MULTIPLE ENERGETIC INJECTIONS IN A STRONG SPIKE-LIKE SOLAR BURST

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(Received 23 September, 1983; in revised form 4 January, 1984)

Abstract. An intense and fast spike-like solar burst was observed with high sensitivity in microwaves and hard X-rays, on December 18, 1980, at 19:21:20 UT. It is shown that the burst was built up of short time scale structures superimposed on an underlying gradual emission, the time evolution of which showed remarkable proportionality between hard X-ray and microwave fluxes. The finer time structures were best defined at mm-microwaves. At the peak of the event the finer structures repeat every 30–60 ms (displaying an equivalent repetition rate of 16–20 s^{-1}). The more slowly varying component with a time scale of about 1 s was identified in microwaves and hard X-rays throughout the burst duration. Similarly to what has been found for mm-microwave burst emission, we suggest that X-ray fluxes might also be proportional to the repetition rate of basic units of energy injection (quasi-quantized). We estimate that one such injection produces a pulse of hard X-ray photons with about $4 \times 10^{21}$ erg, for $\varepsilon \approx 25$ keV. We use this figure to estimate the relevant parameters of one primary energy release site both in the case where hard X-rays are produced primarily by thick-target bremsstrahlung, and when they are purely thermal, and also discuss the relation of this figure to global energy considerations. We find, in particular, that a thick-target interpretation only becomes possible if individual pulses have durations larger than 0.2 s.


An intense spike-like burst was observed on 18 December, 1980, 19:21:20 UT, at various energy ranges, by several space and ground-based observatories (NOAA, 1981). It corresponded to an SN optical flare that occurred in NOAA region 2840 at a location of N 07 W 11. Hard X-ray data with high sensitivity and time resolution were obtained by the Hard X-ray Burst Spectrometer (HXRBS) on the Solar Maximum Mission (SMM) satellite (Orwig et al., 1980; Dennis et al., 1982). High sensitivity and time resolution mm-microwave data were obtained with the Itapetinga 14-m antenna, at
Fig. 1. The 18 December, 1980, 19:21:20 UT solar burst, observed in five energy ranges of the HXRBS experiment on board of SMM satellite. Finer time structures are suggested. They become relatively more important for higher energies.