DERIVATION OF PARAMETERS OF CORONAL MASS MOTIONS FROM NOISE STORM CONTINUUM OBSERVATIONS

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ABSTRACT. Observable parameters of flare-related onsets and intensifications of noise storm continuum and of continua non-related to a flare are used to derive characteristics of the coronal mass motions leading to the emission of these types of radioevents. The results agree quite well with outcomes evaluated in the very few cases for which a direct comparison between optical and radio observations was possible.

ОПРЕДЕЛЕНИЕ ПАРАМЕТРОВ ПЕРЕНОСА МАСС В КОРОНЕ ПО НАБЛЮДЕНИЯМ КОНТИНУУМА ШУМОВЫХ БУР: Наблюдаемые параметры, начала вспышек, интенсификация континуумов шумовых бур, и также континуумов не относящихся к вспышкам были использованы для определения переноса масс в короне, вызывающего эмиссию радиоизлучения этих двух типов. Полученные результаты хорошо совпадают с результатами, найденными для нескольких случаев, в которых оптические и ралионаблюдения были сравнены.

URČENIE PARAMETROV PRENOSU HMOTY V KORÓNE Z POZOROVANIA KONTINUA ŠUMOVÝCH BÚROK: Pozorované parametre, začiatky erupsií, intenzifikácia kontinua šumových búrok a taktiež kontinua nesúvisiaceho s erupciou, boli použité na odvodenie charakteristík pohybu koronálnych hmôt, ktorý vedie k uvedenej rádiovej emisii. Získané výsledky veľmi dobre súhlasia s výsledkami, ktoré boli obdržané v niekoľkých prípadoch inou metódou a to porovnaním optických a rádiových pozorovaní.

We try to derive characteristic features of coronal mass motions, being able to trigger an onset or an intensification of a noise storm continuum, from observable parameters of these radioevents (cf. Fig. 1). The following

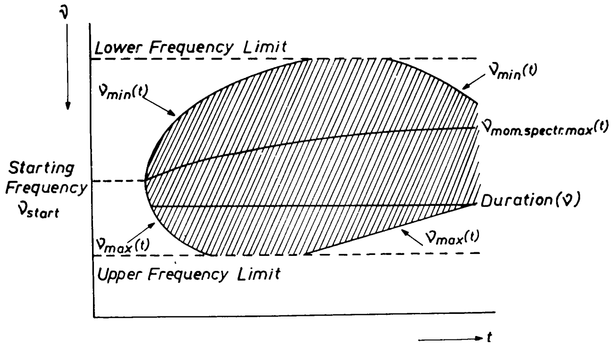

Fig. 1: Schematic spectral diagram of an onset of a noise storm continuum defining its characteristic spectral - time - parameters

two types of radioevents are considered:
T1: flare-related radioevents
T2: non-flare-related radioevents.

The analysis of single frequency records at 510, 362, 287, 234, 113, 64 and 40 MHz provides the following results:

1. In contrast to most of the other solar metrewave bursts noise storm continua may exhibit a non-uniform frequency drift: Many events start at an intermediary frequency and broaden to higher as well as to lower frequencies afterwards.
   Starting from the ideas of Kerdraon et al. (1982, 1983), who postulated the necessity of a coronal mass accumulation for the onsetor intensification of a noise storm continuum, the time dependence of ν_{min} is presumed to be determined by the undisturbed electron density distribution $N_{eo}(h)$, by the outeard drift velocity of that part of a coronal mass motion in which the onset of the radioevent at the different observing frequencies is triggered and by the compression rate $N_e(h)/N_{eo}(h)$ within this region. Therefore, $\nu_{min}(t)$ estimated from single frequency records can be used for derivation of outward drift velocities of the exciters of T1-events and T2-events. However, a correct interpretation of $\nu_{max}(t)$ needs interferometer records.
2. Contrary to the case T2 the T1-events preferably start at the higher observing frequencies (cf. Tab. 1). We find a quite similar behaviour for the upper fequency limits, too (cf. Tab. 2). These results indicate that flare-related mass motions come from deeper layers of the corona and/or lead to relevant modifications againts indisturbed conditions already at the deeper levels than the mass motions triggering the T2-events.
3. On an average T1-events extend to lower frequencies rather than T2-events (cf. Rab. 2). This difference may be explained by an expansion of closed magnetic field configurations by flare-related coronal mass motions whereas the probably less violent mass motions non-related to a flare are less ef-

Table 1

Number of flare-related, possibly flare-related and non-flare-related onsets and intensifications of noise storm continuum as a function of starting frequency

Starting Frequency [MHz]	510	362/287			234			113			64			Total Number
		+	+/-	-	+	+/-	-	+	+/-	-	+	+/-	-	
Flare-correlated Noise Storms	14	0	3	5	0	5	0	0	2	2	0	0	0	31
	14	8			5			4			0			
Possibly Flare-correlated Noise Storms	6	0	3	9	0	3	0	1	1	1	0	0	0	25
	6	12			4			3			0			
Noise Storms without Flares	10	0	6	28	0	11	9	5	13	9	1	0	0	92
	10	34			20			27			1			

+ : noise storms broaden from starting frequency to higher frequencies only

- : noise storms broaden from starting frequency to lower frequencies only

+/- : noise storms broaden from starting frequency to higher as well as to lower frequencies.

Table 2

Number of flare-related, possibly flare-related and non-flare-related onsets and intensifications of noise storm continuum as a function of upper as well as of lower frequency limit.

