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The comparison of the hard X-ray bursts observed by YOHKOH with long-wave radioemission from INTERBALL-1

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The purpose of this investigation is a comparison of long-wave radiobursts, registered in the range of frequencies 100-1500 kHz with multi-channel radiometer AKR-X installed on INTERBALL-1, and hard X-ray fluxes in energy range 14-93 keV observed by YOHKOH/HXT during solar flares. We selected several events with flares of importance X and M, for which there were simultaneous observations in the hard X-ray and radio ranges during the impulsive phase of a flare. The temporal profiles of radiobursts are characterized by the rapid frequency drift, typical to the radiobursts of III type, caused by the motion of energetic electrons accelerated in the flare and which are spreading at the corona and interplanetary medium, up to the Earth orbit.

For the comparison with long-wave radiobursts the X-ray bursts for energies 14-23 keV (L), 23-33 keV (M_1), 33-53 keV (M_2) and 53-93 keV (H) are given in the Fig.1. The greatest interest for us are the data, obtained with M and H channel, since they reflect the properties of the energetic electrons, important to the generation of gectometric radiobursts. Analyzing the temporary changes in the fluxes of hard X-ray and radio emission, we note, that the beginning of the enhancement of a radioburst at the frequency of 1463 kHz is as a rule observed near the maximum value of the hard X-ray with energy$E \geqslant 20 - 30$ keV, which correspond to the impulsive phase of the flare. This means that the energetic electrons which generate radiobursts, escape from the flare region up to the distance $r \geqslant 8R_{\odot}$ without delay relative to the moment of maximum energy release, observed in the hard X-ray and microwave emission.

We studied also the hard X-ray images of the flare, obtained during the impulsive phase (Fig.2). Investigating the dynamics of these images, it should be noted some peculiarities. In several cases, at the onset of radioburst the weakening, displacement and even disappearance of one of the hard X-ray sources at the active region are observed. This can be related to the change of magnetic structure in the acceleration region.

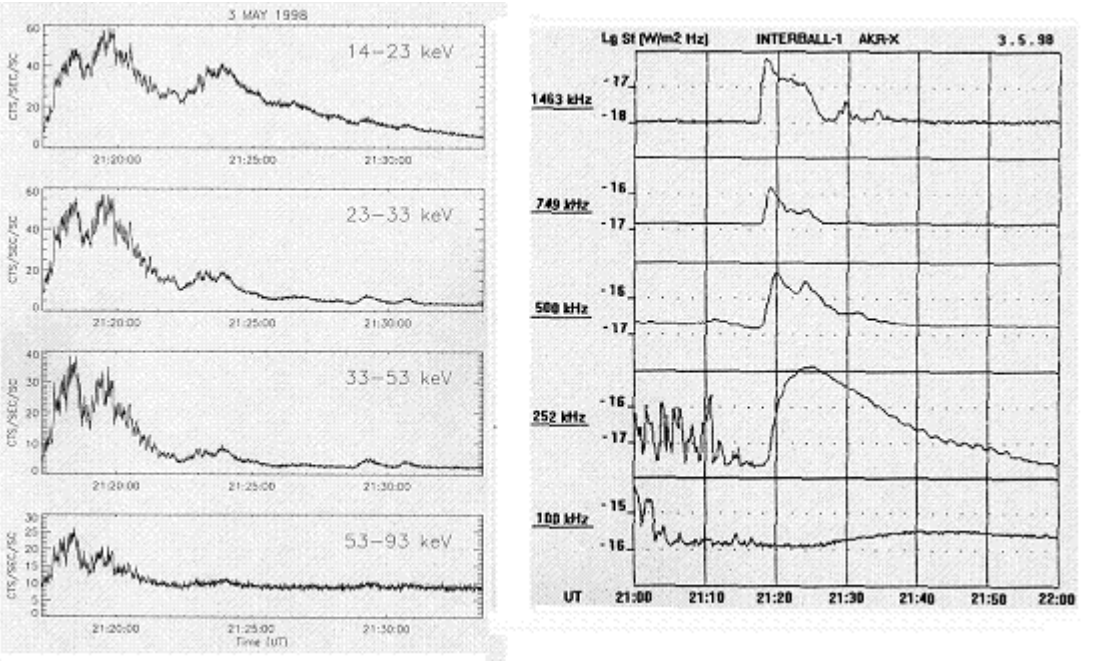

Figure 1. Comparison between the hard X-ray bursts and the radiobursts during 03 May 1998 flare.

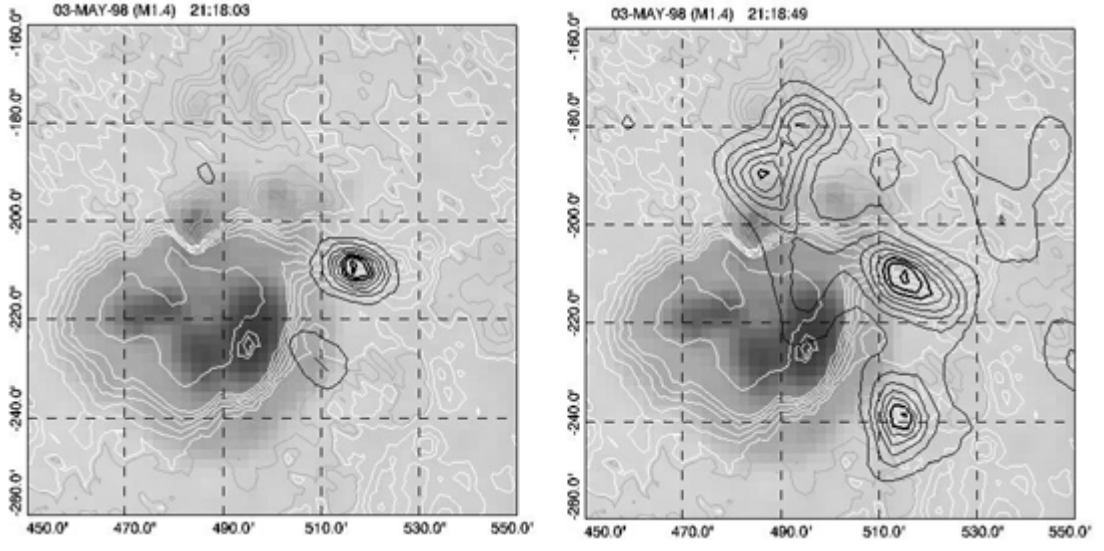

Figure 2. Hard X-ray images of the 03 May 1998 flare, obtained during the impulsive phase.

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