

# THE GREAT SOLAR FLARE OF FEBRUARY 23, 1956 AND ASSOCIATED IONOSPHERIC EFFECTS AT AHMEDABAD

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FOR some months now, the Physical Research Laboratory, Ahmedabad, has been recording continuously cosmic radio noise from the vertical sky on a frequency of 25 Mc/s, using a broadside collinear array of 16 dipole aerials, covering an angle of 37° in N-S and 30° in E-W directions. A Hamnerlund Communications receiver with its output amplified by a differential D.C. amplifier, and calibrated by a diode noise generator, is used to record the noise intensity on an Evershed recording milliammeter. On 23-2-1956, an exceptionally large sudden absorption of cosmic noise (SCA) was observed. It commenced at 0831 hours 75° E Meridian Time, (0331 hours G.M.T.), reached its maximum at 0838 hours and died out by about 0930 hours. The sudden increase in absorption took place in two stages, the second and larger increase being at 0833 hours. A photograph of the record is reproduced in Fig. 1.

2. In Fig. 2, the noise record of 23-2-1956 is compared with those on three neighbouring days. By interpolating the "undisturbed" curve of variation on 23-2-1956, and expressing the differences in intensity at different times from the undisturbed values, it appears that the intensity of cosmic noise at the time of maximum absorption was 6.5 decibels below normal. This value may be compared with the highest absorption of 7 db. noted by Dr. C. A. Shain and Dr. A. P. Mitra (1954) at 18.3 Mc/s during a solar flare on April 20, 1951, in Australia.

3. By the courtesy of the Chief Engineer, Overseas Communication Service, India, we give below the observations on the fade-outs of long-distance communication recorded by the Beam Wireless Station, Poona, on 23-2-1956.

TABLE I  
*Radio-communication fade-outs recorded by Beam Wireless  
Station, Poona, on 23-2-1956*

Circuit	Frequency (Kc./s.)	Time of Fade-out
Osaka, Japan .. ..	18,355	0835 to 1015 hours 75° EMT. Weak signals Up to 1045 hours
China .. ..	20,120	
Melbourne .. ..	18,700	
Bangkok .. ..	18,200	
Indonesia .. ..	18,135	0835 to 1915 hours
Kabul .. ..	7,788	0835 to 1915 hours

The equivalent vertical incidence frequencies for one- or two-hop reflections for an assumed height of reflection of 300 km. are all below 7 Mc/s.

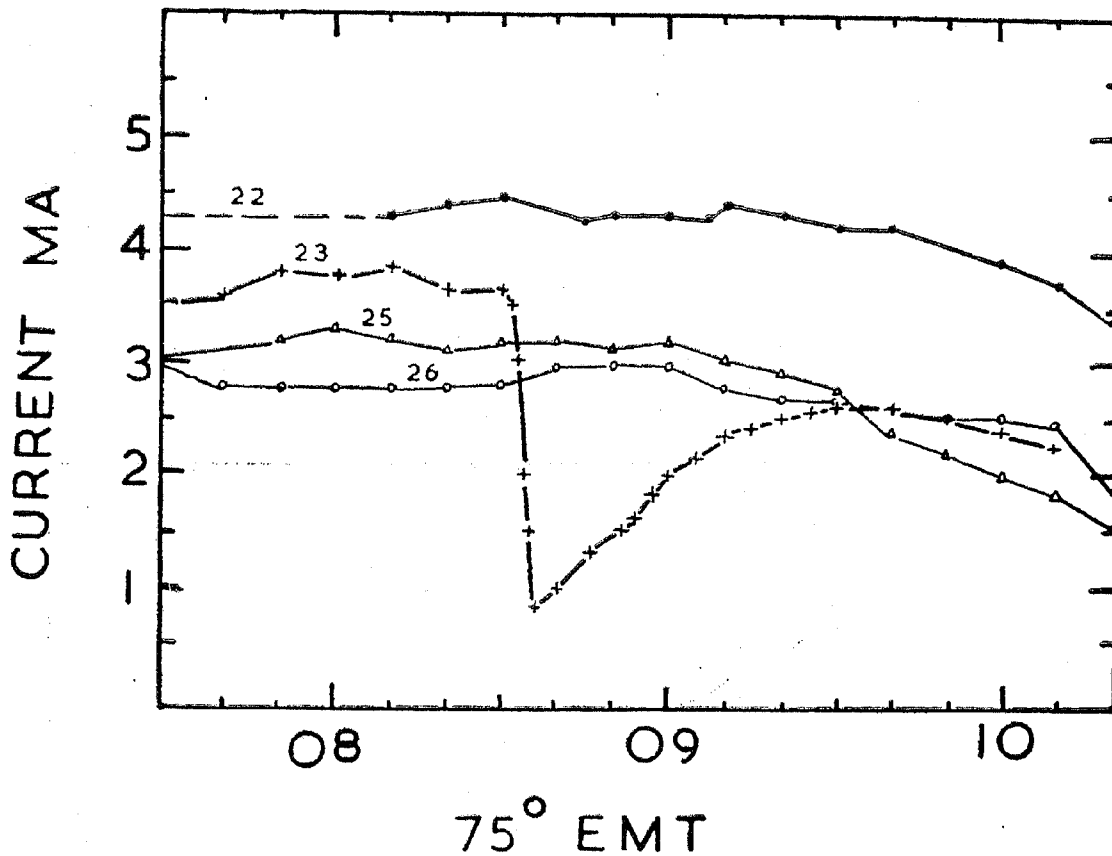


FIG. 2. Cosmic Radio Noise, 25 Mc/s, 1956 Feb. 22, 23, 25 and 26, Ahmedabad.

