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THE NONDIPOLE PART OF THE GEOMAGNETIC FIELD IS MANIFEST AT MAGNETOSPHERE BOUNDARY

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SUMMARY

The author establishes that the magnetosphere boundary is located above the daytime part of the Earth at distances from the center of the Earth, functions of not only interplanetary plasma parameters, but also of the nondipole part of the geomagnetic field, on the basis of data of Explorer-12 & -18.

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Observations of the geomagnetic field from AES have permitted to determine the boundary of the magnetosphere. It has been established that above the daytime magnetosphere this boundary is at $\sim 10\ R_E$ from the center of the Earth . On the daytime side of the magnetosphere the lines of force of the dipole field are very much compressed, whereas on the night side they are stretched into the train. There was so far no question of higher geomagnetic potential harmonics in connection with the boundary of the magnetosphere. This is possibly connected with the fact that at $\sim 10\ R_E$ the field does not contain any nondipole part that one could attempt to make apparent under the existing precisions of measurement and calculations and great magnetosphere variability in time.

The material from magnetic observations from AES Explorer-12 [1] allow us to establish the presence of nondipole part of the geomagnetic field at magnetosphere boundary. Following are the data on 69 magnetosphere intersections borrowed from [1]:

1) the distance R from the center of the Earth to each intersection of the 69 considered cases (in 1000 kilometers);
2) the date and the moment of universal time for each intersection.

The mean value of R was found for each hour U.T. After smoothing out the series of average-hourly R by the formula $(a + 2b + c)/4$, it was found that R is dependent on U.T. In a period of about UT = 12, the value of R is $66 \cdot 10^3$ km and near UT = 18, $R = 80 \cdot 10^3$ km. The question was considered whether this dependence of R on UT is imaginary and conditioned by different average geomagnetic activity level for various hours UT. To that effect we took the

* NEDIPOL'NAYA CHAST' GEOMAGNITNOGO POLYA SKAZYVAYETSYA NA GRANITSE MAGNITOSFERY.

a_p-indices for the 3-hour periods to which the values of R were related. Upon grouping them by hours UT, it was found that the distribution of a is indeed insufficiently uniform (a_p varying from 4 to 50). After that 8 values of R, related to three-hour intervals with $a_p > 39$, were eliminated. Upon averaging by hours UT, the remaining 61 values of R gave for the a_p-indices a variation from 4 to 12. The averaging of the 61 remaining values of R by hours UT gave, after smoothing out the R series, the numbers compiled in Table 1.

TABLE 1

UT	0	1	2	3	4	5	6	7	8
$P \cdot 10^{-3}$ км	71	72	70	68	69	70	72	72	72
UT	9	10	11	12	13	14	15	16	17
$P \cdot 10^{-3}$ км	72	70	69	70	39	70	74	75	78
UT	18	19	20	21	22	23			
$P \cdot 10^{-3}$ км	80	80	75	68	69	72			

It may be seen from Table 1 that R varies within the limits from 68 to $80 \cdot 10^3$ km, i. e., the elimination of 8 values of R did not affect the character of the dependence of R on UT.

The material on R according to data from AES Explorer-18 [2] was given the same treatment. 35 values of R were utilized. It was found that according to this material $R = 70 \div 87 \cdot 10^3$ km, whereupon the maximum values of R corresponded also to the the hours 1500—1800 UT.

Both AES, to which it is referred here, had orbits inclined at ∿ 30°S to the geomagnetic equator plane (with apogee in the Southern Hemisphere). In the 1955 epoch, at the latitude of 30°S, the total strength T_0 of the geomagnetic field on the ground had the extreme values of 0.253 and 0.579 oe. The conversion of these values to distances corresponding to extreme values of R (according to data of Explorer-18) by the formula of the form $T_h = T_0 r^{-3}$ (where r is the geocentrical distance and T_h is the value of the total field strength at that distance), gave the values $T_h = 19$ and 23γ. Thus, we may derive the conclusion that the interplanetary medium compresses the geomagnetic field to the region where it is equal to 20γ in all hours of the day. This region is disposed on different meridians at various distances R from the center of the Earth.

The determination of interplanetary plasma velocity v by the formula

$$T^2 / 8\pi = 2mnv^2$$

for n = 1 (m being the mass of the proton) gave the reasonable value

$$v = 2 \cdot 10^7 \text{ cm} \cdot \text{sec}^{-1}.$$

Therefore, it appears that over the daytime part of the Earth the magnetosphere boundary is disposed at various R not only as a function of interplanetary plasma parameters, but also as a function of the nondipole part of the geomagnetic field.

The author expresses his gratitude to Dr.Cahill for having sent him a preprint of the paper in ref. [1].

**** T H E   E N D ****

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