LETTERS TO THE EDITOR

ASTROPHYSICS

Active Dark Filaments and Type III Bursts

AT the Ondrejov Observatory, simultaneous observations of a spectroheliscope by L. Krivsky and radiometers at 231 and 260 Mc/s by A. Tlamicha were made, showing a clear time coincidence between a type of group of bursts, even when the duration is short, and active dark filaments without flare in more than 15 cases during 1960–62. This type of group of bursts referred to as type N_A (and N_B) (ref. 1) is a group of short duration bursts without remarkable enhancement of base-level.

In order to identify the spectral type of these bursts, the same type of groups of bursts recorded at the Tokyo Astronomical Observatory with a polarimeter at 200 Mc/s has been compared with the spectral data (15–210 Mc/s) obtained at the Dapto Station, Sydney. The foregoing type of bursts seems to be the group of type III bursts. Almost all the identifications were made by using a list of the spectral observations *Spectral Classification of Solar Activity*, Dapto, Sydney, but some of them were already identified with type III bursts by a direct comparison with the spectral records by the courtesy of the Sydney group, and also these bursts are almost unpolarized as the type III bursts at 200 Mc/s usually are.

In order to certify the correlation between the active dark filaments and type III bursts, active prominences and active filaments (without flare) observed in 1960 with a spectroheliscope has been compared with radio activities observed with an interferometer and a polarimeter at 200 Mc/s at the Tokyo Astronomical Observatory. Even though the number of the optical observations is quite small, a good coincidence in position is found in 5 of 6 cases between the active prominences (and active filament) without flare and groups of type III bursts at 200 Mc/s occurring in the periods of the optical activities. The number of association of the type III bursts with the optical activities is 8 out of 21 despite the fact that the high-frequency cut-off for type III bursts may sometimes occur below 200 Mc/s and that the radio waves from the extreme limb may not be observed (Table 1).

Table 1

Active prominences		Type III group at 200 Mc/s			
	No. of events	No. of association	Coincidence in position	No observation in position	No coincidence in position
Prominence	20	7	4	2	1
Filament	1	1	1	0	0
	21	8	5	2	1

During the periods of the active prominences and active filaments already mentioned, 27 out of 33 cases have type III groups given in the list of *Spectral Classification of Solar Activity*, Dapto, Sydney, in some frequency ranges between 210 Mc/s and 15 Mc/s, although chance coincidences may be included and also the sensitivity of the spectrometer is not enough to record weaker type III bursts.

These results may support a statistically significant, but small, correlation, which has been shown by G. Swarup, P. H. Stone and A. Maxwell[2], between surges without flares and fast-drift bursts observed with spectrometers. The correlation is probably better if more weaker type III bursts were able to be recorded. C. S. Warwick[3] has shown a good correlation between large ascending prominences and radio activities at 200 Mc/s. J. P. Wild and H. Zirin[4] have reported that, in some cases, limb surges were associated with groups of type I bursts. These groups of bursts shown in their paper, however, seem to us to be groups of type III bursts.

In order to derive a more definite conclusion, we should like to point out the importance of observations of active dark filaments and active prominences with spectroheliscope using line shifter, taking a direct contact with radio observations with interferometer, more sensitive spectrometer and polarimeter. Both the starting and the location to be observed by the helioscope can be determined by radio observations.

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[2] Swarup, G., Stone, P. H., and Maxwell, A., *Astrophys. J.*, **131**, 725 (1960).
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PHYSICS

Sodium-24 produced by Cosmic Radiation

COSMIC radiation produces several radioactive nuclides by spallation of atmospheric argon. Some of them have been detected; first phosphorus-32 in rain-water[1], then sulphur-35 (ref. 2) and afterwards phosphorus-33 (ref. 3). Sodium-22 was also found[4] in spite of its very low yield caused by the large mass difference compared with argon-40. Furthermore, Winsberg[5] succeeded in finding the short-lived nuclide chlorine-39 (55 min half-life).

The success in detecting sodium-22 and chlorine-39 suggested that it might also be possible to find sodium-24 (15 h half-life) which had not so far been detected. It was to be expected that the production rate would be of the same order as that of sodium-22 and that the yield in rain would be sufficient for measurement.

Indeed sodium-24 has been detected in several rains for the first time during the work recorded here.

A detector had to be designed with an appreciable efficiency and a very low background. Nearly 100 per cent of sodium-24 decay by β^--emission (E_{max} 1·4 MeV) to a 4·12-MeV level of magnesium-24. The de-excitation from this level to the ground-state is associated with a γ-cascade of 2·75 MeV and 1·37 MeV. The 2·75-MeV ray was measured by a 4 in. × 2 in. sodium iodide (Tl)-crystal with a bore-hole of 2 in. diameter and 0·5 in. depth. The 1·37-MeV peak cannot be used because it is obscured by the 1·28-MeV peak and the Compton distribution of the 1·79-MeV sum peak of sodium-22 always present at the same time. To reduce the background the β-radiation is measured in coincidence by a flow counter which extends into the bore-hole of the crystal. Except for the bottom the detector is surrounded by a guard counter in anti-coincidence to eliminate the effects caused by cosmic ray mesons. The whole detector unit is screened by 5·5 in. lead. The counting efficiency of the arrangement is 1·4–1·7 per cent (depending on the β-absorption in the sodium chloride layer of the sample), the background being 0·22 c.p.h. or 0·003 c.p.m. The crystal itself has a counting efficiency of 4 per cent and a background of 72 c.p.h. or 1·2 c.p.m.

Rain-water was collected over an area of 8·6 m² and put through an ion-exchange column of 6 cm diameter and 52 cm length filled with 'Dowex' cation exchange resin,