

TABLE 1.—Solar radiation intensities during December, 1917—Continued.

[Gram-calories per minute per square centimeter of normal surface.]

Lincoln, Nebr.											
Date.	Sun's zenith distance.										
	0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°	
	Air mass.										
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	
A. M.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	cal.	
Dec. 8.				1.42	1.38	1.23					
11.				1.28	1.21	1.12	1.02				
16.				1.30	1.19						
20.				1.20	1.15	1.07	0.99	0.93	0.86	0.80	
27.				1.08		0.81					
Monthly means				1.25	1.23	1.06	(1.00)	(0.93)	(0.86)	(0.80)	
Departure from 3-year normal				-0.04	-0.01	-0.06	-0.01	-0.03	±0.00		
P. M.					1.24	1.20	1.15				
Dec. 8.					1.10	1.06					
16.				1.15	1.10	1.06	0.92	0.89	0.85		
27.					0.98	0.95	0.92	0.89	0.85		
Monthly means				(1.15)	1.11	1.07	(1.04)	(0.89)	(0.85)		
Departure from 3-year normal				-0.12	-0.08	-0.06	-0.05	-0.16	-0.13		

Santa Fe, N. Mex.

A. M.										
Dec. 7.				1.39						
20.			1.47	1.36	1.32	1.27	1.22			
27.			1.46	1.38	1.30					
28.			1.46	1.39	1.33	1.26	1.20	1.18	1.15	
29.				1.34	1.28	1.22	1.17	1.11		
Monthly means			1.46	1.37	1.31	1.25	1.20	(1.14)	(1.15)	
Departure from 6-year normal			-0.04	-0.05	-0.05	-0.05	-0.04	-0.03	-0.01	
P. M.										
Dec. 3.			1.43	1.36	1.30	1.23	1.18	1.14	1.08	
6.			1.46		1.20	1.21	1.17	1.10	0.99	
19.			1.50		1.26	1.25	1.17	1.10	1.10	
27.				1.36	1.31	1.24	1.17	1.10		
28.			1.47	1.38	1.28	1.26	1.18	1.11	1.04	0.97
31.						1.22	1.15			
Monthly means			1.46	1.37	1.27	1.24	1.20	1.13	1.05	(0.97)
Departure from 2-year normal					-0.22	-0.03	-0.01			

TABLE 2.—Vapor pressures at pyrheliometric stations on days when solar radiation intensities were measured.

Washington, D. C.			Madison, Wis.			Lincoln, Nebr.			Santa Fe, N. Mex.		
Dates.	8 a.m.	3 p.m.	Dates.	8 a.m.	3 p.m.	Dates.	8 a.m.	3 p.m.	Dates.	8 a.m.	3 p.m.
1917.	mm.	mm.	1917.	mm.	mm.	1917.	mm.	mm.	1917.	mm.	mm.
Dec. 9	0.74	1.07	Dec. 6	1.19	1.32	Dec. 8	0.41	0.74	Dec. 3	3.45	2.62
10	0.71	1.19	14	0.97	0.81	11	0.71	1.88	6	1.45	2.49
11	0.97	1.32	21	3.15	2.06	16	1.78	3.99	7	2.16	2.49
15	1.19	1.32	22	2.11	4.37	18	3.81	4.57	19	2.62	3.63
26	1.45	1.96	25	0.48	0.86	20	4.57	4.37	20	2.16	3.00
30	0.53	0.71	29	0.41	0.66	27	2.26	0.71	27	3.45	3.15
									28	3.15	2.87
									29	2.36	2.87
									31	2.26	3.15

TABLE 3.—Daily totals and departures of solar and sky radiation during December, 1917.

[Gram-calories per square centimeter of horizontal surface.]

Day of month.	Daily totals.		Departures from normal.		Excess or deficiency since first of month.	
	Washington.	Madison.	Washington.	Madison.	Washington.	Madison.
1917.						
Dec. 1.	152	176	-28	43	-28	43
2.	243	58	70	-74	42	-31
3.	70	166	-106	35	-64	4
4.	24	93	-150	-37	-214	-33
5.	190	105	18	-25	-196	-56
6.	137	229	-33	99	-229	41
7.	74	166	-95	36	-324	77
8.	15	209	-152	79	-476	156
9.	288	199	123	69	-353	225
10.	272	219	108	89	-245	314
Dec. 11.	227	200	65	69	-180	383
12.	167	99	6	-32	-174	351
13.	60	209	-100	78	-274	429
14.	71	212	-99	80	-363	509
15.	221	160	62	28	-301	537
16.	115	132	-44	-1	-345	536
17.	130	171	-39	38	-374	574
18.	92	35	-67	-99	-441	475
19.	66	34	-93	-100	-534	375
20.	184	26	25	-109	-509	266
Decade departure.					-264	-48
Dec. 21.	197	191	38	56	-471	322
22.	208	112	48	-24	-423	298
23.	207	20	47	-116	-376	182
24.	109	86	-51	-51	-427	131
25.	20	198	-140	61	-567	192
26.	218	121	58	-17	-609	175
27.	171	41	10	-98	-499	77
28.	168	93	7	-42	-492	35
29.	122	211	-39	70	-531	105
30.	268	59	107	-83	-424	22
31.	190	161	28	18	-396	40
Decade departure.					+113	-226
Excess or deficiency since first of year.					-7.164	+187
cal. per cent.					-5.6	+0.2

LUNAR TOTAL ECLIPSE, 1917, JULY 4.<sup>1</sup>

By L. PICARD.

[Reprinted from Science Abstracts, Sect. A, Dec. 31, 1917, § 1347.]

Observations by three persons during the lunar eclipse of 1917, July 4, at the Bordeaux-Floriac observatory, indicated that the edges of the moon's limb appeared much brighter than the central portions. Also that the northern limb appeared much brighter than the southern, the moon passing to the north of the axis of the shadow cone; and that the western limb was most luminous until the middle of the eclipse, and the eastern limb during the second half of the eclipse. These facts indicate that the phenomenon is due to the solar rays being refracted on passage through the terrestrial atmosphere.—C. P. B[uller].

523.38 (964)

LUNAR TOTAL ECLIPSE OF DECEMBER 27-28, 1917, AT HONOLULU.

By C. A. REICHEL, Assistant Observer.

[Dated: Weather Bureau Office, Honolulu, Hawaii, Dec. 30, 1917.]

A total eclipse of the moon, remarkable for the brightness of the moon during the eclipse period and also for the attending coronæ visible, was observed at Honolulu, Hawaii, on the night of December 27, 1917.

The eclipse as seen by the naked eye began at about 9:35 p. m. (157° 31' meridian time), was total from 11:10

<sup>1</sup>Comptes rendus, Paris, Aug. 13, 1917, 165:264.

p. m. to 11:25 p. m., and ended at about 1 a. m. of December 28, 1917. Throughout the entire evening the moonlight was very bright, clouds obscuring the moon but for short intervals up to midnight after which the sky became quickly covered with heavy rainclouds and the eclipse was practically hidden. Distinct shadows of objects on the earth were still cast by the moon's light at 10:15 p. m., an hour when more than half of the moon was eclipsed and very dark, so that the moon's edge within the shadow was hardly discernible. As the eclipse progressed the darkened part became much lighter, turning to dull red and later to light red and orange. During the total phase that portion eclipsed first appeared a light red, the central portion a bright orange and the opposite edge or that eclipsed last, a very light yellow. The dark and light spots and the familiar markings on the moon's surface were almost as easily distinguishable during totality as under ordinary conditions.

Phenomena of perhaps rarer occurrence than the moon's eclipse were the lunar coronæ that were present during the earlier stages, and which were so brightly colored that they were mistaken by many people for lunar rainbows. Caused by the thinner portions of the swiftly moving Cu. and St.-Cu. clouds that passed over the moon, they appeared and vanished at irregular intervals during the evening. A few A.-Cu. clouds were also present and the humidity was very high, being above 80 per cent the entire night. The first of these coronæ was observed at 8:30 p. m., and was of about 3° or 4° radius. The circle was complete and the bands of prismatic colors very distinct. Several broken and indistinct coronæ appeared up to 9:35 p. m., when another complete ring of colors formed around the moon, this one being somewhat larger, of 4° or 5° radius, and the brightest corona of the evening. At this time the eclipse had just started and as it progressed the coronæ continued, varying in size and brightness, until at 10:00 p. m., when the moon was fully half eclipsed, a large double corona was formed and remained visible for about five minutes. It was composed of two complete concentric coronæ, the inner one being of 2° or 3° radius with very bright and distinct colored bands, the outer one of about 7° or 8° radius with its separate colors more or less blended but still easily distinguishable.

