NOTES

COSMIC STATIC

Several papers[1] have been published which indicate that an electromagnetic disturbance in the frequency range 10–20 megacycles arrives approximately from the direction of the Milky Way. It has been shown[2] that black-body radiation from interstellar dust particles is not the source of this energy.

The antenna system shown in Figure 1 was constructed for the investigation of this phenomenon.[3] The receiver can be set at the desired declination by rotating along the meridian on the circular tracks at each side. Readings at a fixed declination are taken over an interval of several hours, the rotation of the earth providing the change in right ascension.

The drum at the focal point is an artificial black body described elsewhere.[4] The entire receiving system has an effective cone of acceptance approximately 3° in diameter.

The output is indicated by a microammeter so connected that any intercepted energy will cause the readings to decrease. A few typical records are shown in Figure 2, in which the individual points are omitted because they lie too close together. The magnitude of the dip in the curve gives a measure of the intensity of the received energy. Over a long period, as the apparatus warms up, the zero level will gradually rise. The dotted line indicates the run which would have been obtained had no radiation been captured.

The results of preliminary measures of the variation of the static

[1] K. G. Jansky, *Proc. I.R.E.*, **20**, 1920, December, 1932; **21**, 1387, October, 1933; **23**, 1158, October, 1935; **25**, 1517, December, 1937. H. T. Friis and C. B. Feldman, *Bell Tech. J.*, **16**, 337, July, 1937.

[2] Whipple and Greenstein, *Proc. Nat. Acad. Sci.*, **23**, 177, 1937.

[3] For details of the instrumental design and the method of reduction of the data see G. Reber, *Proc. I.R.E.*, **28**, 68, 1940.

[4] G. Reber, *Communications*, **18**, 5, December, 1938.

disturbance as a function of galactic longitude are shown in Figure 3, in which each point represents the central intensity of the dip on one

FIG. 1.—Antenna system viewed from the north. The resonance chamber can be seen supported at the focal point of the parabolic reflector.

night's record. The magnitude of the systematic error may be ± 50 per cent, but the general order of the disturbance is correct. The plane from which this energy arrives is tilted about 5° south of the plane of the galaxy in the vicinity of longitude 150°.

