

ON THE RESULTS OF SOME MAGNETIC OBSERVATIONS DURING THE SOLAR ECLIPSE OF AUGUST 21, 1914.

BY L. A. BAUER AND H. W. FISK.

No definite information having been received by the Department of Terrestrial Magnetism up to June, 1914, that an organized effort would be made to secure magnetic, electric, and allied observations during the solar eclipse of August 21, 1914, the belt of totality of which (Figs. 1 and 2) was favorably located for European observatories, it was decided to stimulate interest in the important event. Accordingly, the circular letter of June 23, 1914, on page 58, was sent to a number of persons and institutions and published in *Nature* (July 16, 1914, p. 507) and in *Science* (July 24, 1914, p. 140). Later it was ascertained that others, notably Dr. V. Carlheim-Gyllensköld¹ had succeeded in likewise inaugurating desired observational work. It thus happened that at some of the contributing observatories observations were made both in accordance with his program and with ours. Naturally, the following preliminary report deals only with the data obtained in response to our own request. Unfortunately, owing to the European war, the desired data have not yet been received from all observatories which had promised their aid. The majority of the communications here published, it is gratifying to state, were received within six months after the date of the eclipse. It was thought desirable not to await the arrival of further material, but, instead, to make what we have accessible to those who can undertake a more exhaustive discussion. Grateful acknowledgement is here made to all who have cooperated for their cordial and prompt responses.

Abstracts are given of the various reports received, excepting those which have already been published in this journal.² It will be observed that we have given, in general, only the five-minute mean results, although usually the results were tabulated for every minute in the original report. For example, the result published opposite the time 10^h 05^m is the mean of the five readings from 10^h 03^m to 10^h 07^m, etc. Generally also copies of the photographic traces were received, but no attempt was made to scale them if other data (eye readings or magnetogram scalings) were supplied.

¹ Sur une cause possible de l'influence des éclipses de soleil sur le magnétisme terrestre, *Ark. Matem. Stockholm*, Bd. 10, No. 9, 1914.

² See CHREE's report on the Kew observations, vol. 20, pp. 71-74, 1915; also HAZARD's report on the observations at the United States Magnetic Observatories, vol. 21, pp. 9-14, 1916.

To obtain, in as widely-distributed regions of the Earth as possible, some idea of its magnetic state during the eclipse, the field observers of the Department of Terrestrial Magnetism were instructed to make special declination observations, if circumstances permitted. There were thus obtained the five series of observations given in Tables 19-23, distributed over the Earth from Labrador to the Congo, and from the District of Columbia to China.

Effective assistance was rendered in the computations, drawing of the diagrams, and in the preparation of the reports for publication by Messrs. W. F. Wallis, C. R. Duvall, R. R. Mills, and H. D. Harradon, all of the Department of Terrestrial Magnetism.

PROPOSED INTERNATIONAL MAGNETIC AND ALLIED OBSERVATIONS DURING THE
TOTAL SOLAR ECLIPSE OF AUGUST 21, 1914 (CIVIL DATE).

In response to an appeal for simultaneous magnetic and allied observations during the coming total solar eclipse, cooperative work will be conducted at stations along the belt of totality in various countries and also at some outside stations. The general scheme of work proposed embraces the following:

1. Simultaneous magnetic observations of any or all of the elements according to the instruments at the observer's disposal, every minute from August 21, 1914, 10^h A. M. to 3^h P. M. Greenwich civil mean time, or from August 20, 22^h to August 21, 3^h Greenwich astronomical mean time.

(To insure the highest degree of accuracy, the observer should begin work early enough to have everything in complete readiness in proper time. See precautions taken in previous eclipse work as described in the journal *TERRESTRIAL MAGNETISM*, vol. 5, p. 146, and vol. 7, p. 16. *Past experience has shown it to be essential that the same observer make the readings throughout.*)

2. At magnetic observatories, all necessary precautions should be taken to insure that the self-recording instruments will be in good operation not only during the proposed interval but also for some time before and after, and eye-readings should be taken in addition wherever it is possible and convenient. (*It is recommended that, in general, the magnetograph be run on the usual speed throughout the interval, and that, if a change in recording speed be made, every precaution possible be taken to guard against instrumental changes likely to affect the continuity of the base line.*)

3. Atmospheric-electric observations should be made to the extent possible with the observer's equipment and personnel at his disposal.

4. Meteorological observations in accordance with the observer's equipment should be made at convenient periods (as short as possible) throughout the interval. It is suggested that, at least, temperature be read every fifth minute (directly after the magnetic reading for that minute).

5. Observers in the belt of totality are requested to take the magnetic reading every thirty seconds during the interval, 10 minutes before and 10 minutes after the time of totality, and to read temperature also every thirty seconds, between the magnetic readings.

It is hoped that full reports will be forwarded as soon as possible for publication in the journal of *TERRESTRIAL MAGNETISM*.

Washington, D. C., June 23, 1914.

L. A. BAUER.

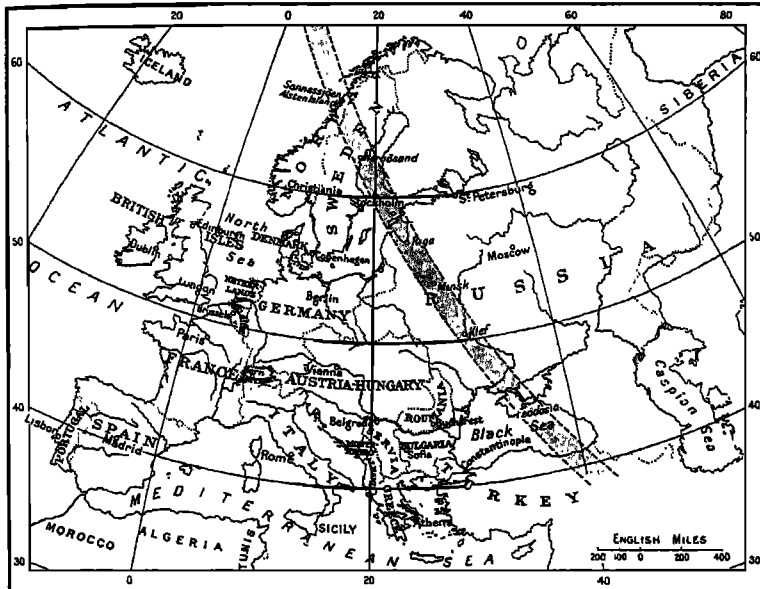


FIG. 1.—Map showing Belt of Totality for Solar Eclipse of August 21, 1914.

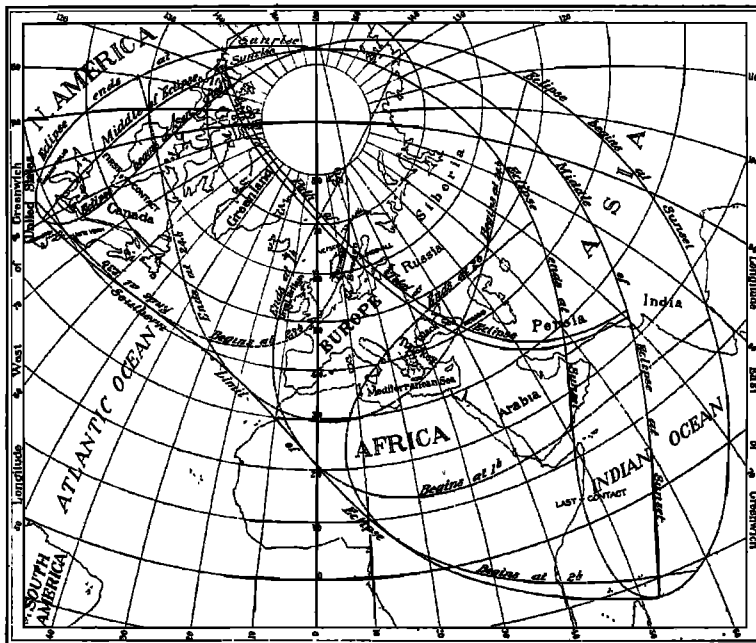


FIG. 2.—Map showing Region of Visibility of the Solar Eclipse of Aug. 21, 1914.

