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DETERMINATION OF UPPER IONOSPHERE PARAMETERS BY THE FARADAY EFFECT

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t; DETERMINATION OF UPPER IONOSPHERE PARAMETERS BY THE FARADAY EFFECT * [French title *]

by Emile Argence and Karl Rawer

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1. The calculation method of the Faraday effect, expounded in the preceding note [1], has been applied to the study of fading registrations obtained by H. A. Hess on the 40 mc/s harmonic from the radioelectrical emissions of Sputnik 3 (1958, δ 2) during 30 ascending trajectories. Nine positions of these registered field minima were selected for each passage.

We proceeded with the computation of the Ω rotation of the polarization plane as a function of the parameter q for each of these positions [1]. The eight characteristic parameters of the lower part of the ionosphere were determined after ionosphere soundings carried out at time of passage. To that effect we utilized regional maps for f_oF_2 and $M(3000)F_2$.

The preceding data allowed us to compute the Faraday rotation relative to the lower ionosphere starting from the exact satellite position defined by the coordinates r and , localizing the penetration point of the electromagnetic ray at the instant considered. The correction of the initial incidence angle can reach 2° in case of extended runs and in the presence of strong F_2 - region ionization. The probable values of the parameter q are then determined acording to the earlier expounded method.

* [Détermination des parametres de l'ionosphere supérieure a partir de l'Effet Faraday.] - Note presented by M. Charles Maurain.

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2. Some maximum and minimum values of the ratio γ and the parameter q are compiled in the following Table :

Date (1959)	Path	U.T. Observed beginning	γ_M (γ maximal).	γ_m (γ minimal).	q_M (q maximal).	q_m (q minimal).
		h mm				
2 June	5372	12 50	2,92	2,42	77,8	53,4
5 "	5415	11 51	2,34	1,83	80,4	47,4
19 "	5616	7 22	2,28	2,02	72,6	52,8
2 August...	6267	20 32	3,57	2,85	102	82,8
26 "	6616	14 21	3,13	2,12	90	52,2
3 September.	6733	12 50	2,36	1,78	72	42
5 "	6761	10 18	2,41	2,02	73,8	42
7 "	6791	11 09	2,76	2,20	72,6	46,8
9 "	6820	10 13	1,87	1,66	33,6	25,8
			2,10	1,72	43,2	29,4
17 "	6937	8 01	2,72	2,46	49,2	42,6
24 "	7040	7 02	3,04	2,70	94,8	83,4
30 "	7128	5 18	3,63	2,30	105,6	55,2
3 October ..	7172	4 27	5,27	2,92	135	60

For the period included between 1 June and 6 August 1959 the values found for γ_M and γ_m are in good agreement with the mean monthly values obtained by Ross [2] after the Doppler effect observed during the passages of the same satellite above Pennsylvania in Eastern United States.

We have utilized only the observations carried out during the magnetically quiet days, with the exception of measurements referring to the passage 7172 (slightly disturbed day, $K_p = 3$).

We represented in Figs. 1 and 2 the variation of the total number of electrons contained in an ionized column of unity section relative to the lower and upper parts of the ionosphere for two passages, and also to the ionosphere considered as a whole (T).

The study of the rather important number of paths shows an accretion of the $\left(\int N dr\right)_T$ values when nearing the high latitude regions. This effect seems to be due to the existence of a rather strong lateral ionization gradient, and also to the progressive increase in electron concentration. The registration of Faraday

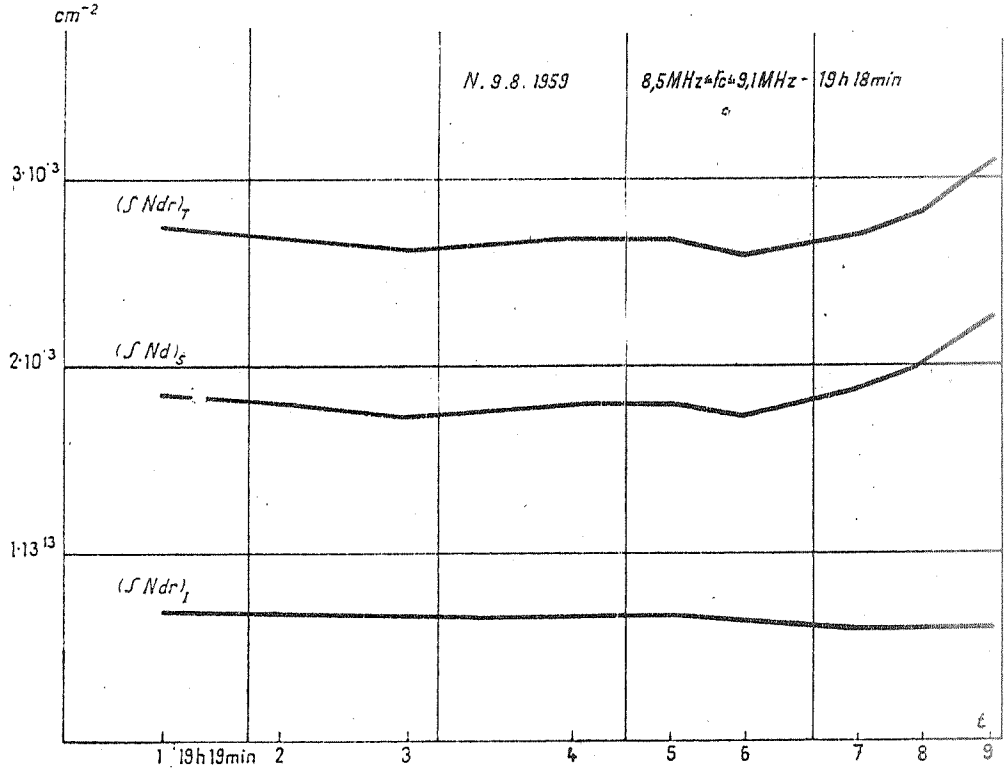
cm⁻²
N. 9.8. 1959
8,5MHz≤fc≤9,1MHz - 19h 18min
3·10⁻³
(∫Ndr)T
2·10⁻³
(∫Nd)S
1·13 13
(∫Ndr)I
t
1 19h19min 2 3 4 5 6 7 8 9

Fig. 1.

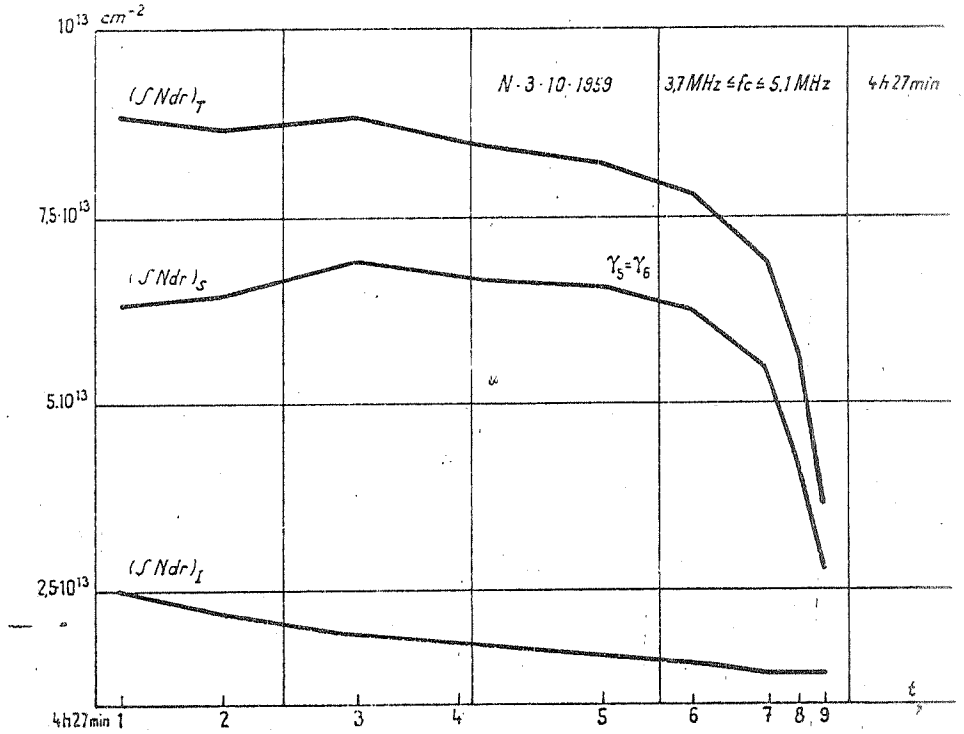
10¹³ cm⁻²
N·3·10·1959
3,7MHz ≤ fc ≤ 5,1MHz
4h27min
(∫Ndr)T
7,5·10¹³
(∫Ndr)S
γS=γG
5.10¹³
(∫Ndr)I
2,5·10¹³
t
4h27min 1 2 3 4 5 6 7 8 9

Fig. 2.

fadings corresponding to the 7172 path is normal, but offers a slight scintillation effect. Fig. 2 shows us the peculiar behavior of $(\int N\,rd)_T$ which is translated by an abrupt drop of ionization toward the North. The origin of this phenomenon may be attributed to local variations of large amplitude of the ionization gradient.

The observations carried out by Aarons and coll [3], during the same path, permitted to conclude about the presence of an anomalously ionized region above the Baltic Sea. The existence of inhomogeneities whose extension increases as one gets nearer to the magnetic pole has been suggested by Kent [4].

The study of the effect due to lateral ionization gradient may be undertaken by a method expounded in an earlier work [5], when the existence of inclined and decentered ionospheric layers is admitted.

*** THE END ***

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