4. The hourly records of the vertical pulse soundings of the ionosphere made in the laboratory showed that the reflections were normal at 0800 hours 75° EMT, but at 0900 hours, there was a black-out of all vertical reflections up to 10 Mc/s (Fig. 3). It will be seen that at the same hour, the reflections of radio waves emitted by broadcasting stations were not visible even at 15 Mc/s.

All this, and most significant of all, the definite significant increase in cosmic-ray meson flux recorded at the low geomagnetic latitudes of Ahmedabad, Kodaikanal and Trivandrum, mark out this solar flare as one of exceptional magnitude and character (*Ibid.*, Sarabhai *et al.*).

5. It is known that these sudden short-wave absorptions (SCA's) follow solar flares and are associated with sudden changes of ionospheric reflections of long radio waves and magnetic "crotchets". The Cavendish workers (Bracewell, 1952; Weekes, 1955) give reasons for thinking that the additional

short-wave absorption occurs in a layer well below the normal E layer, at a height of about 75 km. They have made the suggestion that during strong flares, the sun emits some radiation (probably in the short X-ray region) which penetrates the F and E layers and ionises some constituent of the atmosphere which exists normally in small quantities at about 75 km. Nothing, however, is *definitely* known either about the frequency of the radiation or the atmospheric constituent responsible for the increased low-level ionisation.

6. It may be of some interest to record here another strong cosmic radio absorption which occurred on 10-3-1956. It commenced at 0945 hours, reached its peak at 1005 hours and died out at about 1110 hours 75° EMT (Fig. 4). The maximum absorption in this instance was 3.6 db. The hourly ionospheric vertical soundings at Ahmedabad showed normal reflections at 0850 hours, complete absorption up to 9 Mc/s at 0955 hours and absorption

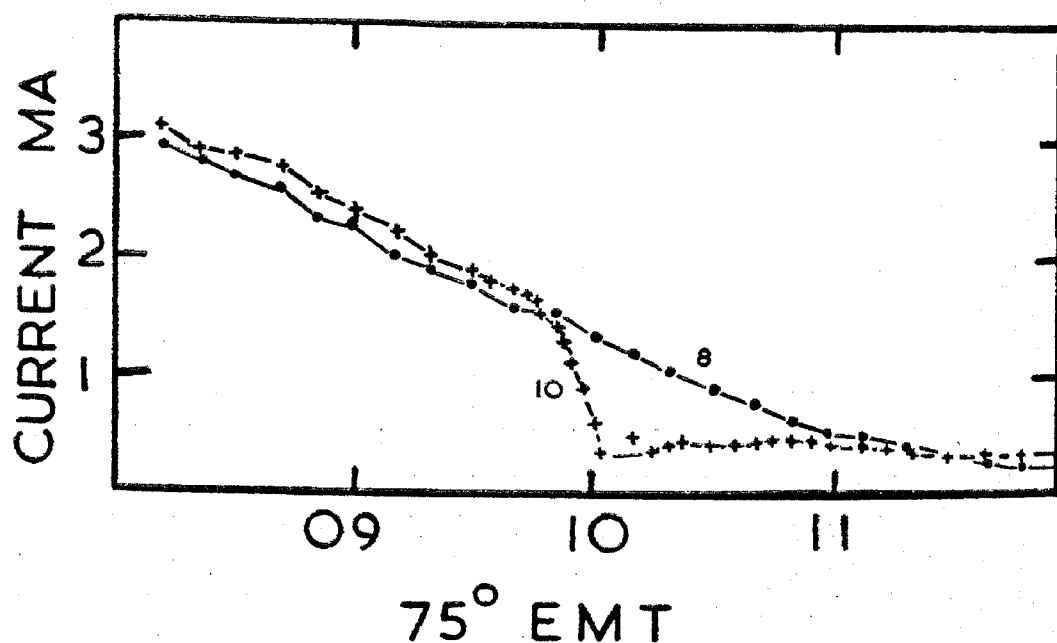


FIG. 4. Cosmic Radio Noise, 25Mc/s, 1956 March 8 and 10, Ahmedabad.

up to 5 Mc/s at 1055 hours. No cosmic ray effects were observed at Indian latitudes.

As we are now on the up-grade of solar activity, more flares of varying degrees of intensity may be expected in the next two or three years and careful monitoring of all the phenomena associated with them, will be of great value.

#### REFERENCES

- Shain C. A. and Mitra, A. P. .. *J. Atmosph. Terr. Phys.*, 1954, 5, 316.  
 .. R. N. .. *Ibid.*, 1952, 2, 226.  
 .. *Observatory, Geophysical Discussion*, 1955, 75, 61.