NO. 1.—OBSERVATIONS AT THE ESKDALEMUIR OBSERVATORY,
SCOTLAND.

The magnetic results given in Table 1-A were derived from the final values for the three intensity components communicated by Superintendent L. F. Richardson. The values of the declination and of the horizontal intensity were computed in the Department of Terrestrial Magnetism from the furnished values of the two rectangular components (north and west). The sensitivities in γ per mm. for the magnetograms were: 8.8 (N. Comp.); 8.7 (W. Comp.); 3.9 (Vert. Comp.).

TABLE 1-A.—Results of magnetic observations at the Eskdalemuir Observatory on August 21, 1914.

G.M.T.	Intensity				Decl'n (West)	G.M.T.	Intensity				Decl'n (West)
	N. Comp.	W. Comp.	V. Comp.	Hor'l			N. Comp.	W. Comp.	V. Comp.	Hor'l	
<i>h</i>	γ	γ	γ	γ	$^{\circ}$ $'$	<i>h</i> <i>m</i>	γ	γ	γ	γ	$^{\circ}$ $'$
10 01	15976	5109	45192	16773	17 44.0	13 00	15990	5145	45189	16798	17 50.1
05	15971	08	92	768	44.2	05	15993	45	89	800	50.0
10	15971	10	92	768	44.5	10	15993	45	89	800	50.0
15	15973	14	92	771	45.2	15	15993	46	90	801	50.1
20	15975	17	92	775	45.7	20	15990	44	91	797	49.9
25	15975	19	92	775	46.0	25	15989	43	92	796	49.8
30	15974	18	92	774	46.0	30	15987	42	92	794	49.8
35	15972	16	92	771	45.6	35	15988	43	93	795	49.9
40	15974	16	92	773	45.5	40	15988	42	94	795	49.6
45	15975	16	92	774	45.6	45	15990	44	94	797	50.0
50	15978	19	92	778	45.8	50	15992	45	94	799	50.0
55	15982	22	90	783	46.3	55	15992	46	95	800	50.1
11 00	15985	25	89	786	46.6	14 00	15994	48	96	802	50.5
05	15986	26	89	788	46.6	05	15994	47	96	802	50.4
10	15986	27	89	788	46.9	10	15994	45	96	801	50.0
15	15988	28	88	790	47.0	15	15996	47	96	804	50.3
20	15989	28	88	791	46.9	20	15998	47	96	805	50.1
25	15989	29	86	792	47.1	25	15996	46	96	804	50.0
30	15990	30	86	793	47.3	30	15998	45	96	805	49.7
35	15989	30	85	792	47.3	35	16000	44	96	807	49.4
40	15990	31	84	793	47.4	40	16001	43	96	807	49.1
45	15991	32	84	793	47.5	45	16000	42	96	806	49.1
50	15992	31	84	795	47.3	50	16003	41	96	808	48.7
55	15990	30	84	793	47.3	55	16004	41	96	810	48.5
12 00	15989	30	84	792	47.3	14 59	16004	39	96	809	48.1
05	15989	30	85	792	47.3	G. M. T. Mean hourly values.					
10	15987	30	86	790	47.4						
15	15990	35	86	795	48.2	<i>h</i>	γ	γ	γ	γ	$^{\circ}$ $'$
20	15993	38	87	798	48.6	10	15979	5112	45192	16777	17 44.4
25	15994	40	88	800	49.0	11	15983	123	90	784	46.3
30	15995	41	88	801	49.1	Noon	15989	34	86	793	48.1
35	15996	43	88	802	49.4	13	15992	44	89	799	49.9
40	15995	44	88	802	49.7	14	15994	46	96	802	50.1
45	15994	44	88	801	49.6	15	16004	39	97	809	48.1
50	15991	43	88	798	49.8						
55	15992	43	89	798	49.7						

TABLE 1-B.—Air temperatures at the Eskdalemuir Observatory during the solar eclipse of August 21, 1914.

G.M.T.	Abs. Temp.	G.M.T.	Abs. Temp.	G.M.T.	Abs. Temp.	G.M.T.	Abs. Temp.	G.M.T.	Abs. Temp.
^h ^m	[°]	^h ^m	[°]	^h ^m	[°]	^h ^m	[°]	^h ^m	[°]
10 00	287.7	11 00	288.7	12 00	289.0	13 00	288.8	14 00	288.2
10	287.8	10	288.8	10	288.6	10	288.7	10	288.2 ^a
20	287.7	20	288.7	20	288.5	20	288.8	20	288.4
30	287.7	30	288.6	30	288.5	30	289.0	30	288.5
40	288.0	40	288.7	40	288.6	40	288.6	40	288.6
50	288.3	50	288.6	50	289.0	50	288.4	50	289.0
								15 00	289.4

^a Minimum, 288.°1 at 14^h 05^m.

TABLE 1-C.—Hourly values of temperature recorded at the Eskdalemuir Observatory on August 21, 1914, and converted into centigrade degrees, absolute.

G. M. T.	Abs. Temp.	G. M. T.	Abs. Temp.	G. M. T.	Abs. Temp.	G. M. T.	Abs. Temp.
^h	[°]	^h	[°]	^h	[°]	^h	[°]
1	281.9	7	283.6	13	288.8	19	286.9
2	282.7	8	285.2	14	288.2	20	286.1
3	282.9	9	286.4	15	289.2	21	286.1
4	281.4	10	287.6	16	288.6	22	286.3
5	281.6	11	288.6	17	287.5	23	285.7
6	282.8	Noon	288.8	18	287.6	Midnight	284.7

Maximum, 289.°4 at 15^h 05^m; Minimum, 281.°3 at 4^h 45^m.ATMOSPHERIC-ELECTRIC OBSERVATIONS AT THE ESKDALEMUIR
OBSERVATORY, AUGUST 20-22, 1914.*(Abstract of L. F. Richardson's Report.)*

Ionization and conductivity were determined by eye observations made at every hour G. M. T. (civil) from 4^h to 20^h on the three days August 20, 21, and 22, 1914. On the 21st, additional observations were made at the half-hours from 10^h 30^m to 19^h 30^m. The results are given in Tables 1-D and 1-E. The positive and nega-

tive charges in the air per c. c. (E_+ and E_- , respectively) were obtained from two Ebert aspiration-apparatuses made by Messrs. Günther and Tegetmeyer, and the durations of the individual runs were from 12 to 15 minutes.

The conductivity was determined with a Wilson "universal portable electrometer" made by the Cambridge Scientific Instrument Company. The electrometer was allowed to collect ions for three successive periods of five minutes, and a quantity proportional to the potential-gradient was observed at the beginning and end of each period by the same apparatus. All measurements were made by observing the gold-leaf with the compensator drawn fully out and with the cap on. The compensator was used to adjust the collector to earth-potential during the collecting period. If δ_1 is the displacement of the gold-leaf due to the charge induced on the plate by the potential-gradient at the beginning of the five minutes, and δ_3 a similar quantity at the end of the same period, and if δ_2 is the displacement of the leaf due to the ions collected during five minutes while at earth-potential, then it was assumed that the conductivity λ in E. M. U. is:

$$\lambda = \frac{\delta_2}{2\pi v^2 t (\delta_1 + \delta_3)}$$

where t is the time of exposure in seconds and v the velocity of light.

