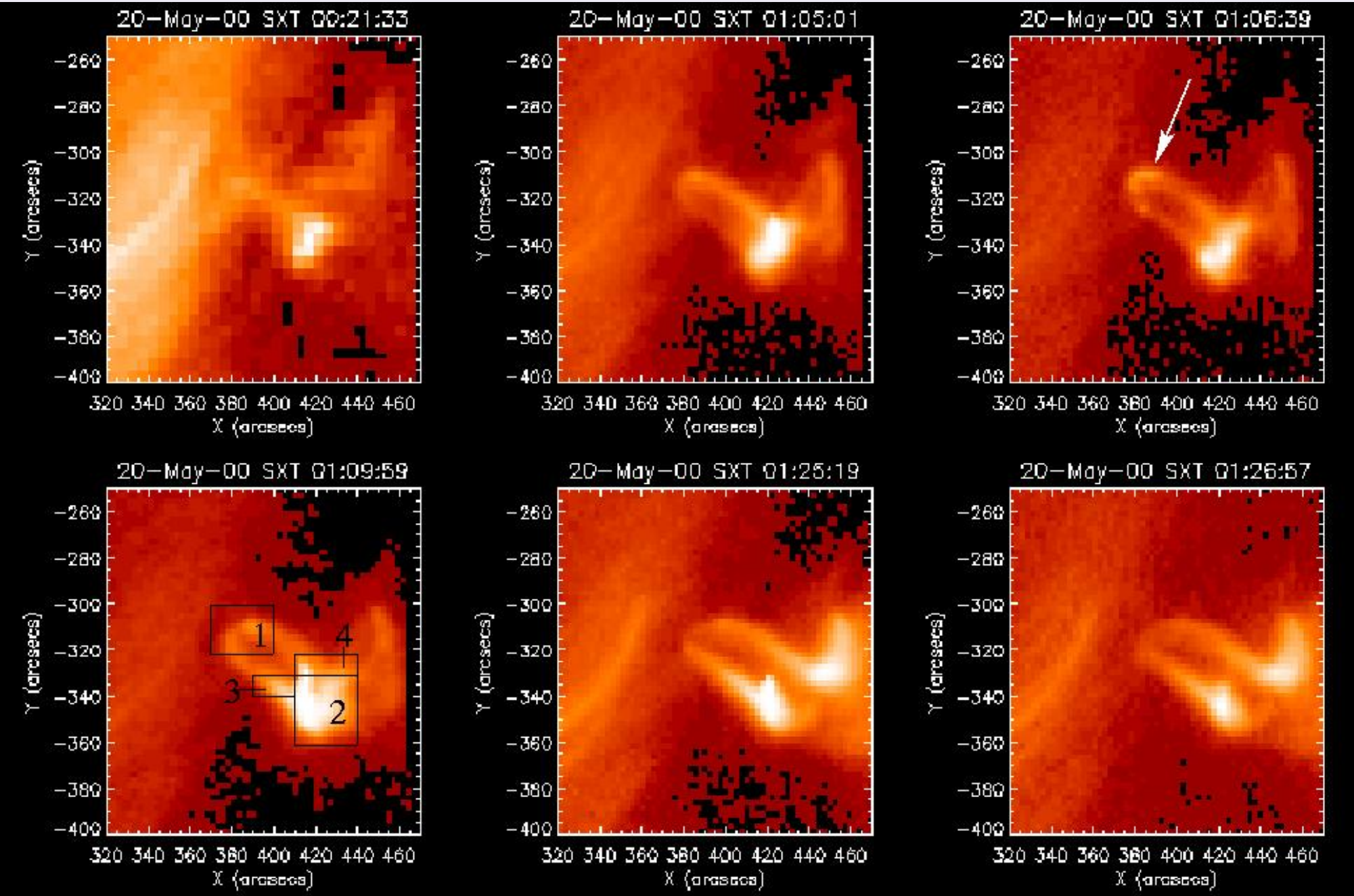
AR evolution in soft X-rays

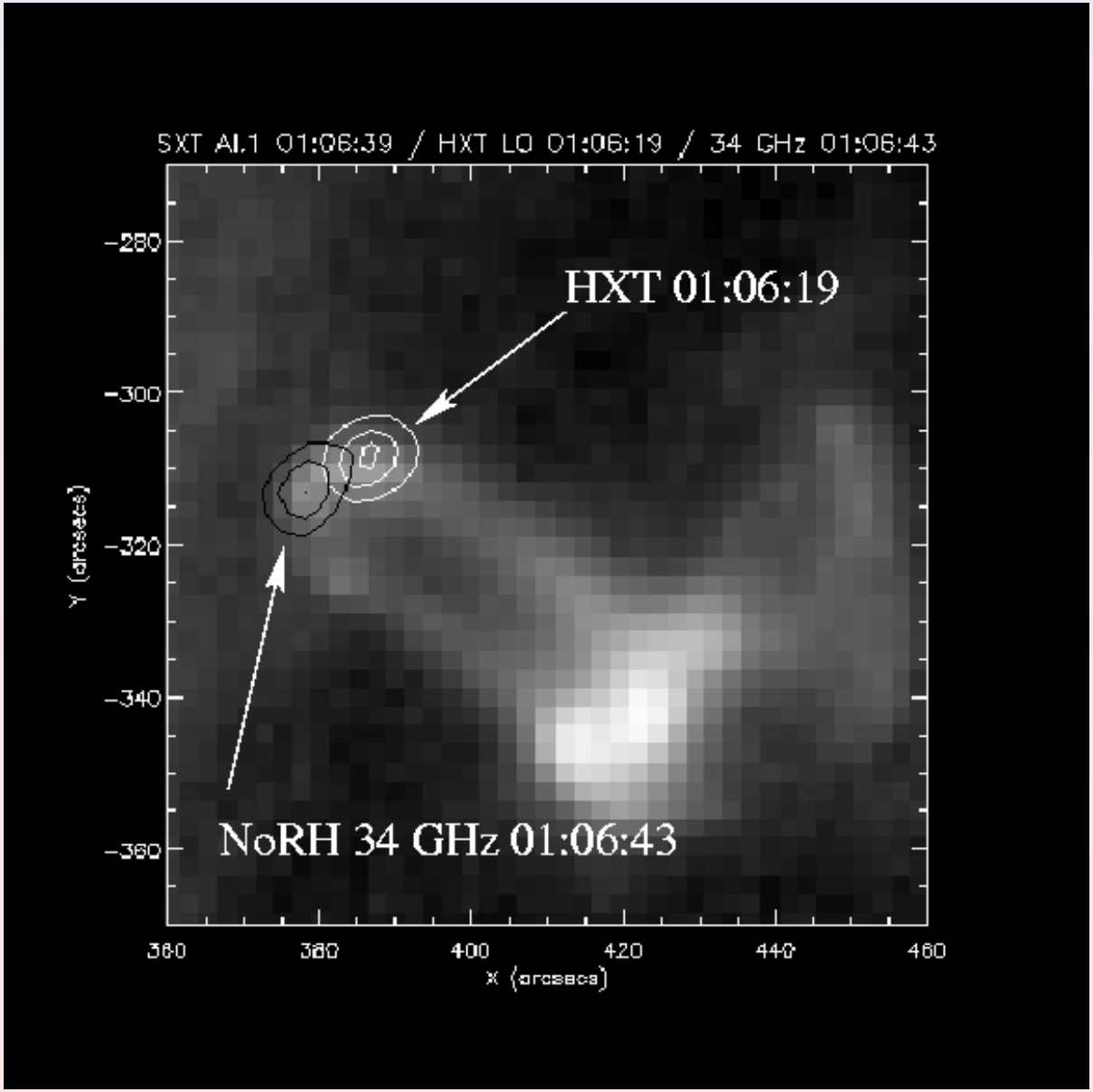


SXT MOVIE

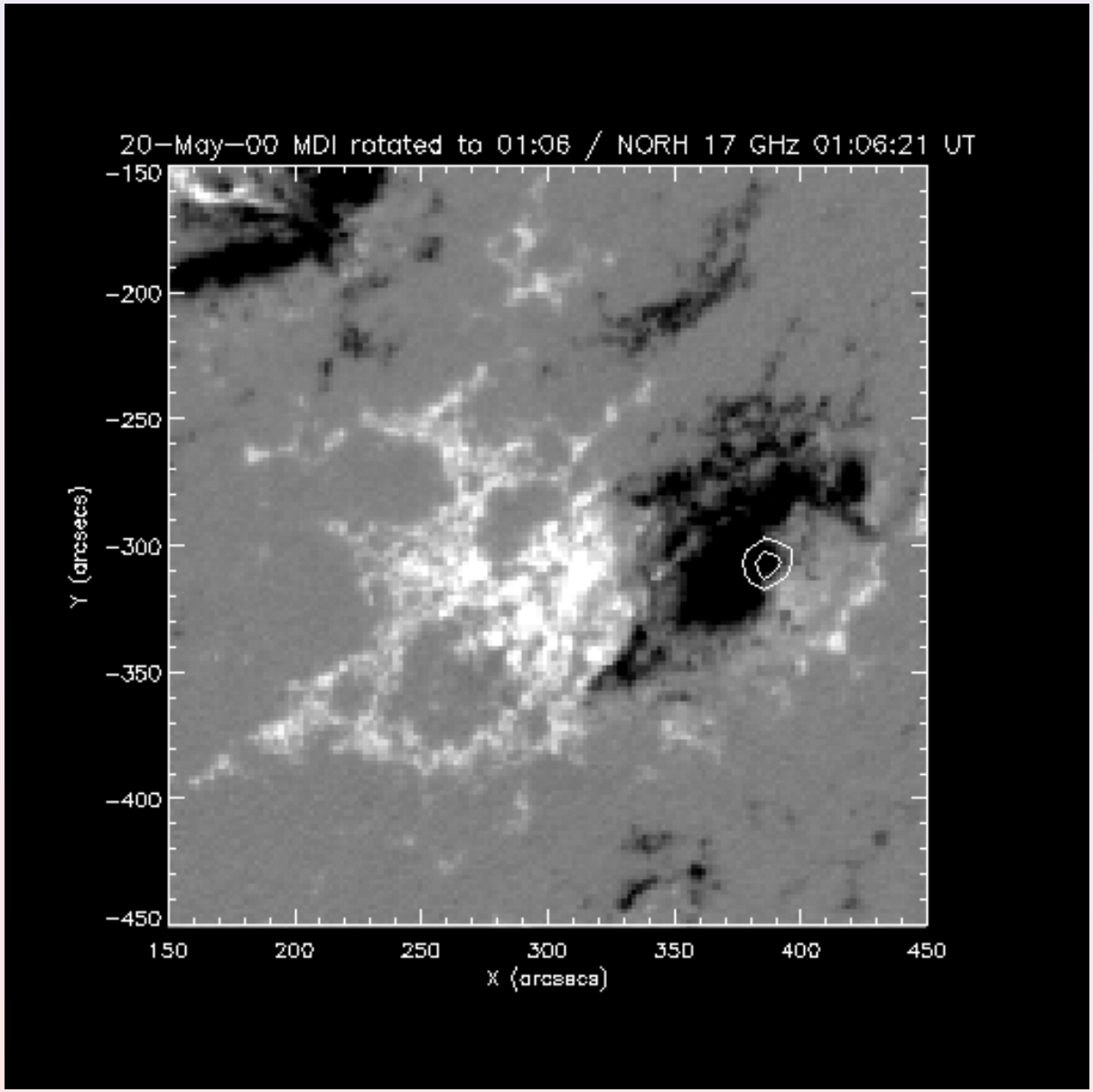
