SOME PROPERTIES OF THE SOURCES OF SLOWLY VARYING COMPONENT AND OF BURSTS AT 612 Mc/s*

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A high-resolution 24-element, E–W interferometer situated at Kalyan near Bombay has been used to study the sources of slowly varying component and of bursts at a frequency of 612 Mc/s. This interferometer has a half-power beamwidth of 2·8 min of arc, and the fan beams are located about a degree apart in the sky. Thus, a strip scan is obtained roughly every 4 min as the Sun drifts through the beams. About 20 slowly varying sources and 11 bursts were observed during the period June 1965 to February 1967 at 612 Mc/s.

1. Slowly Varying Component

The half-power widths of the sources of S-component determined after removing the estimated quiet Sun level from the recorded strip scans, were found to vary from about 7 min of arc to about 13 min of arc. Figure 1a shows a histogram of the angular size of the sources.

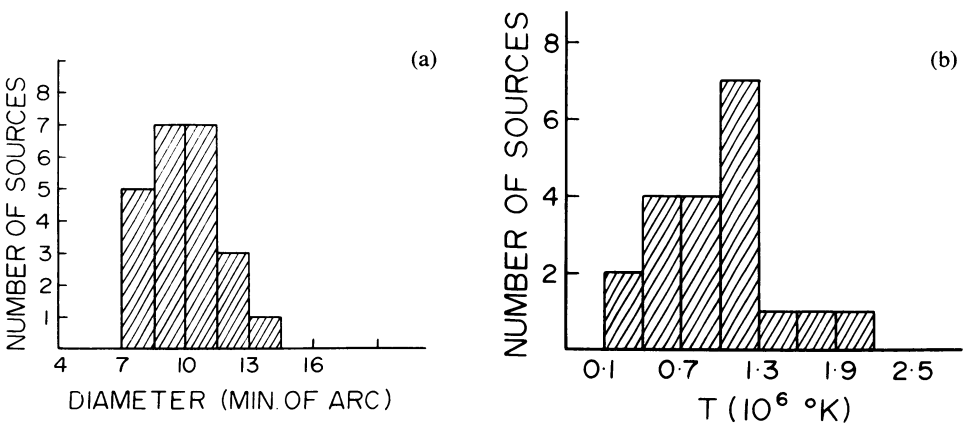

FIG. 1. *The distribution of (a) the angular size and (b) the brightness temperature of the sources of slowly varying component.*

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Kiepenheuer (ed.), Structure and Development of Solar Active Regions, 581–584.

In the absence of data on daily flux values of the Sun around 600 Mc/s for the entire period, flux values at 1000 Mc/s from Toyokawa were used to normalize the observed scans. A multiplication factor of 0·765 was used to reduce the Toyokawa daily flux values at 1000 Mc/s to those at 606 Mc/s. This factor was determined by comparing the flux values of Sagamore Hill at 606 Mc/s when they became available with those of Toyokawa. This method seems to be justified since there is a good correlation between the Toyokawa and Sagamore Hill flux values. The resulting brightness temperatures of the sources are shown in the form of a histogram in Figure 1b. As shown in Figure 2, the brightness temperature is roughly proportional to the sunspot area.

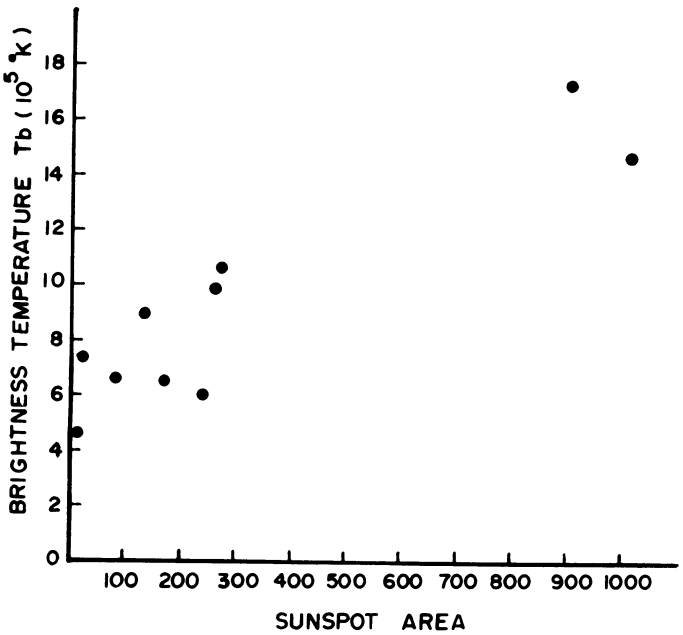

FIG. 2. *Brightness temperature of the S-component as a function of sunspot area.*

The centre-to-limb variation of the flux density of three isolated sources as they moved across the Sun's disk was determined from the observations of March–May, 1966. The directivity is found to be steeper than cosine law.

In order to determine the height of a source, we have plotted the displacement of the source from the axis of rotation against the sine of the angle of rotation of the Sun. Comparing the rate of rotation of the source with that of the most probable optical source, the height was determined. The heights of three sources having CMP on March 20, April 17, and May 15, 1966 were found to lie between 40000 and 65000 km above the photosphere.

2. Bursts

Most of the 11 bursts recorded during the period March 1966 to March 1967 lasted for less than about 10 min, appearing only on a few successive scans (Figure 3). Only one long-duration burst lasting over 4 hours was recorded on January 18, 1967.