The potential-gradient observations, made in the open, are given in Tables 1-D and 1-E, expressed in volts per meter. The air-earth currents i , as recorded in the tables, were calculated from λ and the potential-gradient by Dr. W. F. G. Swann of the Department of Terrestrial Magnetism. Copies of the electrograms from the Kelvin water-dropper and of the thermograms were also supplied.

Cloud Observations were made hourly from 4^h to 21^h. It may suffice to say that the sky was completely or 0.9 covered up to 16^h, and that from then onwards the amount of cloud decreased a little. The motion of the clouds was in general from the SW.

Condition of the upper air. Two registering balloons were liberated so as to reach their highest points one before and one after the maximum obscuration. If the instruments are found, the results will appear in the Geophysical Journal published by the Meteorological Office, London.

Observations with the Ebert and Wilson instruments were made from 4^h to 20^h by Mr. E. H. Nichols on a number of days in August, and will be published in due course. [See p. 79.]

TABLE 1-E.—Results of atmospheric-electric observations at Eskdalemuir Observatory on August 21 and 22, 1914.^a

G. M. T.	August 21 ^b						August 22					
	λ		E+		Av. E		i		λ		E+	
	(E. M. U. $\times 10^{-20}$)	(E. M. U. $\times 10^{-20}$)	E-	(E. M. U. $\times 10^{-20}$)	E-	(E. M. U. $\times 10^{-20}$)	E+	(E. M. U. $\times 10^{-17}$)	E-	(E. M. U. $\times 10^{-17}$)	E+	(E. M. U. $\times 10^{-17}$)
4 00	.212	40	140	90	3.50	1.84	233	897	350	233	3.85	320
5 00	[.335]	86	203	145	2.36	2.78	247	867	.226	247	3.51	440
6 00	.431	109	296	203	2.72	2.54	151	1196	.434	151	7.92	580
7 00	.500	110	359	235	3.26	1.65	69	538	.264	69	7.80	580
8 00	.542	87	419	253	4.81	1.84	69	419	.434	69	6.07	500
9 00	.661	87	449	268	5.15	1.78	274	628	1.434	274	2.29	180
10 00	.767	135	538	337	3.99	1.15	315	628	1.524	315	2.00	190
10 30	.784	160	458	309	2.86	1.25	178	478	.771	178	2.68	190
11 00	.735	187	399	293	2.13	1.03	178	478	.851	178	2.35	160
11 30	.750	196	319	258	1.63	0.98	178	419	1.222	384	1.24	180
12 00	.752	206	329	268	1.60	0.83	178	419	1.256	589	1.17	160
12 30	.828	224	349	287	1.56	0.91	384	478	1.196	548	1.14	180
13 00	.838	229	339	284	1.48	1.09	384	478	.563	96	2.49	160
13 30	.775	242	439	340	1.81	1.24	589	688	1.104	781	.65	150
14 00	.931	270	478	374	1.77	1.21	548	628	1.300	370	1.46	110
14 30	1.051	274	528	401	1.93	1.26	548	628	1.372	425	1.06	90
15 00	1.237	274	568	421	2.07	1.61	548	628	[1.400]	380	1.10	20
15 30	1.040	293	668	481	2.28	1.35	96	239				
16 00	.937	379	907	643	2.40	1.22	96	239				
16 30	1.179	480	1106	793	2.30	1.77	781	508				
17 00	1.515	516	1246	881	2.42	2.58	781	508				
17 30	1.840	507	1206	857	2.39	2.39	370	538				
18 00	1.819	416	1206	811	2.90	3.09	370	538				
18 30	1.738	311	1156	734	3.71	3.13	425	448				
19 00	1.607	205	1076	641	5.24	4.02	425	448				
19 30	1.475	141	967	554	6.85	5.16	425	448				
20 00	1.366	82	897	490	10.94	6.01	425	448				

^a Bracketed figures refer to interpolated or extrapolated results.^b The various values below are the means of 3 consecutive observations centering at the hour and the half-hour; the values of i are derived with the aid of the P. G. quantities in Table 1-D.

NO. 2.—OBSERVATIONS AT THE STONYHURST OBSERVATORY, ENGLAND.

The magnetograms for declination (D) and horizontal intensity (H) on August 21, 1914, were supplied by Director Walter Sidgreaves, S. J. Owing to a mishap the vertical intensity variometer was not in operation at the time in question. The results of our D -scalings are shown in Fig. 4, p. 83.

TABLE 2-A.—Results of temperature measurements at the Stonyhurst Observatory on August 21, 1914.

G.M.T.	Temp. (Fahr)	G.M.T.	Temp. (Fahr)	G.M.T.	Temp. (Fahr)	G.M.T.	Temp. (Fahr)	G.M.T.	Temp. (Fahr)
h m	°	h m	°	h m	°	h m	°	h m	°
10 00	64.0	11 00	64.4	12 00	63.7	13 00	63.9	14 00	62.0
05	64.5	05	64.4	05	63.6	05	64.0	05	61.9
10	64.7	10	64.3	10	63.5	10	64.0	10	61.8
15	64.9	15	64.5	15	63.5	15	64.6	15	61.9
20	64.5	20	64.6	20	63.4	20	64.6	20	62.0
25	64.6	25	65.0	25	63.2	25	64.5	25	62.0
30	64.6	30	65.1	30	63.4	30	64.4	30	61.8
35	64.5	35	65.2	35	63.3	35	64.2	35	61.8
40	64.6	40	64.7	40	63.1	40	64.0	40	62.0
45	64.5	45	64.3	45	63.1	45	63.7	45	62.1
50	64.4	50	63.9	50	63.0	50	63.4	50	62.0
55	64.4	55	63.8	55	63.2	55	63.2	55	62.0
								15 00	62.0

NO. 3.—OBSERVATIONS AT THE KEW OBSERVATORY, ENGLAND.

Dr. Chree's report has already appeared (*Terr. Mag.*, vol. 20, pp. 71-74). The declination curve given in Fig. 4 has been obtained from our scalings of the copy of the magnetogram supplied by Dr. Chree, supplemented by the values in Tables 1 and 2 of Chree's article.

NO. 4.—OBSERVATIONS AT THE RUDE SKOV OBSERVATORY, DENMARK.

Table 4-A gives the results of the D , H , and Z measurements supplied by Director C. H. Ryder for every minute from 10 A. M. to 3 P. M. Greenwich civil mean time. The table has been condensed from the original tables supplied, only the five-minute means being here given.

NO. 5.—OBSERVATIONS AT THE KSARA OBSERVATORY, SYRIA.

The issue of *Comptes Rendus* (Paris) of October 27, 1914, contains, on pp. 614-615, an account by B. Berloty of some magnetic observations made at the Ksara Observatory on August 21, 1914,

TABLE 4-A.—Values of the magnetic elements at Rude Skov Observatory on August 21, 1914.

G.M.T.	Decl'n (West)	Intensity		G.M.T.	Decl'n (West)	Intensity		G.M.T.	Decl'n (West)	Intensity	
		Hor'l	Vert'l			Hor'l	Vert'l			Hor'l	Vert'l
h m	° ' "	γ	α	h m	° ' "	γ	α	h m	° ' "	γ	α
10 01	8 54.1	17264	44587	11 45	8 56.7	17289	44594	13 25	8 57.0	17283	44602
05	53.8	60	587	50	56.5	89	594	30	56.7	81	603
10	53.9	61	587	55	56.3	88	594	35	56.4	84	604
15	54.4	63	588	12 00	55.9	88	594	40	56.0	82	604
20	54.9	65	589	05	55.4	86	594	45	55.8	85	605
25	55.0	65	589	10	55.2	85	594	50	55.8	86	606
30	54.6	64	590	15	55.0	88	595	55	55.7	86	606
35	54.5	65	590	20	55.3	88	596	14 00	55.8	87	607
40	54.5	66	590	25	55.7	88	597	05	55.6	85	607
45	54.5	68	591	30	56.3	88	597	10	55.2	85	607
50	54.7	71	591	35	56.8	88	598	15	55.2	89	608
55	55.3	76	592	40	57.0	89	598	20	55.1	90	608
11 00	55.5	79	593	45	57.2	86	598	25	54.7	90	608
05	55.7	80	593	50	57.1	85	598	30	54.5	90	608
10	56.0	81	593	55	57.2	85	599	35	54.3	91	608
15	56.3	83	593	13 00	57.5	85	599	40	53.9	91	609
20	56.4	85	593	05	57.6	84	599	45	53.5	92	609
25	56.7	85	593	10	57.4	84	600	50	53.4	93	609
30	56.9	85	593	15	57.4	85	601	55	53.2	94	609
35	56.9	87	593	20	57.2	83	602	59	52.9	b94	b610
40	56.7	88	594								

a Mean of the 3 values at 10^h 00^m, 10^h 01^m, and 10^h 02^m.

b Mean of the 3 values at 14^h 58^m, 14^h 59^m, and 15^h 00^m.

at the time of the solar eclipse. The position of this observatory is given as 33° 49.4' N. and 2^h 14^m 12^s east of Paris, or 2^h 23^m 33^s (35° 53.2') east of Greenwich. The eclipse was partial; the phase of maximum obscuration (about 0.87) occurred approximately at 13^h 21.^m5 Greenwich civil mean time, or 15^h 45^m (3^h 45^m P. M.) Ksara local mean time, August 21.

Unfortunately, the magnetograph was not in operation at the time. However, during the eclipse a member of the Observatory staff, Jacques Tonello, it is stated, made careful observations of the changes in the magnetic declination and the inclination. A Kew-pattern magnetometer and a Dover dip circle were used. As it is somewhat precarious to observe variations in the inclination by means of a dip circle, these observations are omitted here. Accordingly, only the declination results are found in Table 5-A. The author's differential values have been referred approximately to absolute values by assuming a base line of 0° 13' W. as derived from the observed value of the declination on August 20, 1914, at

5^h 01^m P. M., Ksara m. t., 0° 16' W, and the differential readings at the same time on August 21.

Berloty states that, according to some magnetograms of previous years, the phase of maximum west declination in August should occur normally between 1 and 2 P. M. (Ksara m. t.); thereafter west declination should decrease until reaching a minimum between 5 and 6 P. M. Instead, on the day of the eclipse the turning point, after which the decrease should set in, was retarded, and did not occur until 3^h 57^m P. M. (about 12^m after the phase of maximum obscuration), or two hours and more after the usual time. (See Table 5-A.)

Attention is also directed by Berloty to the large spot on Sun on this day, and the question is raised whether it will be possible to disentangle an eclipse magnetic effect from a disturbance connected with the sunspot.

TABLE 5-A.—*Magnetic declination observations at the Ksara Observatory on August 21, 1914.*

K.M.T.	G.M.T.	Decl'n (West)	K.M.T.	G.M.T.	Decl'n (West)	K.M.T.	G.M.T.	Decl'n (West)
h m	h m	° /	h m	h m	° /	h m	h m	° /
13 32	11 08	0 13.0	15 12	12 48	0 15.8	16 12	13 48	0 17.1
47	23	13.0	17	53	15.1	17	53	17.1
14 02	38	13.2	22	58	16.3	22	58	16.7
17	53	13.6	27	13 03	16.3	27	14 03	16.7
32	12 08	14.1	32	08	16.5	32	08	16.7
37	13	14.5	37	13	16.5	37	13	16.7
42	18	14.7	42	18	16.9	42	18	16.5
47	23	14.7	47	23	17.1	47	23	16.5
52	28	14.9	52	28	17.1	17 02	38	16.3
57	33	14.9	57	33	17.4	17	53	16.3
15 02	38	15.0	16 02	38	17.3	32	14 08	16.3
07	43	15.4	07	43	17.3			

NO. 6.—OBSERVATIONS AT THE EKATERINBURG OBSERVATORY,
RUSSIA.

(Communicated by H. Abels and P. Mueller.)

The following magnetic and meteorological observations were made in accordance with the program given in the circular letter received from Dr. Bauer. The eye readings of the variometers were taken every minute on August 21, 1914, from 10 to 15 o'clock (3 P. M.) Greenwich mean civil time. The observers were Messrs. Korovin (10 to 11 A. M.), Putnin (11 to Noon), and Metnikov (Noon to 3 P. M.).

Various observers took part successively in the meteorological

observations; while some were taking the readings indoors of the barometer and of the anemometer, others were making simultaneously the outdoor observations. The geographic position of the Observatory is: $56^{\circ} 49.6' N.$; $60^{\circ} 38.3' E.$ of Gr.

[Table 5-A has been condensed from the authors' original table. Instead of giving the original values for each minute, described above, five-minute means are given. For example, the values for $10^h 05^m$ are the means of the readings from $10^h 03^m$ to $10^h 07^m$. The values for $10^h 01^m$ are the means of the three readings at $10^h 00^m$, $10^h 01^m$, and $10^h 02^m$. Similarly, the values for $14^h 59^m$ are the means of the three readings at $14^h 58^m$, $14^h 59^m$, and $15^h 00^m$. The authors also sent with their report copies of the magnetograms for August 21, 1914.—B.]

TABLE 6-A.—Results of magnetic observations at the Ekaterinburg Observatory on August 21, 1914.

G.M.T.	Decl'n (East)	Intensity		G.M.T.	Decl'n (East)	Intensity		G.M.T.	Decl'n (East)	Intensity	
		Hor'l	Vert'l			Hor'l	Vert'l			Hor'l	Vert'l
h m	° ' "	γ	γ	h m	° ' "	γ	γ	h m	° ' "	γ	γ
7 00	10 57.6	17257	50863	11 30	10 56.8	17290	50865	14 00	11 03.2	17275	50868
15	57.4	56	63	35	56.8	91	66	05	02.9	74	68
30	57.0	61	62	40	56.7	92	67	10	02.7	73	67
45	56.3	62	60	45	56.8	93	67	15	02.4	76	67
8 00	55.9	66	58	50	56.9	93	67	20	01.9	76	67
15	55.6	68	60	55	57.1	91	67	25	01.8	76	67
30	55.5	67	55	12 00	57.4	90	67	30	01.7	77	66
45	56.0	64	54	05	57.9	89	67	35	01.5	78	66
9 00	55.4	72	54	10	58.3	89	66	40	01.2	78	65
15	55.0	77	56	15	58.2	91	67	45	01.0	77	64
30	55.0	76	58	20	58.4	89	66	50	00.8	78	64
45	55.1	77	61	25	58.7	87	66	55	00.8	78	64
10 01	55.8	76	62	30	58.9	85	67	59	01.0	79	64
05	56.4	72	62	35	59.2	84	67	15 15	00.7	78	64
10	56.6	71	62	40	59.8	83	68	30	00.5	79	63
15	56.6	72	62	45	11 00.7	81	68	45	00.4	80	63
20	56.8	74	62	50	01.3	79	68	16 00	00.2	84	62
25	57.1	76	62	55	01.7	78	69	15	00.5	84	61
30	57.3	78	62	13 00	01.9	77	70	30	00.1	85	61
35	57.4	80	62	05	02.2	76	70	45	00.9	84	60
40	57.5	80	62	10	02.5	77	71	17 00	01.1	83	60
45	57.6	82	62	15	02.6	78	71	15	01.1	88	60
50	57.4	84	62	20	02.9	77	71	30	00.5	88	59
55	57.3	87	63	25	02.8	78	71	45	00.6	86	59
11 00	57.0	90	63	30	03.1	74	70	18 00	00.2	85	58
05	57.0	90	64	35	03.0	76	70	15	11 00.2	85	59
10	57.1	90	64	40	03.2	75	69	30	10 59.9	84	58
15	56.9	91	64	45	03.3	75	68	45	11 00.2	83	58
20	56.7	91	65	50	03.2	75	68	19 00	00.0	82	58
25	56.7	91	65	55	03.3	75	68				

TABLE 6-B.—*Results of meteorological observations at the Ekaterinburg Observatory on August 21, 1914.*

G.M.T.		Pres- sure	Temp. of Air	Vapor Tension	Rel. Hum.	Wind		Cloudiness
						Dir.	Vel.	
h	m	mm	°	mm	%		m	
10	00	733.1	27.0	9.5	35	S	8	⊙ 5 Ci, Ci-Cu, Cu
	15	32.9	27.8	9.4	35	SSW	9	⊙ 4 Ci, Ci-S, Cu
	30	32.8	27.6	9.5	35	S	10	⊙ 4 Ci, Ci-S, Cu
	45	32.9	27.2	9.2	35	S	10	⊙ 4 Ci, Ci-S, Cu
11	00	32.9	26.8	9.1	35	S	7	⊙ 3 Ci, Cu
	05	32.9	27.2	9.5	35	S	8	⊙ 4 Ci, Cu
	10	32.9	27.4	9.3	35	S	10	⊙ 3 Ci, Ci-S, Cu
	15	32.9	26.8	9.1	35	SSE	10	⊙ 3 Ci, Ci-S
	20	32.9	26.8	9.1	35	SE	9	⊙ 3 Ci, Ci-S, Cu
	25	32.8	26.8	9.1	35	S	9	⊙ 3 Ci, Ci-S, Cu
	30	32.8	26.6	8.9	35	S	12	⊙ 2 Ci, Ci-S, Cu
	35	32.8	26.8	9.1	35	SSE	9	⊙ 2 Ci, Ci-S, Ci-Cu, Cu
	40	32.8	26.6	8.9	35	S	10	⊙ 2 Ci, Ci-S, Ci-Cu, Cu
	45	32.8	26.7	8.8	35	SSE	9	⊙ 2 Ci, Ci-S, Ci-Cu, Cu
	50	32.8	27.0	8.8	34	SSE	9	⊙ 2 Ci, Ci-S, Ci-Cu, Cu
	55	32.8	26.6	8.3	33	S	9	⊙ 2 Ci, Ci-S, Ci-Cu
12	00	32.8	26.6	8.9	35	S	10	⊙ 3 Ci, Ci-S, Ci-Cu, Cu
	05	32.8	26.7	9.0	35	S	9	⊙ 3 Ci, Ci-S, Ci-Cu, Cu
	10	32.8	26.5	8.8	35	S	9	⊙ 3 Ci, Ci-S, Ci-Cu, Cu
	15	32.8	26.4	8.9	35	S	8	⊙ 3 Ci, Ci-S, Ci-Cu, Cu
	20	32.8	26.4	8.9	35	S	6	⊙ 3 Ci, Ci-S, Ci-Cu, Cu
	25	32.8	26.2	8.9	35	S	8	⊙ 3 Ci, Ci-S, Ci-Cu, Cu
	30	32.7	26.0	8.9	36	S	7	⊙ 3 Ci, Ci-S, Ci-Cu, Cu
	35	32.7	25.8	8.8	36	S	8	⊙ 3 Ci, Ci-S, Ci-Cu, Cu
	40	32.7	25.6	9.0	37	S	7	⊙ 3 Ci, Ci-S, Ci-Cu
	45	32.7	25.6	9.0	37	S	7	⊙ 2 Ci, Ci-S, Ci-Cu
	50	32.7	25.4	8.9	37	S	6	⊙ 3 Ci, Ci-S, Ci-Cu
	55	32.7	25.4	8.9	37	S	6	⊙ 3 Ci, Ci-S, Ci-Cu
13	00	32.7	25.3	9.0	37	S	6	⊙ 2 Ci, Ci-Cu
	05	32.7	25.2	9.1	38	SSE	5	⊙ 1 Ci, Ci-Cu
	10	32.7	25.2	9.1	38	S	6	⊙ 1 Ci, Ci-Cu
	15	32.7	25.2	9.1	38	SSE	5	⊙ 1 Ci, Ci-Cu
	20	32.7	25.2	9.4	39	SSE	6	⊙ 1 Ci, Ci-Cu
	25	32.7	25.2	9.5	39	S	5	⊙ 1 Ci, Ci-Cu
	30	32.6	25.2	9.2	38	S	6	⊙ 1 Ci, Ci-Cu
	35	32.6	25.2	9.1	38	SSE	6	⊙ 1 Ci, Ci-Cu
	40	32.6	25.4	9.4	39	SSE	7	⊙ 0
	45	32.6	25.3	9.1	38	S	6	⊙ 0
	50	32.7	25.2	9.1	38	S	6	⊙ 0
	55	32.7	25.2	8.9	37	S	6	⊙ 0
14	00	32.7	25.0	9.0	38	S	7	⊙ 1 Ci, Ci-Cu
	05	32.7	25.0	8.9	37	S	6	⊙ 1 Ci, Ci-Cu
	10	32.7	24.8	9.0	38	S	7	⊙ 1 Ci, Ci-Cu
	15	32.7	24.8	8.9	38	S	7	⊙ 1 Ci, Ci-Cu
	20	32.7	24.7	8.9	38	S	7	⊙ 1 Ci, Ci-Cu
	25	32.7	24.6	9.0	39	S	7	⊙ 1 Ci, Ci-Cu
	30	32.7	24.4	9.0	39	S	7	⊙ 1 Ci, Ci-Cu
	35	32.8	24.2	9.1	40	S	6	⊙ 1 Ci, Ci-Cu
	40	32.8	24.1	9.0	40	S	5	⊙ 0
	45	32.8	23.8	9.2	41	S	5	⊙ 0
	50	32.8	23.5	9.2	42	SE	5	⊙ 1 Ci, Ci-Cu
	55	32.8	23.3	9.2	43	SE	5	⊙ 2 Ci, Ci-Cu
15	00	32.8	23.1	9.2	43	SE	5	⊙ 2 Ci, Ci-Cu

NO. 7. OBSERVATIONS AT MAURITIUS OBSERVATORY, AUG. 21, 1914.

(Communicated by A. Walter, Director.)

G. M. T.		MAGNETIC ^a				METEOROLOGICAL ^a							Remarks
		Absolute Values			Barom- eter Pres- sure	Temperature		Wind		Cloud (0-10)			
		W. Decl.	Hor. Int.	Ver. Int.		Air	Evap.	Direc- tion ^b	Veloc- ity ^c	Upper	Lower		
h	m	°	'	γ	in.	°	°		pts.	miles			
9	55	9 35.1	23	24	31	10	12						Weather fine through- out period
10	00	34.9	41	12	29	938	75.1	65.9	10		1	1	
	05	34.9	39	12						3			
	10	34.7	38	11	932	75.2	65.3						
	15	34.7	39	12				10			1	1	
	20	34.5	39	12	930	75.0	65.7			2			
	25	34.5	40	12									
	30	34.3	41	12	929	74.9	66.0	10			0	1	
	35	34.3	41	12									
	40	34.3	42	13	928	74.7	65.8			2			
	45	34.1	43	13				10			0	2	
	50	33.9	43	13	929	74.7	65.9						
	55	33.9	44	13					7				
11	00	33.9	45	12	930	74.6	65.7	11			0	2	
	05	33.7	45	12									
	10	33.7	45	12	931	74.5	65.6			7			
	15	33.7	45	12				10			0	1	
	20	33.7	44	12	934	74.5	65.7						
	25	33.7	44	12					7				
	30	33.9	43	12	939	74.1	65.7	10			0	2	
	35	33.9	42	11									
	40	33.9	41	12	938	73.7	65.7			4			
	45	33.7	40	12				10			0	1	
	50	33.7	39	13	939	73.6	65.6						
	55	33.9	38	13					3				
12	00	33.9	37	14	938	73.5	65.9	10			0	1	
	05	33.9	37	14									
	10	34.1	36	15	942	72.9	65.7			4			
	15	34.1	36	15				10			0	1	
	20	34.1	35	16	945	72.1	75.5						
	25	34.1	34	16					5				
	30	34.3	33	16	949	71.9	65.0	10			0	2	
	35	34.5	32	16									
	40	34.9	31	17	951	71.6	64.9			5			
	45	34.9	30	18				10			0	2	
	50	34.7	29	18	950	71.7	64.7						
	55	34.7	28	19					5				
13	00	34.7	27	20	952	71.3	64.6	10			0	3	
	05	34.9	26	20									
	10	34.9	26	21	955	70.8	64.5			3			
	15	35.1	25	22				9			0	3	
	20	35.1	25	22	957	70.6	64.3						
	25	35.1	25	23					8				
	30	35.3	25	24	959	70.5	64.2	10			1	3	
	35	35.3	25	24									
	40	35.3	25	24	960	70.3	64.1			5			
	45	35.5	25	24				10			1	2	
	50	35.5	25	24	963	69.9	64.1						
	55	35.5	25	24					3				
14	00	35.5	25	24	966	69.8	64.0	9			1	4	
	05	35.5	25	24					3				
	10	35.7	25	24	969	69.7	64.1						
	15	35.7	25	24				10			1	3	
	20	35.7	26	24	971	69.6	64.0			4			
	25	35.9	26	24									
	30	35.9	27	24	972	69.5	63.9	10			1	3	
	35	35.9	27	24									
	40	35.9	28	24	975	69.3	63.8			3			
	45	36.1	28	24				9			2	2	
	50	36.1	28	24	977	69.2	63.7						
	55	36.1	28	24					3				
15	00	35.9	28	24	979	68.8	63.7	10			2	3	

^a Change of temperature during observations in basement nil.

^b N = 0; E = 8; S = 16; W = 24 points.

^c Miles per 15 minutes.

NO. 8. DATA FOR BOMBAY AND ALIBAG OBSERVATORIES, AUG. 21,
1914. (*Communicated by N. A. F. Moos, Director.*)

G. M. T.		Absolute values of magnetic elements at Alibag			Values of meteorological elements at Bombay (Colaba)					
		Decl'n (East)	Intensity		Temp. of air (Fahr.)	Wet Bulb Temp. (Fahr.)	Bar. Press corr'd for means s. l. and grav	Wind		
			Hor'l	Vert'l				Velocity miles per hour	Dir.	
h	m	°	'	γ	γ	°	°	in.		
10	00	0	43.3	36884	16609	84.0	78.5	29.651	12	W
	05		43.5	81	610	83.9	78.8	.649	11	W
	10		43.7	79	611	84.1	79.2	.647	10	W
	15		43.8	79	611	84.2	78.8	.647	11	W
	20		44.0	79	612	84.2	78.8	.647	12	W
	25		44.0	78	611	84.2	78.8	.647	12	W
	30		44.2	79	612	84.2	78.6	.645	12	W
	35		44.3	79	612	84.1	77.8	.645	12	W
	40		44.4	78	612	84.1	78.0	.644	14	W
	45		44.5	78	612	84.1	78.1	.643	13	W
	50		44.6	79	612	84.2	78.4	.643	14	W
	55		44.6	79	611	84.1	77.9	.643	14	W
11	00		44.6	80	610	83.9	77.7	.642	14	W
	05		44.7	80	610	83.9	77.5	.641	14	W
	10		44.7	79	610	83.9	77.4	.643	14	W
	15		44.8	78	610	83.9	77.7	.644	13	W
	20		44.8	78	610	83.9	77.8	.643	13	W
	25		44.8	77	609	83.9	77.7	.641	14	W
	30		44.8	76	608	83.9	77.6	.637	13	W
	35		44.9	75	607	83.9	77.5	.637	13	W
	40		44.9	75	607	83.7	77.9	.639	12	W
	45		45.0	74	606	83.7	77.6	.639	12	W
	50		44.9	73	604	83.7	77.6	.639	12	W
	55		44.9	72	603	83.7	77.7	.640	11	W
12	00		45.0	71	602	83.6	77.6	.641	10	W
	05		45.0	71	602	83.4	77.7	.641	10	W
	10		45.0	70	601	83.3	77.6	.641	12	W
	15		45.0	70	599	83.4	77.8	.641	12	W
	20		45.0	70	598	83.3	77.2	.641	12	W
	25		44.9	68	598	83.0	77.3	.642	14	W
	30		44.9	67	597	82.8	77.0	.643	14	W
	35		44.9	66	595	82.7	76.9	.643	14	W
	40		44.9	66	595	82.6	76.7	.643	13	W
	45		44.9	65	594	82.6	77.0	.642	12	W
	50		44.8	64	593	82.6	77.2	.642	12	W
	55		44.8	63	593	82.5	76.9	.644	11	W
13	00		44.8	62	592	82.3	76.7	.644	11	W
	05		44.7	62	591	82.3	76.9	.646	11	W
	10		44.6	62	589	82.3	76.4	.648	12	W
	15		44.4	62	590	82.2	76.3	.649	11	W
	20		44.4	61	589	82.2	76.5	.651	11	W
	25		44.2	61	589	82.1	76.5	.653	11	W
	30		44.2	61	589	82.1	76.5	.655	12	W
	35		44.1	60	588	81.7	76.4	.656	12	W
	40		44.0	60	589	81.7	76.3	.657	12	W
	45		44.0	60	589	81.7	76.5	.659	12	W
	50		44.0	60	590	82.3	76.4	.658	12	W
	55		44.1	59	589	81.6	76.5	.659	12	W
14	00		44.0	58	590	81.5	76.6	.661	12	W
	05		44.0	58	589	81.5	76.3	.663	12	W
	10		43.9	58	590	81.4	76.2	.664	12	W
	15		43.9	59	590	81.4	76.0	.666	12	W
	20		43.8	60	589	81.2	76.4	.667	12	W
	25		43.8	60	590	81.2	76.2	.671	12	W
	30		43.8	61	589	81.2	76.2	.675	11	W
	35		43.7	62	589	81.2	76.2	.674	11	W
	40		43.6	63	589	81.2	76.5	.675	10	W
	45		43.6	63	590	81.2	76.7	.677	9	W
	50		43.6	64	590	81.2	76.7	.679	11	W
	55		43.6	64	590	80.1	75.7	.680	8	W
15	00		43.6	64	591	80.1	75.8	.683	8	W

Table 8-B.—Average hourly values derived from all days in the month of August, 1914.

G. M. T. Hour(a)	10	11	12	13	14	15
	° /	° /	° /	° /	° /	° /
Declination.....	0 42.8 E	0 43.8 E	0 44.4 E	0 44.3 E	0 43.7 E	0 43.6 E
Horizontal Intensity..	36885	36877	36870	36866	36866	36867
Vertical Intensity....	16594	16597	16596	16590	16587	16589
	°	°	°	°	°	°
Temperature of air...	82.9 F	82.4 F	81.6 F	81.0 F	80.6 F	80.4 F
Wet Bulb Temp....	78.6 F	78.2 F	77.7 F	77.4 F	77.1 F	77.1 F
	in.	in.	in.	in.	in.	in.
Barometric Pressure..	29.666	29.659	29.662	29.673	29.689	29.705

(a) The hours as given denote exact full hours of G. M. T. for the magnetic elements; those for temperature, dry and wet, denote 11 minutes past the full hour; and those for barographs, 16 minutes past the full hour, as the measurements of the curves are made always at these exact instants of time.

NOS. 9 AND 10.—MAGNETIC OBSERVATIONS AT THE DEHRA DUN
AND THE KODAIKANAL MAGNETIC OBSERVATORIES DURING
THE SOLAR ECLIPSE OF AUGUST 21, 1914.

(Communicated by Captain R. Thomas, R.E.)

In response to Dr. Bauer's circular letter requesting cooperation in the special program of magnetic observations during the solar eclipse of August 21, 1914, the following observations were taken at the Dehra Dun and the Kodaikanal magnetic observatories.

Dehra Dun. Magnetometer *H*-observations: Full deflection observations were made at the commencement of every hour during the desired period, scale readings being taken every minute between the deflection observations. Corrections for change of declination and temperature were applied to the scale readings and the variations in *H* between two sets of deflection observations were then derived from the changes in the resulting deflection angles. Magnetometer *D*-observations: Two full sets of declination were made at the beginning and subsequently scale readings were taken every minute.

Kodaikanal. Magnetograph eye readings were made every

half minute; as only one observer was available, magnetometer observations could not be made.

Tables 9-A and 10-A are abstracts of the observations at both observatories; in order to reduce the observing error the means of five-minute observations have been taken out.

TABLE 9-A.—Abstract of magnetic observations taken at Dehra Dun during the solar eclipse on August 21, 1914

G. M. T.	Declination		Hor. Int.		V. Int.	G. M. T.	Declination		Hor. Int.		V. Int.
	From Magnetometer E 2° +	From Magnetograph E 2° +	From Magnetometer 3300 γ +	From Magnetograph 3300 γ +	From Magnetograph 3200 γ +		From Magnetometer E 2° +	From Magnetograph E 2° +	From Magnetometer 3300 γ +	From Magnetograph 3300 γ +	From Magnetograph 3200 γ +
h m	'	'	γ	γ	γ	h m	'	'	γ	γ	γ
10 00	17.9	18.1	182	179	486	12 35	19.6	19.4	152	155	486
05	18.1	18.3	175	176	486	40	19.6	19.4	151	155	486
10	18.3	18.4	175	173	486	45	19.7	19.4	150	154	486
15	18.5	18.5	174	172	486	50	19.7	19.5	149	153	486
20	18.7	18.6	174	172	486	55	19.7	19.5	.....	153	485
25	18.8	18.7	175	173	487	13 00	19.7	19.5	151 ^d	151	485
30	18.8	18.9	172	173	488	05	19.8	19.5	.....	150	485
35	18.9	19.0	174	173	489	10	19.6	19.4	145	152	485
40	19.2	19.1	175	172	490	15	19.4	19.4	145	152	485
45	19.4	19.2	176	172	490	20	19.5	19.3	150	150	485
50	19.4	19.3	176	173	490	25	19.7	19.3	155	151	486
55	19.4	19.3	179	173	490	30	19.7	19.3	156	150	486
11 00	19.3	19.3	176 ^a	174	490	35	19.7	19.3	157	150	486
05	19.3	19.2	179 ^b	174	490	40	19.6	19.2	159	150	486
10	19.4	19.4	.....	172	490	45	19.4	19.2	153	150	486
15	19.4	19.4	178	172	490	50	19.3	19.2	149	149	486
20	19.4	19.4	175	171	489	55	19.2	19.2	.....	149	486
25	19.4	19.3	173	170	489	14 00	19.2	19.2	145 ^e	148	487
30	19.5	19.4	169	167	488	05	19.2	19.1	.....	148	486
35	19.6	19.4	169	167	487	10	19.3	19.2	147	149	487
40	19.6	19.4	167	166	487	15	19.3	19.2	151	149	488
45	19.6	19.5	165	164	487	20	19.2	19.0	152	150	488
50	19.7	19.5	166	163	487	25	19.0	18.9	150	151	490
55	19.7	19.5	.....	162	486	30	18.9	18.9	153	153	490
12 00	19.7	19.5	160 ^c	161	486	35	18.8	18.8	155	154	490
05	19.7	19.5	.....	161	486	40	18.7	18.6	153	154	490
10	19.7	19.5	160	160	486	45	18.6	18.4	155	155	490
15	19.6	19.5	156	159	486	50	18.6	18.4	157	156	491
20	19.6	19.4	153	158	486	55	18.6	18.4	156	157	491
25	19.6	19.4	154	158	486	15 00	.....	18.5	.....	156	491
30	19.6	19.4	150	156	486	06	18.7	18.5	156	158	491

^a At 11^h 02^m. ^b At 11^h 08^m. ^c At 12^h 01^m. ^d At 13^h 03^m. ^e At 14^h 02^m.

TABLE 10-A.—*Abstract of magnetic observations taken at Kodaikanal during the solar eclipse on August 21, 1914.*

G. M. T.	Decl'n (West)	Intensity		G. M. T.	Decl'n (West)	Intensity	
		Hor'l	Vert'l			Hor'l	Vert'l
h m	° '	γ	γ	h m	° '	γ	γ
10 00	1 17.8	37540	2792	12 35	1 16.7	37556	2767
05	17.7	537	792	40	16.8	557	767
10	17.5	535	790	45	16.8	557	765
15	17.5	534	789	50	16.8	557	764
20	16.9	535	791	55	16.8	556	764
25	16.8	535	791	13 00	16.8	556	762
30	16.8	536	792	05	16.9	556	761
35	16.8	535	792	10	17.2	556	761
40	16.7	535	792	15	17.7	556	761
45	16.7	536	792	20	17.8	556	760
50	16.7	537	791	25	17.8	555	760
55	16.7	538	791	30	17.8	553	760
11 00	16.6	540	790	35	17.8	553	759
05	16.6	541	789	40	17.8	551	759
10	16.6	542	789	45	17.9	551	759
15	16.6	543	788	50	17.9	550	759
20	16.6	543	788	55	17.9	550	759
25	16.6	543	787	14 00	17.9	550	759
30	16.6	543	786	05	17.9	550	759
35	16.6	545	785	10	17.9	550	759
40	16.6	546	783	15	17.9	550	759
45	16.6	548	783	20	17.9	550	759
50	16.6	549	780	25	17.9	550	760
55	16.6	550	778	30	17.9	550	763
12 00	16.6	550	775	35	17.9	551	764
05	16.6	552	774	40	17.9	552	764
10	16.6	554	773	45	17.9	553	764
15	16.6	555	773	50	17.9	553	764
20	16.6	556	773	55	17.9	554	764
25	16.6	556	772	15 00	17.9	553	764
30	16.6	556	768				

NO. 11.—MAGNETIC AND METEOROLOGICAL OBSERVATIONS MADE
AT THE LUKIAPANG OBSERVATORY DURING THE TIME OF THE
SOLAR ECLIPSE OF AUGUST 21, 1914.

(Communicated by J. de Moidrey, S.J.)

In spite of our distance from the provinces where the eclipse of August 21, 1914, was to be visible, I was getting ready to make certain observations when Dr. Bauer's circular of June 23, 1914, reached me. We have not followed it exactly, but the following shows what has been done. I note that the fine sun-spot which was crossing the disc, while it did not produce a great perturbation, produced waves at our station probably more noticeable than an effect of the eclipse.

