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16. Abstract

Precision and relative measurements of the phase curve of the average effective lunar temperature were conducted on wavelengths of 1.25, 1.45, 1.60, 1.80, 2.0 and 2.5 cm to determine whether there is high absorption in the lunar surface of radio waves close to $\lambda = 1.6$ cm. The electromagnetic absorption coefficient and loss tangent in the lunar soil are found from the relative constant component and amplitude of the first harmonic of $\overline{T}_{ef}$ of the moon. The findings are preliminary and require further experimental check and simulation of electrical properties of lunar soil in artificial dielectrics.

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LUNAR RADIO EMISSION IN THE 1.25 TO 2.5 cm BAND

V. M. Plechkov[1]

Experimental and theoretical investigations of lunar thermal radio emission /104* in a wide frequency band yielded valuable physical data on the surface layers of the moon. Measurements of the phase curve of the effective lunar temperature, in particular, yield information on the spectrum of electromagnetic absorption in lunite. The experiment, according to [1, 2], affords the possibility of determining thermal parameter δ, equal to the ratio of the depth of penetration of electromagnetic wave l_e to the depth of penetration of thermal wave l_t, for a homogeneous model of the lunar surface. According to data [3] the most probable values are $l_t \simeq 7$ cm, and the dielectric constant for the three-layer model varies from 1.7 to 2.3. This makes it possible to determine the electromagnetic absorption coefficient and loss tangent in lunar soil for the examined frequency band. Analysis of the absorption spectrum in the 0.18 to 10 cm band revealed that there exists, according to previous measurements, high absorption of electromagnetic waves close to $\lambda = 1.6$ cm in the lunar surface. In order to explain this peculiarity we conducted both precision and relative measurements of the phase curve of the average effective disc temperature of the moon T_{ef} on wavelengths of 1.25, 1.45, 1.60, 1.80, 2.0, 2.5 cm. The results of these measurements are presented in the table. Presented in Figure 1 by way of example is the phase curve $\overline{T}_{ef}$ for $\lambda = 2.0$ cm. Figure 2 shows the loss tangent ($\tan \Delta$) in the surface layer of the moon as a function of wavelength. The corresponding data of other authors [4, 5] are presented in Table 1 and Figure 2. It is noteworthy that the electromagnetic absorption /105 coefficient in lunar soil and the loss tangent in it are found from the relative constant components and amplitude of the first harmonic of $\overline{T}_{ef}$ of the moon. Measurement accuracy is determined by the mean square deviation of the experimental points from the approximate phase curve. This error does not exceed ±5%, /106 which produces an error of not more than 10-15% in determination of $\tan \Delta$.

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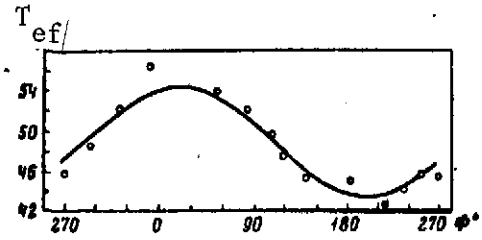

Figure 1. T_{ef} of Moon as Function of Phase of Lunar Cycle for λ = 2.0 cm.

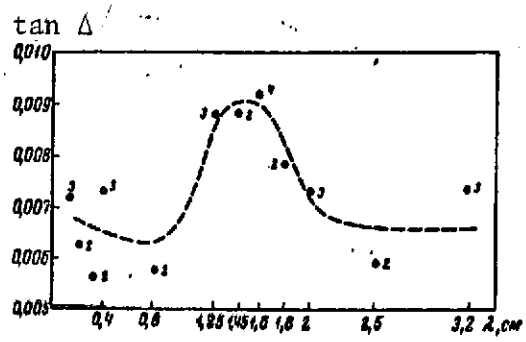

Figure 2. Tan Δ of Lunar Soil as Function of Wavelength. Points correspond to average tan Δ according to measurements, the number of which is indicated.

λ, см	T_0, °K	T_1, °K	$M = \frac{T_0}{T_1}$	δ	l_e, cm	tan Δ	Sources
0,106	183	105	1,75	0,232	1,60	0,0083	
0,12				0,3	2,10	0,0071	[6]
0,126	187	107	1,75	0,254	1,76	0,0089	[5]
0,13	216	120	1,80	0,307	2,15	0,0075	[7]
0,145	194	97	2,0	0,36	2,54	0,0071	[5]
0,18	240	115	2,08	0,50	3,56	0,0063	[5]
0,225	200	80	2,50	0,64	4,5	0,0062	[8]
0,32				0,93	6,5	0,0059	[9]
0,33				1,08	7,3	0,0057	[10]
0,4	230	73	3,15	0,95	6,65	0,0075	[11]
0,4	228	85	2,7	0,88	6,16	0,00814	[12]
0,4	204	54	3,8	1,22	7,84	0,0064	[13]
0,8	197	32	6,16	2,63	18,4	0,0054	[14]
0,8	211	40	5,28	2,36	16,5	0,0062	[15]
0,86	180	35	5,14	2,25	18,15	0,0058	[16]
1,25	215	36	6	2,42	16,7	0,0085	[17]
1,25	208	41	5,1	2,0	14,0	0,0102	[18]
1,25			6,2	2,62	18,3	0,0078	[18]
1,45	209	35	5,98	2,45	17,5	0,0094	[18]
1,45			6,8	2,87	20,5	0,0082	[18]
1,63	224	36	6,22	2,62	18,3	0,0101	[19]
1,6	208	37	5,63	2,28	16,0	0,0114	[20]
1,6	207	32	6,47	2,70	18,9	0,0097	[21]
1,6	205,6	23	8,90	3,85	27,0	0,0068	[22]
1,8	202	24	8,35	3,68	25,7	0,0080	[23]
1,8			8,55	3,76	26,6	0,0077	[23]
2	190	20	9,5	4,6	32,4	0,0072	[24]
2	206	19	10,8	4,9	34,6	0,0066	[23]
2			9,3	4,15	28,4	0,00816	[23]
2,5	210	15,5	13,4	6,18	43,4	0,0066	[23]
3,2	215,3	14,8	14,55	6,9	48,4	0,00735	Average of 3 measurements

Note: Commas indicate decimal points.

As seen in Figure 2 there apparently is high absorption in the lunar surface of radio waves close to $\lambda = 1.6$ cm. This conclusion, of course, is preliminary and requires further experimental checking during observation of the phase curve of T_{ef} of the moon on wavelengths close to $\lambda = 1.6$ cm, and simulation of the electrical properties of lunar soil in artificial dielectrics.

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