The angular width of the burst sources was generally found to be about 3 min of

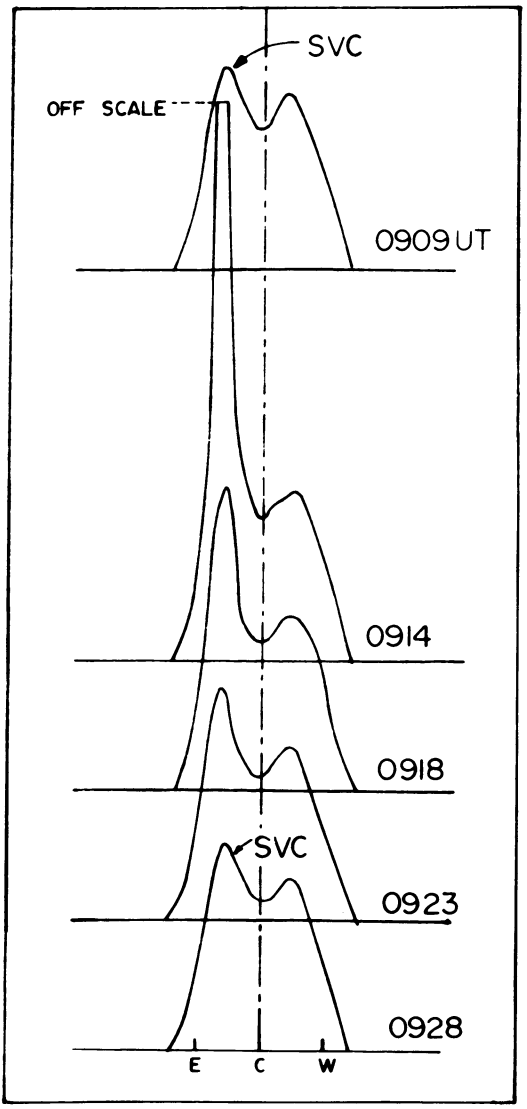

FIG. 3. *Successive strip scans during a burst recorded on March 16, 1966.*

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arc; three sources, however, being less than 1·5 min of arc wide. The maximum size recorded was only 4·9 min of arc. The total Sun flux values of Toyokawa at 1000 Mc/s were used (with a multiplication factor of 0·765) to normalize the scans and to determine the total flux for each burst. The brightness temperatures computed by assuming the sources to be circular vary between 10^6 °K and 10^8 °K. No burst was observed near the limb to enable a determination of the height of the burst source.

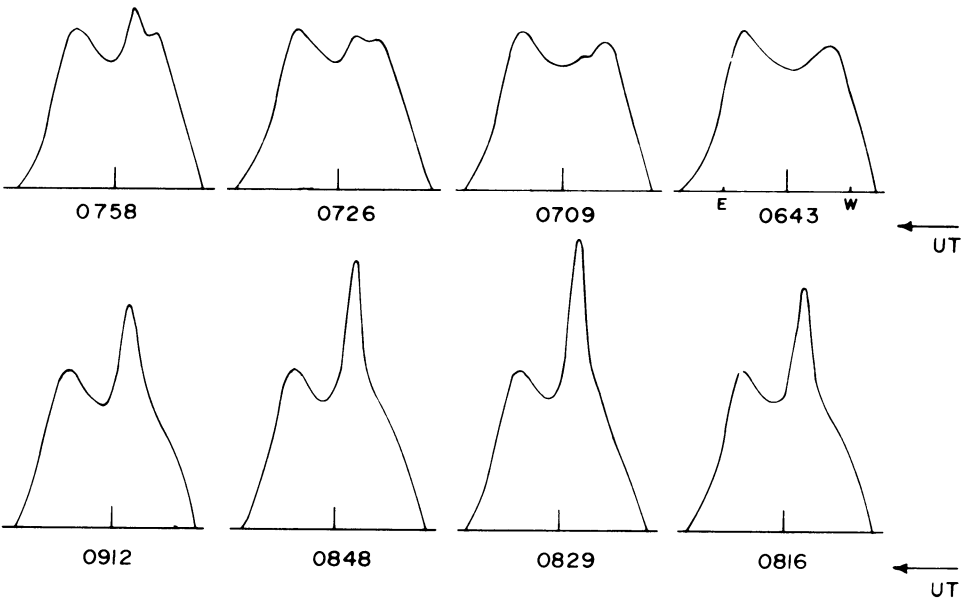

FIG. 4. *Selected scans of the long-lasting burst observed on January 18, 1967.*

The long-lasting event on January 18, 1967 began around 0630 UT, gradually rose to its peak intensity ($T_b \sim 10^7$ °K) around 0830 UT and declined thereafter. An interesting feature of this burst was that the peak of the burst source (situated 4·5 min of arc West of central meridian) did not coincide with the peak of a source of slowly varying component, as shown in Figure 4. However, the position of the burst agreed well with that of a source of slowly varying component at the shorter wavelengths of 21 cm and 9·1 cm observed at Fleurs and Stanford respectively. No change in the position, greater than about $\pm\frac{1}{2}$ min of arc, was observed during the period of the burst, indicating that the burst source did not move significantly. The size of the burst source was seen to remain constant at $3\pm\frac{1}{2}$ min of arc.

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