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ANOMALOUS NIGHT-TIME RECEPTION OF A MAJOR SOLAR RADIO BURST

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Anomalous Night-Time Reception of a Major Solar Radio Burst

DURING the early morning hours of March 8, 1958, the planet Jupiter was under observation by a total of five different receiving arrays at the University of Florida Radio Observatory. Two of these arrays operated at a frequency of 18 Mc./s., two at 22·2 Mc./s., and one at 27·6 Mc./s. Both pen recording and aural monitoring of the signals by an observer were employed. At 0235 U.T. an unusual event began simultaneously on all five channels, consisting of a single very intense burst of noise which slowly rose to a maximum, and even more slowly declined over a total period of about 2 min. During this interval the observer was able to obtain an excellent record of the polarization of the disturbance with the 22·2 Mc./s. polarimeter, which was kept in stand-by condition during all periods of observation.

The outburst differed from typical Jupiter noise in a number of respects: (1) the relatively smooth rise and fall of the signal was slower by at least an order of magnitude than any previously observed single Jupiter pulse[1]; (2) no Jupiter pulse had been observed at this Laboratory simultaneously on all three frequencies; (3) analysis of the polarimeter record showed the burst to be polarized in the left-hand elliptical sense, whereas all the Jupiter noise analysed here had shown right-hand circular or elliptical polarization. Although the event had occurred more than four hours prior to sunrise, it was inescapable that it displayed many of the characteristics of a solar burst, rather than a Jupiter pulse.

Subsequent correspondence with C. A. Shain in Australia disclosed that a major solar burst had indeed been observed at stations in Potsdam, Uccle, Nogaya, Tokyo and Sydney, on the sunlit hemisphere of the Earth, at the same instant as the event described above. Unfortunately, all the available observations were at frequencies much higher than those of the Florida station; but the observations made at Sydney at 108 Mc./s. were off-scale and were described as possibly "one of the largest bursts ever observed near this frequency". It seems clear, then, that the event observed in Florida was this major solar burst, propagated by some means far into the dark hemisphere of the Earth.

The relevant relationships are shown in Fig. 1

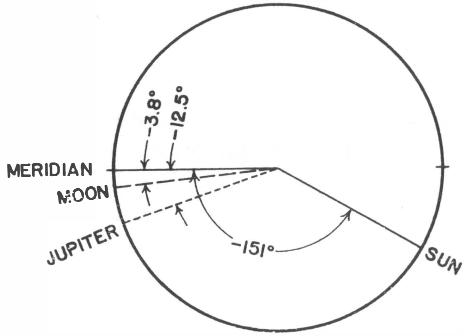

Fig. 1. Polar diagram showing the relationships between the bodies of interest

which is a polar diagram of the Earth, with the directions of the bodies concerned shown in terms of hour angle. It should be remarked in connexion with this diagram that the antenna patterns are centred on the meridian and are approximately 30° wide in the east–west direction. Of interest is the fact that the Moon was actually closer to the centres of the antenna beams than was Jupiter at 0235 hr. U.T., so that a lunar reflexion of the burst immediately suggests itself. If one assumes a lunar reflexion coefficient of 0·15 and a directivity factor of 4 due to scattering[2], the attenuation factor for a lunar echo would be about 10^{-5}. The peak flux recorded at Florida at 18 Mc./s. was off-scale at approximately 6×10^{-20} watt m.$^{-2}$ (c./s.)$^{-1}$, suggesting that at this frequency the directly received burst would have had an intensity of about 6×10^{-15} watt m.$^{-2}$ (c./s.)$^{-1}$ at 18 Mc./s. The Australian observers estimated the intensity as being of the order of 10^{-17} watt m.$^{-2}$ (c./s.)$^{-1}$ at 108 Mc./s. Although no direct comparison can be made because of this large difference in frequency, the orders of magnitude do not seem entirely to exclude the possibility of a lunar reflexion. (We would welcome intensity data from this event from any station which happened to record it at a frequency nearer 18 Mc./s.).

The other possibility is, of course, that the radiation penetrated the ionosphere through an anomalous 'thin' spot in the daylight hemisphere, and was then propagated around the Earth by the usual modes of transmission. In this connexion, Shain was kind enough to point out to us the curious focusing at the antipodal point of the 40-Mc./s. signal from *Sputnik I*, which was reported by Wells[3].

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