Short Time Transients in Solar Noise

At the radio observatory near Dwingeloo, a beginning has been made with measurements of solar radiation at 400 Mc./s. The aim is to obtain quantitative data about transients of short duration (pips), and possibly some insight into the underlying mechanism which excites the coronal plasma. Some parameters in question are: length of the time interval between half-power points (duration), intensity, asymmetry, frequency band-width and polarization-rate.

The principal result of preliminary measurements on a dozen days, spread over three months, concerns the duration of pips. A histogram on 500 isolated and fairly isolated ones yields a sharp maximum at 0·18–0·03 sec. Other values occur much less frequently, and there is no indication of a second maximum of less than 1 sec. No correlation has been found between duration and height of pips.

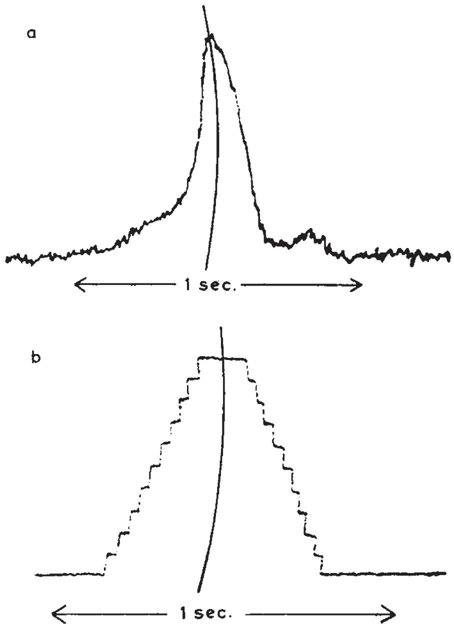

Fig. 1. (*a*) Record of a typical pip. (*b*) Record of a step voltage illustrating resolving power in time of recorder

Perhaps the time interval between successive pips is a relevant quantity during noise storms. Such a period on August 29, 1956, yielded 0·25 ± 0·04 sec.; the mean duration was 0·13 ± 0·03 sec.

The fact that these values come out with a rather low spread suggests that they are related to an elementary phenomenon, amenable to theoretical description. Reber[1] has put forward a hypothesis, which claims the existence of a linear relationship between wave-length in metres and duration of pips in seconds, the constant of proportionality being one. Apparently this does not hold when the wave-length is 0·75 m.

An accuracy of 0·01 sec. being readily obtainable, it seems to be worth while to determine mean durations on several wave-lengths and their dependence on time.

Thanks are due to the Radio Astronomy Section of the Netherlands PTT (Postal Service) for lending the receiver. The work has been supported financially by the Netherlands Organization for Pure Scientific Research (ZWO).

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[1] Reber, G., *Nature*, 175, 132 (1955).

Determination of Radon and Thoron in Air

The presence of natural radioactive gases in the atmosphere was first demonstrated more than fifty years ago, and in recent years interest has been renewed in the subject.

A method for determination of radon favoured by the later investigators has been filtration of about 1 cubic metre of air, and subsequent detection of the activity found on the filter using a particle counter or ionization chamber; radon passes through the filter and the short-lived activity observed is that of the four immediate daughter products attached to dust particles. With appropriately large volumes of air, a similar procedure is suitable for the determination of thoron products, the activity of which still remains when, after the lapse of a few hours, radon products are virtually decayed. Activity remaining after a few days is attributable to fission dust.

Published figures of natural radioactivity show some differences which are difficult to reconcile, and, in so far as investigators have been reticent in indicating their methods of calculation, it is uncertain whether satisfactory formulation has always been achieved of the equations which express the complex pattern of decay. The purpose of this communication is to put forward general expressions by which the concentration of radioactive gas may be related to the observed activity of mixed decay products in the filtration type of experiment. These expressions are a corollary of Rutherford's mathematical theory of successive changes and they are found to reduce to a simple symmetrical form.

The decay constant (λ) for each radioactive species is commonly employed in such calculations, but in the present instance there is a notational advantage in using the reciprocal of λ. This constant, denoted here as Λ, can be defined as the time in which a large number of atoms of an isolated species decays to the fraction $1/e$; Λ also represents the mean life of the atoms.

Consider the case in which air is filtered at a constant rate from an atmosphere in which the concentration of radon remains constant, the decay products being in secular equilibrium. Let Λ_A be the mean life of radium A expressed in minutes, and Λ_B, Λ_C, $\Lambda_{C'}$, the corresponding constants for radium B, C and C′. T is the period of filtration in minutes, and t any time in minutes subsequent to T. For typographical convenience:

$$A = 1-\exp(-T/\Lambda_A)\,; \quad B = 1-\exp(-T/\Lambda_B)\,;$$

$$C = 1-\exp(-T/\Lambda_C)\,; \text{ etc.}$$

$$a = \exp(-t_1/\Lambda_A) - \exp(-t_2/\Lambda_A)\,;$$
$$b = \exp(-t_1/\Lambda_B) - \exp(-t_2/\Lambda_B)\,; \text{ etc.}$$

It can be shown that the expressions which follow are a measure of the number of particles of each type emitted from the filtered material in an interval $t_2 - t_1$: