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Fig. 1

Figure 1: Fig. 1

## Abstract

## Full Text

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**GEOPHYSICS**

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# ON THE BEHAVIOR OF MICROPULSATIONS OF THE TYPE *Pi*1

# AT MAGNETICALLY CONJUGATE POINTS

*(Presented by Academician A. N. Tikhonov, 31 III 1967)*

**1.** The subject of the present article is a description of the results of a study at the magnetically conjugate points Cogra (58° N lat., 122° E long.) and Kerguelen (58° S lat., 124° E long.) of one of the kinds of pulsations *Pi*1, known under the name of bursts ([1–4]).

*Sip* bursts are observed mainly at high-latitude observatories. They have a short duration (from 3 to 10 min.) and have

**Fig. 1**

the character either of an individual phenomenon or of a group of pulsation bursts following one another at intervals from 10 to 20 min. (Fig. 1).

*Sip* bursts are recorded in the evening, night, and early morning hours. The maximum of their frequency of occurrence is confined to the pre-midnight hours.

Comparison of records of micropulsations with records of other types of variations of the geomagnetic field indicates that *Sip* bursts are accompanied by irregular pulsations of the *Pi*2 type, developing in their initial part. However, they are a characteristic microstructure of *Pi*2 trains only when the latter are excited against the background of bay-like disturbances. Thus, in November 1966, 54 *Pi*2 trains were recorded at Cogra, 40 of them

was accompanied by *Sip* bursts. In all the noted cases this phenomenon was observed on the leading front of bay-like disturbances.

Fig. 2

Figure 2: Fig. 2

As can be seen from Fig. 1, the *Sip* bursts appear simultaneously at magnetically conjugate points, but their frequency spectrum is somewhat different. In order to study the spectrum of the bursts in greater detail, their sonographic analysis was carried out and the autocorrelation functions of the signals recorded at Sogra and on Kerguelen on February 3, 1965 were calculated (Figs. 2 and 3). From the sonograms it follows that, at the moment of excitation, the *Sip* bursts contain a broad frequency range. During the development of a burst, the high-frequency harmonics are gradually suppressed. If the phenomenon contains a group of bursts, the development of each of them proceeds independently. The sonograms convincingly indicate the nonidentity of the *Pi1* spectrum at magnetically conjugate points.

**Fig. 2**

Comparison of the form of the autocorrelation functions also confirms the difference between the spectra of the *Sip* bursts at Sogra and on Kerguelen. It follows from Fig. 2 that the spectral density of the signals is not uniform, but has max-

maximum at certain frequencies, which are different at conjugate points.

Let us note that the characteristics of the apparatus used in the processing did not allow signals with frequencies below 0.2 Hz to be analyzed. However, directly from the magnetograms (Fig. 1) it is clear that the bursts also contain oscillations with periods from 5 to 15 sec. In the case under consideration, for the burst of 3 II 1965 this phenomenon was accompanied by the excitation of pulsations of the *Pi2* type and of a bay-like disturbance.

2. The appearance of the micropulsations under consideration at the leading front of bay-like disturbances and their high-latitude character apparently indicate that this phenomenon is connected with the injection of particles into the lower layers of the ionosphere in the auroral zone. The coincidence, found in (5), of the excitation time of *Sip* bursts with riometric absorption of cosmic radio emission and with an increase in X-ray emission also confirms the above point of view. According to (5), during the excitation of *Sip* bursts there occurs a sharp change in the position of the auroral zone. Visual observations of auroras showed that at this moment flashes of ray-like electron forms of aurora are observed, located 100–20 km south of the main glow zone. This circumstance speaks in favor of Nishida' s theory (6), which explains the nature of the phenomenon by a gyroresonant interaction arising between an electron beam and the surrounding plasma. Micropulsations with a frequency of about 1 Hz can be generated at altitudes of the order of 1000–2000 km, and, consequently, differences in the state of the plasma at these altitudes in the northern

Fig. 3

Figure 3: Fig. 3

and southern hemispheres lead to differences in the spectra recorded at conjugate radiation points.

**Fig. 3**

As noted above, *Sip* bursts are accompanied by pulsations of the *Pi2* type. According to the conclusions drawn in (6), the same physical mechanism is attributed to these phenomena. However, one cannot agree with such an opinion. Comparison and analysis of magnetograms with *Pi2* records obtained at Sogra and Kerguelen indicate good agreement in the behavior of pulsations of this type at magnetically conjugate points (7). Apparently, the physical mechanism proposed in (6) may be valid only for oscillations with periods shorter than 5-10 sec.

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