Byfleet 3161 Ex.13. Ref: PE/JSH

Military Operational Research Unit.
Broadoaks,
Parvis Road,
West Byfleet.
Surrey.
ENGLAND

7th April, 1948.

Dr. C. Reber,
National Bureau of Standards,
Washington 25,
U.S.A.

Your Ref. 14.5/904

Dear Dr. Reber,

Thank you for your letter of 2nd February. Since we moved from Richmond Park to our new station here at West Byfleet we have not had the effort available to restart any galactic noise measurements, and therefore no further experimental observations on the Cygnus fluptuations have been made since those in 1946 referred to in our Report 355 (now published in Proc. Roy. Soc.)

Our 1946 observations were sufficient to rule out the ionospheric origin of the fluctuations because -

(a) Cygnus was the only region showing the fluctuations.

(b) The fluctuations were observed both for the rising and setting of Cygnus which took place at constant sidereal times and therefore, for observations made in May-June and October-December, at widely different solar times.

The recent publication of Bolton & Stanley in Nature supports our view that the origin is outside the solar system although their location of the source is of considerably smaller angular width than we had derived from our results, which of

course, were obtained with a comparatively wide beam.

I am not sure what measurements of galactic noise we shall attempt in the future as we have much other work on our official programme. I shall look forward to seeing the publication of any work you are doing.

Yours sincerely,

J. S. Hey

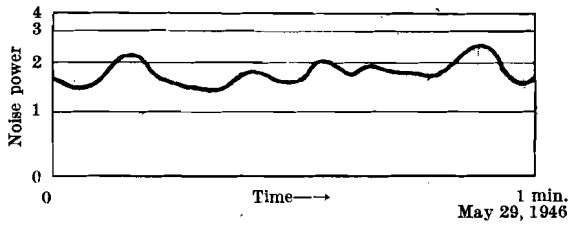
P.S. I enclose a reprint of our earliest publication on the Cygnus fluctuations.

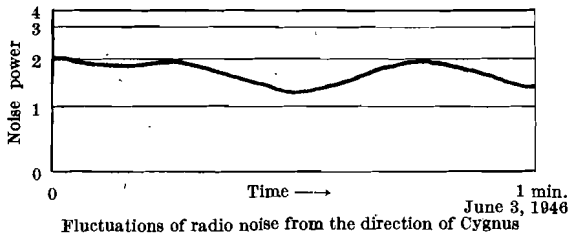
(*Reprinted from* NATURE, *Vol.* 158, *page* 234, *August* 17, 1946.)

Fluctuations in Cosmic Radiation at Radio-Frequencies

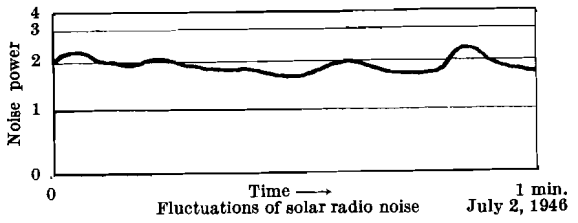
IN a previous publication[1] we described the results of an investigation into the spatial distribution of cosmic electromagnetic noise radiation at 5 metres wave-length. We have recently been engaged in an attempt to make a more detailed determination by using a more sensitive receiver of narrower beam-width. An interesting new feature which has emerged from these latter experiments is the occurrence of short-period irregular fluctuations which have been found to be associated with the direction of Cygnus. This region, which is a secondary peak in the cosmic noise distribution, appears to be unique in being characterized by short-period variations of marked amplitude in the intensity of power flux.

A watch on this region has been kept intermittently during the last four months. The receiving apparatus, situated in Richmond Park, has an aerial beam rotatable in bearing but fixed in elevation at an angle of 12°. The region of the fluctuations ascended and descended through the aerial beam on bearings 30° and 330° respectively. The





Fluctuations of radio noise from the direction of Cygnus



Fluctuations of solar radio noise

corresponding times were 0100 hr. and 1900 hr. G.M.T. in February, when the watch was commenced, while in June they were 1800 hr. and 1200 hr. G.M.T. Care was taken to avoid including recordings taken in daylight periods when the powerful solar noise emission associated with the great sunspot in February was also present. Since the observations covered a wide range of bearings and solar times, we were able to rule out the possibilities of terrestrial or solar causes, and the interpretation of the results was consistent only with an origin in the direction of Cygnus.

It is not easy to determine the bearing of a source of irregular disturbance with a high order of accuracy unless an exceptionally narrow beam is used. The aerial of the equipment has a beam width of approximately ± 6° to half power in bearing and elevation, and the average of a large number of observations indicated a source of disturbance subtending an angle not exceeding 2°. There may be other areas of occasional fluctuation in the immediate vicinity (within 8°).

The average amplitude of the fluctuation is 15 per cent of the mean power received. If the disturbed area be assumed to extend over a circle of angular diameter 2°, then this solid angle is 1/36 of that for the equivalent acceptance cone of the aerial beam. The variations in power per unit solid angle therefore correspond to more than five times the mean power per unit solid angle for the whole beam. The centre of the region is approximately R.A. 2000 hr., Decl. + 43°. The type of fluctuation, which itself varies from day to day, is illustrated in the accompanying figure. The noise from Sagittarius would, by comparison, appear as a straight line on a diagram of this scale.

It appears probable that such marked variations could only originate from a small number of discrete sources. This suggests at once the analogy with the radio-frequency sunspot radiation[2,3,4]. The solar radio noise from sunspots is also characterized by strong fluctuations. A recording of these solar radiations, taken on July 2, is also shown in the figure. On the other hand, Greenstein, Henyey and Keenan[5] have recently pointed out the difficulties in attempting to account for the magnitude of cosmic radiations in terms of the solar phenomena; further, they direct attention to the close agreement between experimental observations of cosmic noise intensity and their calculations of the expected interstellar radiation arising from free transitions of electrons in the field of protons. A theory in terms of widely distributed interstellar matter does not, however, appear readily to account for the localized disturbances just described. These fluctuations therefore appear of special importance in that they may prove particularly relevant to the explanation of the origin of cosmic radiations at radio frequencies.

We are indebted to the Director General of Scientific Research and Development (Defence), Ministry of Supply, for permission to publish this communication.

J. S. HEY
S. J. PARSONS
J. W. PHILLIPS

Ministry of Supply.
July 4.

[1] Hey, Parsons and Phillips, *Nature*, **157**, 296 (1946).
[2] Appleton, *Nature*, **156**, 534 (1945).
[3] Hey, *Nature*, **157**, 47 (1946).
[4] Pawsey, Payne-Scott and McCready, *Nature*, **157**, 158 (1946).
[5] Greenstein, Henyey and Keenan, *Nature*, **157**, 805 (1946).

PRINTED IN GREAT BRITAIN BY FISHER, KNIGHT AND CO., LTD., ST. ALBANS