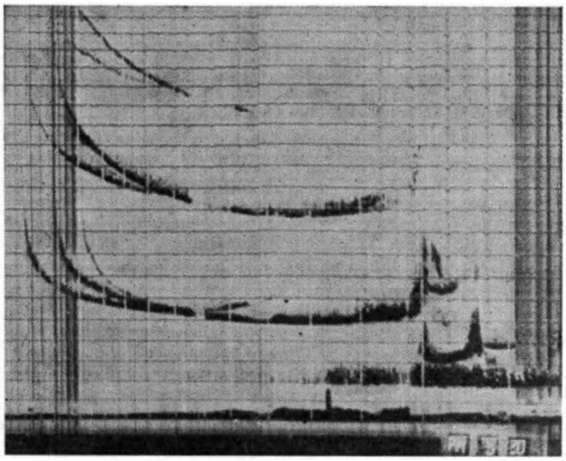
Triple Magneto Ionic Splitting of Rays Reflected from the F_2 Region

A RECORD for 1700 hr. local time on November 9, 1946, from the Hobart *P′f* recorder operating in the frequency range 1·5–13 Mc./s. is reproduced below.



The record shows the ordinary and extraordinary rays usually present from F_2 with critical frequencies of 7·6 and 8·5 Mc./s. respectively, as well as a third ray the critical frequency of which is 7·0 Mc./s. The critical frequencies of these rays correspond approximately to the Appleton–Hartree[1] reflexion condition $\mu = 0$ except that, neglecting collision, one would expect the third ray to have a critical frequency of 6·7 Mc./s. Discrepancies of about this magnitude and sign which are not ascribable to experimental error occur in all the 'triple split' measurements taken and may perhaps be accounted for if collision effects were included in the calculations. The possible existence of triple magneto ionic splitting in a layer where the variation of electron density with height is very rapid was first discussed by Mary Taylor[2], and the phenomenon has been observed by Toshniwal[3] and Liev Harang[4]; but the record shown is one of the best examples of it that we have seen.

Thirty-nine definite examples of this triple splitting have been observed in some 50,000 records spaced at regular intervals over a period of a year. Other records possibly showing this effect (quadruple and even higher multiple forking) have been discounted as examples of multiple magneto ionic splitting because of indications of stratification in F_2 or very spread echoes. The triple split records are generally accompanied by sporadic E ionization and seem more likely to occur under disturbed conditions. Triple splits have been observed at nearly every hour of the day, but they occur most frequently between the hours of 1700 and 2000. Occasionally they appear on the records over a period of several hours, starting or finishing as multiple forked records in the stratified layer. There appears on the Hobart data to be no evidence for the seasonal variation noticed by Harang. The figures for the number of occasions present (they may be either single occurrences or last for several hours) over twelve months are: 1946, September 2, October 4, November 3, December 0; 1947, January 0, February 3, March 5, April 1, May 0, June 2, July 5 and August 4. Further data on the occurrence of the phenomena will be analysed as they become available.

The records from the Hobart *P′f* recorder are measured by the University of Tasmania for the Radio Research Board of the Council of Scientific and Industrial Research, and I would like to acknowledge the help received from that body in this and other ionosphere investigations.

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Variable Source of Radio Frequency Radiation in the Constellation of Cygnus

COSMIC or galactic noise was discovered by Jansky[1] in 1931; but its exact origin has remained uncertain. It is generally supposed to originate from collisions in interstellar matter[2]; but there are divergencies between existing theory and experimental results, particularly at lower radio frequencies[3]. Hey, Parsons and Phillips[4] discovered variations in the intensity of galactic noise from the direction of the constellation of Cygnus, with a period of about one minute—suggesting that this particular radiation has its origin in a discrete source.

During the past three months, we have made a study of this region, mainly on 100 Mc./s., but also occasionally on 60, 85 and 200 Mc./s. The technique employed was to observe the region rising over the sea with aerials situated on a high cliff, as described by Pawsey, Payne-Scott and McCready[5]. Due to interference between the direct ray and the ray reflected from the sea, a lobe pattern is obtained which gives rise to a succession of maxima and minima. An estimate of the size of the source can be made from the relative heights of maxima and minima, and an accurate position found from the times of occurrence of minima.

Small aerial arrays were used—one or two Yagis—and considerable care was taken with receiver stabilization enabling receiver noise to be balanced out and the input signal amplified for presentation on a recording milliammeter. At 100 Mc./s. receiver fluctuations represented an input signal of less than 3×10^{-24} watts m.$^{-2}$(c./s.)$^{-1}$.

The general results of our investigations are:

(1) The variations from Cygnus originate in an area of less than 8′ angular width. This is an upper estimate and the source may well be effectively a point.

(2) The location of the source is R.A. 19 hr. 58 min. 47 sec. $\pm$ 10 sec. Dec. $+41° 41' \pm 7'$.

(3) The radiation consists of two components, one constant and the other showing considerable variation over short and long periods. In Fig. 1, a typical record of the source rising, the two components are separated by a dotted line. A record of the 'quiet' sun rising is shown for comparison in Fig. 2. The frequency in both cases was 100 Mc./s.; intensity scales are the same on both records.

(4) Observation on different frequencies shows that the intensity of the constant component has a shallow