Upper Frequency Limit	510				362/287				234				113 [MHz]			Total
Lower Frequency Limit	234	113	64	40	234	113	64	40	234	113	64	40	113	64	40	Number
Flare-correlated Noise Storms	0	1	8	14	0	2	5	4	0	0	0	0	0	1	1	36
	Σ23				Σ11				Σ0				Σ2			
Possibly Flare-correlated Noise Storms	0	4	4	5	1	2	3	4	0	0	0	0	0	1	0	24
	13				10				0				1			
Noise Storms without Flare	1	8	11	7	2	21	15	5	0	4	4	4	4	5	0	91
	27				43				12				9			

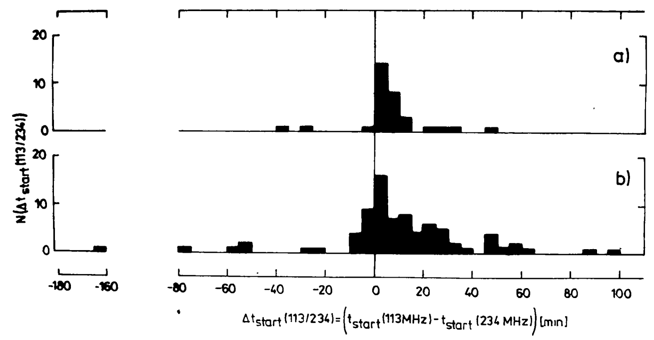

Fig. 2: Number of T1-events (a) and T2-events (b) as a function of their difference of starting times at 234 and 113 MHz.

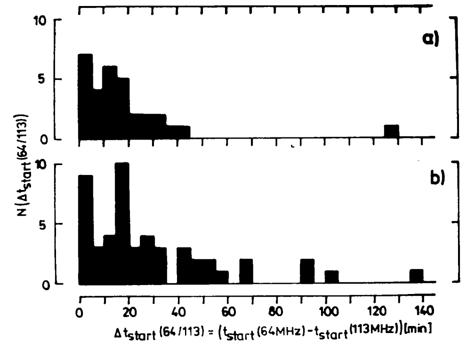

Fig. 3: Number of T1-events (a) and T2-events (b) as a function of their difference of starting times at 113 and 64 MHz.

fective in this respect.

4. The differences $\Delta t_{start}(\nu_1/\nu_2)$ of starting times at neighbouring observing frequencies ν_1, ν_2 ($\nu_1 < \nu_2$) tend to be longer in the case T2 (cf. Fig. 2, 3). This is especially valid if events with $\nu_2 \sim \nu_{start}$ are taken into consideration.
5. The $\Delta t_{start}(\nu_1/\nu_2)$ of T1-events scatter considerably less than those of T2-events. Therefore, T1-events can be presumed to be caused by coronal mass motions of quite uniform characted in contrast with T2-events.
6. Electron densities tenfold to the Newkirk model (Newkirk, 1967) in the relevant parts of flare-related mass motions combined with $\overline{\Delta t_{start}(113/234)}$ evaluated from observations would lead to a mean outward drift velocity of about 800 km s^{-1} for the exciters of T1-events. However, there are some reasons to reject this rather high value setting constraints to the compres-

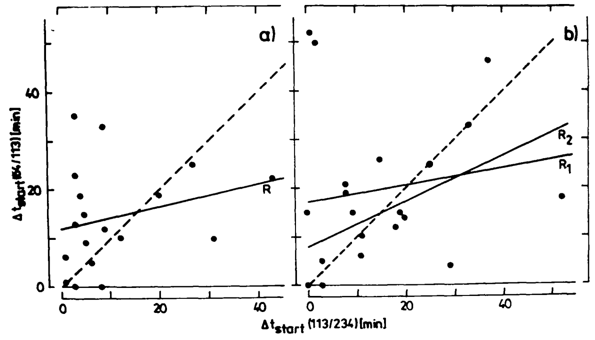

Fig. 4: Comparison between the related values of $\Delta t_{start}(113/234)$ and $\Delta t_{start}(64/113)$ for T1-events (a) and T2-events (b)

sion rate within the "trigger zone" of flare-related mass motions at least at heights which noise storm continua at frequencies ≥ 113 MHz come from.

7. Starting from electron densities 2 - 5 x $N_{eNewkirk}$ the mean outward drift velocity of the exciters of the T1-events can be estimated to 400-500 km s^{-1} agreeing quite well with the drift velocities measured directly for the tops of transients which have been observed to trigger a noise storm continuum (Kerdraon et al., 1982).
8. The mean outward drift velocity of the exciters of T2-events is evaluated to about 100 km s^{-1}. This formally calculated value can be regarded as a hint that a high fraction of the T2-events must have been caused by the slow mass motions described by Kerdraon et al. (1982, 1983).
9. Comparing $\overline{\Delta t_{start}(113/234)}$ and $\overline{\Delta t_{start}(64/113)}$ of T1-events we conclude that the dependence of the electron density in the "trigger zone" of flare-related mass motions on the height cannot well be represented by a model const. $xN_{eNewkirk}$.
10. There is a very loose correlation between the related values of $\Delta t_{start}(113/234)$ and $\Delta t_{start}(64/113)$ especially in case of T1-evets (cf. Fig. 4). For this reason it cannot be excluded that the start of a noise storm continuum at the different observing frewuencies may be triggered in different parts of an outward drifting exciter.

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