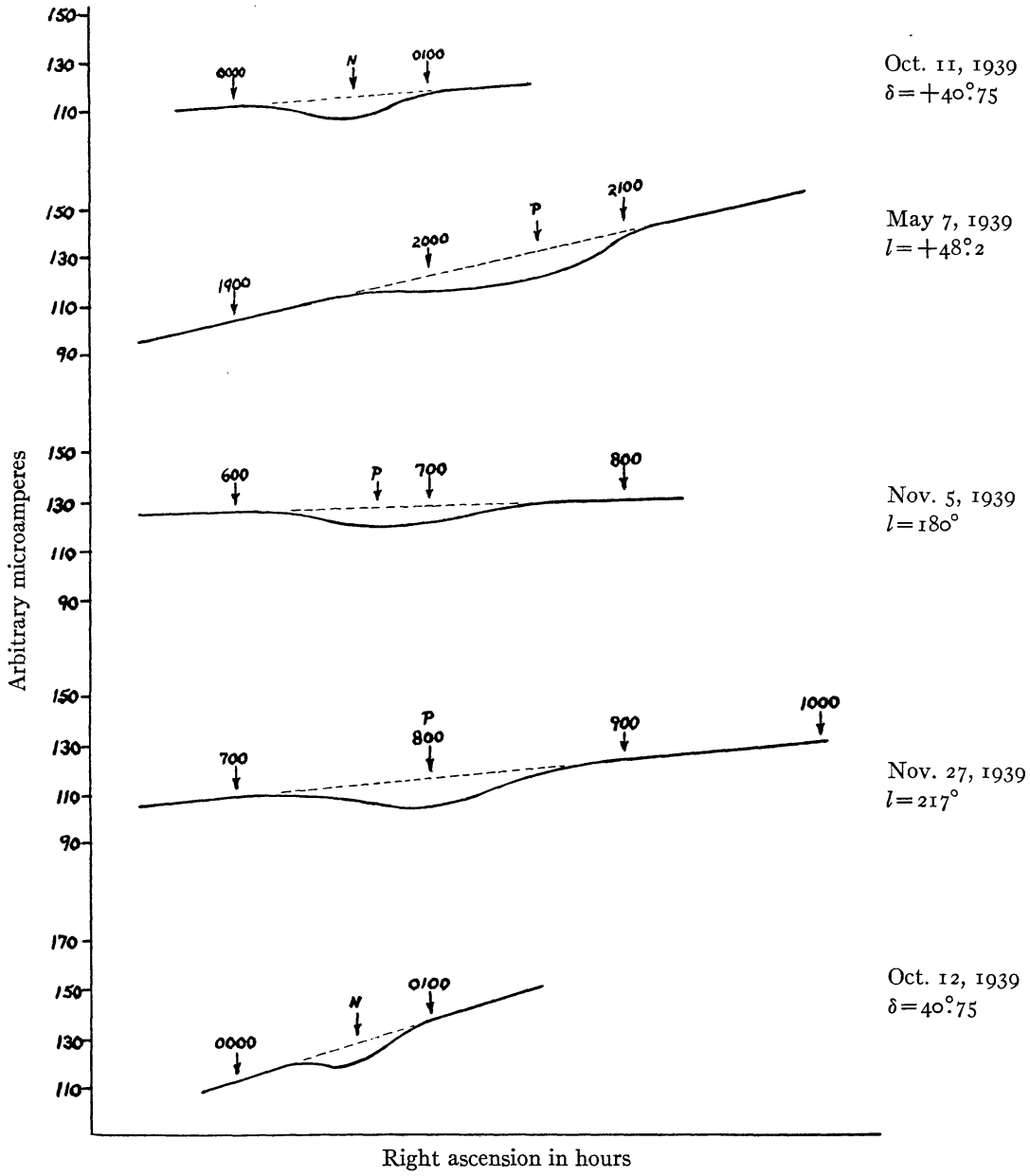

FIG. 2.—Typical records of observation. *P*—plane of Milky Way; *N*—center of Andromeda Nebula.

Since the theory of black-body radiation predicts an intensity proportional to the square of the frequency in this range, the first tests were made at 3300 megacycles. Nothing was found at the sensitivity limit of 10^{-20} watts per square centimeter per circular degree per kilocycle band width. Improved equipment for the frequency of 900 megacycles gave no results at the limit of 10^{-22} watts per square centimeter per circular degree per kilocycle band width. The data of Figures 2 and 3 were obtained at 162 megacycles.

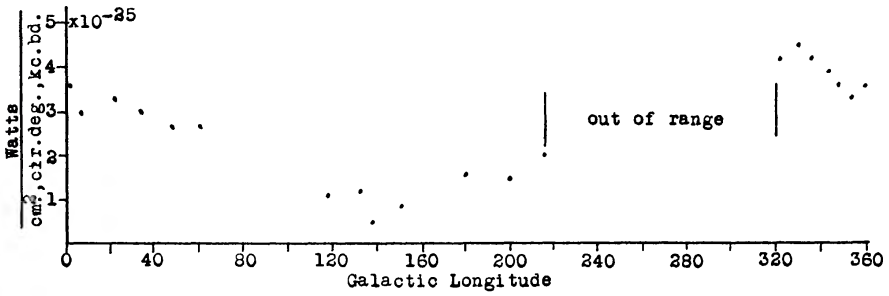

FIG. 3.—Intensity of maximum incident radiation as function of galactic longitude.

A few bright stars, such as Vega, Sirius, Antares, Deneb, and the Sun, gave negative results. Mars and the Orion nebula also gave no readable indication. If radiation is present from any of these objects, the intensity is below 10^{-25} watts per square centimeter per circular degree per kilocycle band width at 162 megacycles. The only other positive results are from the great nebula in Andromeda, with a mean of four readings, giving a maximum intensity of 8×10^{-26} watts per square centimeter per circular degree per kilocycle band width.

The foregoing observations confirm previous evidence that radiation in the radio spectrum is apparently coming from the direction of the Milky Way. The intensity is a function of galactic longitude.

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