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LOCATION ON JUPITER OF A SOURCE OF RADIO NOISE

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A search of old records of cosmic noise, taken in the Radiophysics Laboratory at 18·3 Mc./s., has confirmed the discovery, by Burke and Franklin [1], of radio radiation from Jupiter, and has further shown that in 1951 the radio radiation came from a very localized region of the planet.

The records studied fall into two series. The first series comprised records, using an aerial with beam-width 17°, taken at intervals during the period October 1950 to April 1951. Radiation from Jupiter appeared on about one-half of the days on which records were suitable (correct aerial direction, no obvious interference, etc.), and it was clear that the Right Ascension of the source changed with that of Jupiter. For some of these records more accurate direction-finding was possible using a split-beam technique, and these records proved that the position of the source was within $\pm 1°$ of Jupiter.

The second series of records had been taken with the aerial modified in such a way that the beam was still narrow in declination but was very broad in hour angle. Because of its broad beam it was capable of receiving signals from an extra-terrestrial source for nearly eight hours per day—a time which would cover nearly one complete rotation of Jupiter. This series of records, from 15 August to 2 October 1951, revealed Jupiter radiation on twenty-seven out of the thirty days on which there were suitable records, although on all days the bursts of radiation came in groups only an hour or two long.

A most interesting new fact coming out of the examination of these records was the very close relation between the times of occurrence of bursts and the rotation of Jupiter. For each record the times of activity were noted. Fig. 1 shows the longitudes of the central meridian during the times when bursts were received. The equatorial regions of the visible surface of Jupiter rotate more rapidly than the remainder of the planet

https://doi.org/10.1017/S0074180900049512 Published online by Cambridge University Press

and two conventional systems of zenocentric longitude are used. System I, which applies to the equatorial regions, is based on a rotation period of about $9^h\ 50^m$; system II on a rotation period of about $9^h\ 55^m$. It will be seen that the lines indicating times of occurrence of bursts are almost directly under each other when plotted against system II longitudes and show a steady drift towards increasing longitudes in system I. Closer examination shows that there is actually a small negative drift in the system II diagram. These drifts imply that the source of radiation had a rotation period slightly shorter than that adopted for the calculation of system II longitudes; the period of rotation is found to be $9^h\ 55^m\ 13^s$, with an estimated probable error of $\pm 5^s$.

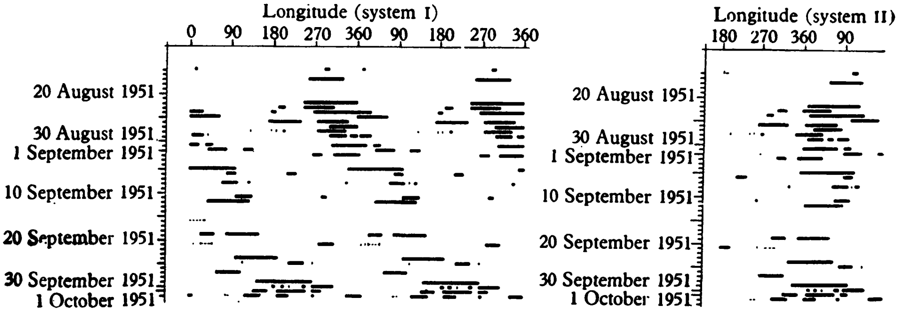

Fig. 1. Periods of occurrence of 18·3 Mc./s. radiation from Jupiter plotted against longitude of the central meridian at the time of observation.

After allowing for the slight drift in longitudes, all the lines in Fig. 1 were superimposed to give a histogram of the frequency of occurrence of the noise for 5° intervals of central meridian longitude. This is shown in Fig. 2, the longitudes being system II longitudes on 14 August. This figure shows that for a band of longitudes centred on 67° and extending from about 0° to 135°, the frequency of occurrence was much greater than outside this band. This suggests an origin in a very localized source on Jupiter. Since there were about 120 rotations of Jupiter during the period of the observations on which the figure is based, the probability that the effect observed is due to chance is extremely small.

Fox [2] has given a summary of the observations of Jupiter at this time which were communicated to the Jupiter Section of the British Astronomical Association. A disturbance at the boundary between the South Temperate Zone and the South Temperate Belt, which was observed for several months, had an observed rotation period of $9^h\ 55^m\ 13^s$, that of the radio source. All the other belts which move with system II were either faint, with no certain markings, or moved slightly more slowly than system II. Fox gave a sketch by E. J. Reese which depicted the visually most active region of the South Temperate Belt at the end of November 1951. The radio observations ceased on 2 October, but, allowing for a continuing drift in longitude, the longitude of the radio source on 30 November would have crossed the middle of one of the prominent white markings in Reese's sketch. Therefore, although the identification is not proved beyond all doubt, it seems very probable that this visually dis-

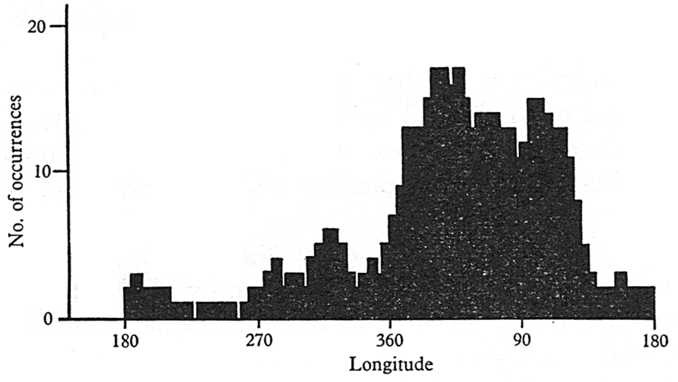

Fig. 2. Frequency of occurrence of 18·3 Mc./s. radiation from Jupiter for intervals of 5° in longitude (based on a rotation period of $9^h\ 55^m\ 13^s$). The longitudes are system II longitudes on 14 August 1951.

turbed region was responsible for the radio radiation, the most intense source lying in one of the white spots at the southern edge of the South Temperate Belt.

The mechanism of origin of the radiation is still unknown. Observations during the last few months have confirmed a result suggested by the 1950–51 observations that the individual bursts have durations ranging from fractions of a second to many seconds. An origin in electrical discharges analogous to terrestrial atmospherics is not unlikely. The recent observations are also consistent with the hypothesis of a localized source of the radiation.

A full discussion of the 1950–51 observations will be given in the *Australian Journal of Physics*. [3]

REFERENCES

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