Sources of Radio Noise on the Planet Jupiter

THE discovery in 1955 by Burke and Franklin[1] of a source of radio noise corresponding to the position of the planet Jupiter was confirmed by Shain[2], who reviewed a series of old records taken in an investigation of cosmic noise at 18·3 Mc./s. during 1950–51. Shain found that certain noise bursts, which previously had been assumed to be interference, corresponded to the times when Jupiter was passing through the reception beam of the aerial system. He then expressed the times at which these noise bursts occurred in terms of the System I and System II zenocentric longitudes used for Jupiter (corresponding respectively to rotation periods of 9h. 50m. 30s. in the equatorial belt and 9h. 55m. 40·6s. for the rest of the planet) and found that a certain periodicity was shown in the System II longitudes, corresponding to a localized source at a longitude of 67°. The results were correlated, so far as possible, with visual observations made by the Jupiter Section of the British Astronomical Association, and the possible identification of the noise source with a visual disturbance in the Southern Temperate Belt was discussed.

A further investigation of the Jupiter radio noise has been made in this laboratory at 18·0 Mc./s., using an eight-dipole aerial array having a beam width, to the half-power points, of about 30° in the east–west direction. A series of daily records were taken from December 31, 1956, to March 8, 1957; nearly every record was taken in the presence of an observer to guard against recording unwanted interference. It was found that the noise bursts occurred less frequently than when observed by Shain during 1950–51; a total of sixty-seven observations yielded thirty-seven useful records on which the radiation appeared with a good degree of certainty.

Following Shain, the times when the noise bursts occurred were expressed in longitudes of the central meridian during the bursts, and these are shown for System II in Fig. 1. Histograms were made of the frequency of occurrence of the noise for 5-deg. intervals of central meridian longitude, and these are shown in Fig. 2. In System I the distribution appears to be random, but in System II the noise bursts occur most frequently in two longitude bands centred on about 105° and 210°, each band having a maximum

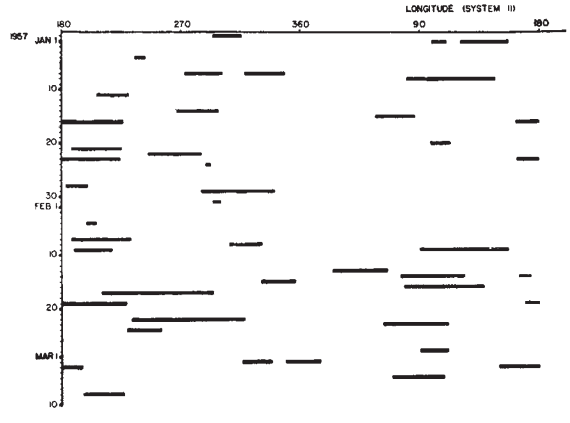

Fig. 1. Observed periods of noise in terms of System II zenocentric longitude

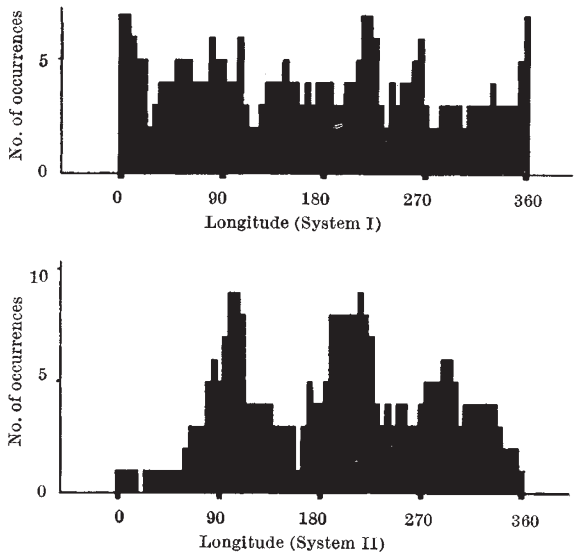

Fig. 2. Histograms showing frequency of occurrence of the noise bursts for 5-deg. intervals of central meridian longitude in both System I and System II

width of about 90°. This suggests the existence of two sources of noise, with the possibility of a somewhat weaker source centred on about 290°, near the present longitude of the Red Spot.

A final correlation of the radio observations with possible visual features is awaiting reports from the British Astronomical Association and the Association of Lunar and Planetary Observers on the current apparition of Jupiter. It would seem likely from both Shain's and our observations that any radio noise which has been observed so far is due to a localized source, or sources, and is not distributed over the whole body of the planet.

The narrow longitude band-widths of the two sources indicated in Fig. 2 suggest the existence of an ionosphere on Jupiter, since the longitude band-widths should be at least 180° if no refraction effects occur. If a localized source is assumed and the critical angle is taken as 45° (half the longitude band-width), then an electron density of the order of 10^6/cm.[3] is indicated, which is comparable to that of the Earth.

Shain's source was found to have a longitude band-width of about 135°; this could have been due to two overlapping sources, possibly the same two sources observed by us, drifts in longitude having taken place to separate the sources and to change the longitudes of their centres.

It is hoped to publish a more detailed account of this work elsewhere. One of us (C. H. B.) is studying in the United States under the Fulbright Programme sponsored by the Institute of International Education.

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[1] Burke, B. F., and Franklin, K. L., *J. Geophys. Res.*, **60**, 213 (1955).
[2] Shain, C. A., *Nature*, **176**, 836 (1955); *Austral. J. Phys.*, **9**, 61 (1956).