A few broken coronæ were seen after this and the final colored one was observed at 10:35 p. m., at which time the moon was about three-fourths covered by the earth's shadow. This was a small circle of 2° or 3° radius, the colors faint and the upper part broken, due to the shape of the cloud forming it. During the total phase of the eclipse no colored coronæ were visible, but as thin clouds passed between the moon and the earth a small ring of whitish light 1° or 1½° radius surrounded the darkened moon. During the final stages of the eclipse heavy clouds covered the sky, no coronæ were visible and the moon itself appeared only for very brief intervals of time.

551.540.2 (048)

#### PERMANENT PERIODICITY OF SUNSPOTS.<sup>1</sup>

By J. LARMOR & N. YAMAGA.

[Reprinted from Science Abstracts, Sect. A, Dec. 31, 1917, § 1344.]

A reëxamination of the available sunspot records for the 160 years, 1750-1910, leads to the conclusion that an

unbroken solar periodicity of about 11.125 years is firmly established, if the two strongly discrepant cycles from 1776 to 1798 are left out of consideration. The graph of this periodic constituent is shown to have the property of being antisymmetrical with respect to the axis which bisects its undulations, each undulation giving equal areas above and below, the curve repeating as a reflected image. *Examination of the residuals after extraction of the 11.125-year pulses shows no indication of periods other than are sporadic in character.*

A letter is appended from Wolfer, of Zurich, giving interesting particulars concerning the compilation of the sunspot data, those of the discrepant period from 1775 to 1795 being almost exclusively made by Stoudacher of Nuremberg. The epochs of maxima, 1778 and 1787, are considered fairly reliable; and the large departures of the lengths of the periods observed between 1770 and 1805 from the mean value of 11.125 years, are to be considered as real.—C. P. B[utler].

#### POLARIZATION OF SKYLIGHT.<sup>1</sup>

By A. GÖCKEL.

[Abstract of paper presented to Swiss Society of Geophysics, etc., Zurich, Sept. 11, 1917.]

The present study was undertaken for the purpose of verifying the conjecture, made elsewhere, that there exists (1) a relation between the polarization of the skylight and the sun's activity, and (2) also a relation between this polarization and certain electric phenomena such as the propagation of hertzian waves and the rapid variations in the atmospheric electric gradient. It was first necessary to determine to what extent one might deduce daily means from isolated observations, and also whether one might use observations made on days when the sky was not perfectly free from clouds.

The Martens polariphotometer was the instrument used.

The greater portion of the observations were made on the zenith and at 90° from the sun. Further observations were made on the variation in polarization of certain points in the sky with varying distances of the sun. The time of day was found to influence the polarization independently of the location of the point observed; and it also appeared that at the same time of day and at equal distances from the sun the polarization varied with the zenithal distance of the point observed.

The variations affecting polarization at sunrise and at sunset may be explained by modifications in the sun's illumination due to the formation or shifting of haze or fogs which provoke variations in the electric gradient.

Measurements at Silvaplana (altitude = 1,800 m.) have not revealed any influence of altitude.

The formation of clouds is betrayed several hours in advance [of their appearance] by a decrease in the polarization. Cirrus and strato-cumulus scarcely lower the polarization of the blue sky areas near them, but cumulus and cumulo-nimbus affect it thus very strongly. However, one can not employ the degree of polarization of skylight for forecasting weather without taking account of all the other determining factors.

<sup>1</sup>A. Gockel (Fribourg). Polarisation de la lumière du ciel. Archives des sci. phys. et nat., Genève, 15 Nov., 1917, 44: 349.

<sup>1</sup>Proc. Roy. Soc., London, Sept. 1, 1917, 93: 493-506.