Flare E: interacting loops



Hard X-ray and radio source locations

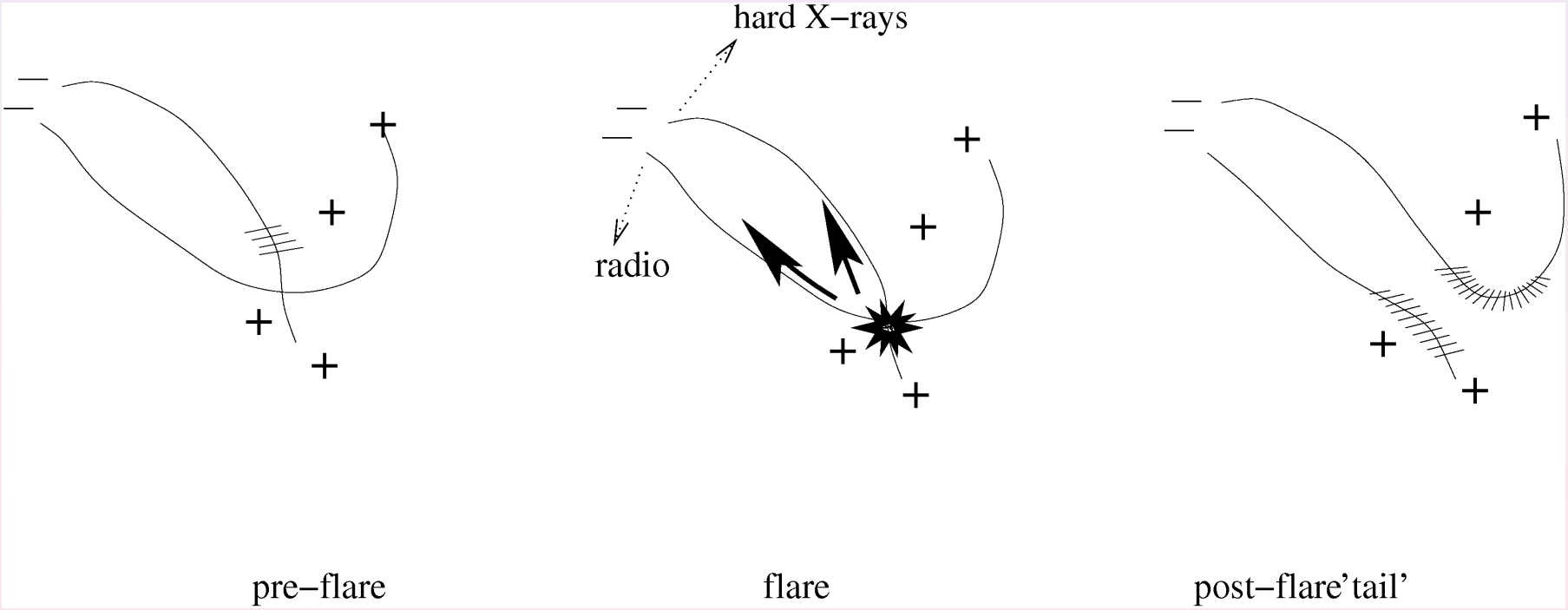


Flare location at the edge of a large sunspot region



MDI MOVIE

Model for the repeated flaring



- for more details see Pohjolainen, *Solar Physics* 213 (2003)