Nighttime Pi2 Micropulsations at Kodaikanal

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The occurrence characteristic of nighttime Pi2 micropulsations at Kodaikanal (geogr. lat: 10° 14′ N; dip: 3·5° N) is studied from normal run magnetogram data for a 1-yr period from January to December 1973. It is noticed that the occurrence of Pi2 pulsations is a broad maximum around local midnight. The dependence of the occurrence of Pi2 pulsations on magnetic activity is of composite nature in that the occurrence is positively correlated with K_p index in the range 0^+ to 2, and negatively correlated with K_p index in the range 2 to 5.

IRREGULAR PULSATIONS in geomagnetic field have been studied for more than half-a-century under various names ever since it was noticed as a characteristic pulsation at the start of a geomagnetic bay by Angenheister[1]. The nomenclature for geomagnetic micropulsations is now standardized[2] and irregular damped oscillations in geomagnetic field with periods in the range 40-150 sec are designated as Pi2 (Pi2 corresponds to P_i adopted by the 10th committee of IAGA in 1957). Earlier work on Pi2 pulsations has been reviewed by Jacobs and Westphal[3] and Troitskaya[4] and on micropulsations in general by Campbell[5] (for the period 1969-71). It is now more or less established that Pi2 micropulsations occur more frequently during nighttime with a maximum just before local midnight and its amplitude is dependent on latitude with a maximum at the auroral latitudes. The dominant period of Pi2 micropulsations is, however, independent of latitude according to most investigators.

Continuous photographic recording of the H, Z and D of the geomagnetic field is being done at this institute with the La Cour and Watson variometers calibrated with quartz horizontal magnetometer (QHM) and magnetic zero balance (BMZ) and supplemented with a proton precession magnetometer. In this communication we present the results of our study on nighttime (1800-0600 hrs) Pi2 micropulsations (in H component) over a period of 1 yr (Jan.-Dec. 1973) at Kodaikanal (geogr. lat: 10°14′) using normal run magnetogram data (from Watson variometer : sensitivity 6·4 γ-11·4 γ/cm, chart speed 15 mm/hr). It is to be emphasized that our recording system is not ideally suited for the study of micropulsations in view of its low sensitivity and low time resolution. However, we have noticed from careful visual examination of the magnetograms that they are adequate for the study of Pi2 micropulsations, especially their occurrence. With this understanding our analysis mainly consisted in noting down the time of occurrence of the Pi2 pulsations from careful visual examination of the magnetograms. From this data the occurrence of Pi2 micropulsations in relation to local time during night and level of magnetic activity is studied and the results are presented in the following. In view of the low

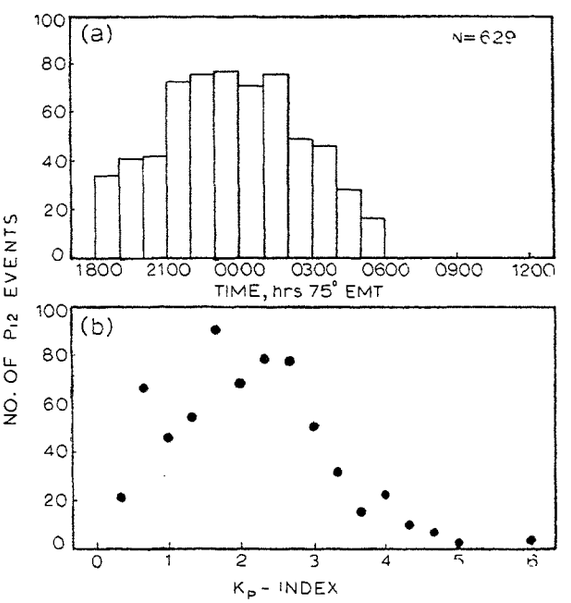

Fig. 1 — Occurrence characteristics of nighttime Pi2 micropulsations at Kodaikanal : (a) local time variations; and (b) variation with K_p index

sensitivity of the system we have been able to take into consideration only those Pi2 micropulsations whose amplitude is greater than at least 1 γ so that it can be identified visually.

In Fig. 1(a) is shown the distribution of the occurrence of Pi2 micropulsations against local time during night (1800-0600 hrs). It is evident that the occurrence is a broad maximum around midnight. This observation is in conformity with the more or less established feature of nighttime Pi2 micropulsations. Several theories have been propounded for the generation of Pi2 micropulsations[6-10]. Saito and Matsushita[8] suggested that Pi2 peak occurrence time may be closely related to the deflection angle of the magnetotail axis with respect to the sun-earth line, which is conditioned by the solar wind. Smith[11] calculated the solar wind streaming angle variation of the solar wind proton pressure, which determines the occurrence of Pi2, for both high and low K_p (magnetic planetary index) and showed that it is 188° during low K_p and 165° during high K_p, measured positive eastward from the sun-earth line.

To infer the dependence of the occurrence of Pi2 micropulsations on the level of magnetic activity, the 3 hr K_p index has been assigned to all the events observed and variation of the Pi2 pulsation occurrence with K_p index is shown in Fig. 1(b). It is interesting to note that the Pi2 occurrence shows positive correlation with K_p index from 0^+ to 2 and negative correlation with K_p index from 2 to 5. A consideration of the above result in the light of earlier work indicates a latitudinal dependence of the occurrence of Pi micropulsations in relation to the level of magnetic activity. To elaborate, Kannangara and Fernando[12] and Ishikara[13] reported a positive correlation between the occurrence of Pi2 micropulsations and K_p index for Colombo (geogr. lat : 6°54′N) and Istanbul (geogr. lat : 41°03′ N), respectively. On the other hand, Sarma[14] and Smith[11] reported the dependence of Pi2 micropulsations occurrence on K_p index to be of a composite nature for Hyderabad (geogr. lat: 17° 25′N), Memambetsu (geogr. lat: 53° 54′N) and Wingst (geogr. lat : 53° 45′ N) stations, respectively. A comprehensive analysis of Pi2 micropulsations at a number of stations covering a wide latitude range for a specific period will throw more light on this characteristic of Pi2 micropulsations.

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