Magnetographs. Calibrations were made on August 20 and 22. Although the sensitiveness of the balance was very insufficient, we preferred not to touch the instrument for fear of altering the base line.

Below is given the value of 1 mm. during the eclipse:

$$dD = 0'.48; dH = 2.3\gamma; dZ = 6.2\gamma.$$

The temperatures under the bell jars were:

Greenwich Mean Time	For H	For Z
7 ^h	31.20	31.15
12	31.20	31.15
25	31.02	31.00

The temperature coefficients are: $q_h = 38.1$ and $q_z = 28.1$.

Besides the automatic even-hour interruptions, a more exact mark was made at 9^h 51^m and at 15^h 03^m, care having been taken to obtain the precise time by telephone from Zi-ka-wei. The precise point which corresponds to these hours is the mean of the interruption of the curves, either of the base line or of the other, the interruptions being indicated by the little arrow. (See Fig. 3.)

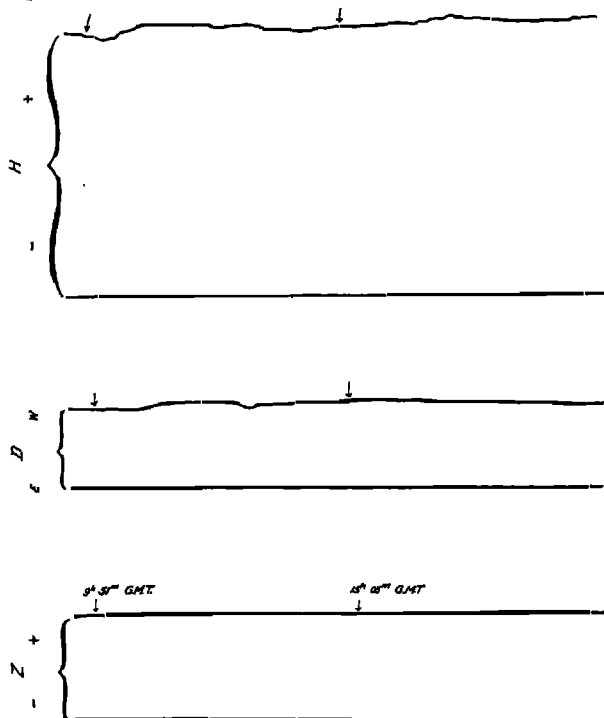


FIG. 3.—Magnetograms at Luk'apang Observatory, August 21, 1914; outside of Eclipse Limits. (Reduction, 2. 5.)

Meteorological Observations. The condition of the registering apparatus was verified, and Mr. Ignace Li read by Greenwich time the Fuess psychrometer and the Tonnelot barometer. The latter is here reduced to 0, at sea level and normal gravity.

G. M. T.	Dry Thermometer	Wet Thermometer	Barometric Pressure
	°	°	mm
10	27.6	26.1	752.32
11	26.3	25.7	752.36
12	26.0	25.1	752.91
13	25.2	24.9	753.54
14	24.9	24.6	753.56
15	24.7	24.5	753.39
24	28.0	26.0	752.84

NO. 12.—OBSERVATIONS AT THE ANTIPOLLO MAGNETIC OBSERVATORY, PHILIPPINES.

(Communicated by M. Saderra Maso, Assistant Director.)

TABLE 12-A—Magnetic declination readings and meteorological observations at the Antipollo Magnetic Observatory on August 21, 1914.

G. M. T.	ΔD^a	Air Temp.	Wind		Weather	G. M. T.	ΔD^a	Air Temp.	Wind		Weather
			Direc.	Force					Direc.	Force	
h m	'	°				h m	'	°			
10 00	0.00	23.8	SW	2	Rainy	12 30	-0.92	22.5	SW	5	Squally
05	0.00	23.8	"	"	"	35	-0.95	22.3	"	5-3	"
10	0.00	23.8	"	"	"	40	-1.08	22.1	"	3-4	"
15	-0.40	23.8	"	"	Overcast	45	-1.18	22.1	NW	5-4	"
20	-0.67	23.8	"	"	"	50	-1.25	22.0	SW	4-6	"
25	-0.67	23.8	"	"	"	55	-1.40	22.0	"	6	"
30	-0.67	23.8	"	"	Fog	13 00	-1.50	22.0	NW	5	"
35	-0.75	23.8	W	1	"	05	-1.58	22.0	"	"	"
40	-0.75	23.8	"	"	"	10	-1.58	22.1	"	"	"
45	-0.80	23.8	SW	2	Drizzle	15	-1.63	22.2	"	"	"
50	-0.80	23.9	"	"	Overcast	20	-1.83	22.2	"	"	"
55	-0.80	23.9	"	"	"	25	-1.79	22.1	"	"	"
11 00	-0.80	23.9	"	1	"	30	-1.63	22.0	SW	5-4	"
05	-0.80	23.9	W	"	"	35	-1.63	22.0	"	4	"
10	-0.80	24.0	"	"	"	40	-1.63	22.0	"	"	"
15	-0.80	24.0	"	"	"	45	-1.63	22.0	"	"	"
20	-0.80	24.0	"	"	"	50	-1.63	22.0	"	"	"
25	-1.00	24.1	SW	3	Squally	55	-1.63	22.0	"	"	"
30	-1.00	24.1	"	"	Thun., Rainy	14 00	-1.63	22.0	"	4-3	"
35	-1.00	24.0	"	"	Rainy	05	-1.60	22.0	"	3	"
40	-1.00	23.9	"	"	Heavy Rain	10	-1.58	22.0	"	"	"
45	-1.00	23.8	"	4	Squally	15	-1.56	22.0	"	"	"
50	-1.00	23.6	"	"	"	20	-1.55	22.0	"	"	"
55	-1.00	23.5	N	3-4	Thun. Show.	25	-1.55	22.0	"	"	"
12 00	-0.94	23.4	N	3-4	Heavy rain	30	-1.52	22.0	"	3-2	"
05	-0.92	23.2	N	4	"	35	-1.50	22.0	"	2	"
10	-0.92	23.1	SW	3	Overcast	40	-1.50	22.0	"	"	"
15	-0.92	23.0	"	"	Ov't, Light'g	45	-1.46	22.0	"	"	"
20	-0.92	22.8	"	4-3	Overcast	50	-1.42	22.0	"	"	"
25	-0.92	22.6	"	3-5	Ov't, Squally	55	-1.42	22.0	"	"	"

^a The author does not explain the meaning of the sign —; it is assumed that increasing negative quantities indicate westward motion of north end of needle.—B.

NO. 13.—OBSERVATIONS AT THE AGINCOURT OBSERVATORY,
CANADA.

(Communicated by R. F. Stupart, Director.)

TABLE 13-A.—Values of the magnetic elements at Agincourt Observatory on
August 21, 1914.^a

G.M.T.	Decl'n (West)	Hor'l Int.	G.M.T.	Decl'n (West)	Hor'l Int.	G.M.T.	Decl'n (West)	Hor'l Int.
h m	° /	γ	h m	° /	γ	h m	° /	γ
10 01	6 25.8	16072	11 45	6 21.1	16081	13 25	6 21.9	16061
05	26.9	70	50	20.8	82	30	22.3	60
10	27.3	69	55	20.6	83	35	22.4	59
15	27.2	70	12 00	20.6	82	40	22.8	56
20	27.5	70	05	20.5	82	45	22.6	53
25	27.0	73	10	20.6	82	50	22.6	53
30	26.4	74	15	20.0	81	55	23.1	50
35	26.1	74	20	19.5	81	14 00	23.3	48
40	25.8	74	25	19.4	80	05	24.1	48
45	25.7	75	30	19.6	79	10	24.6	47
50	25.4	77	35	20.1	77	15	24.6	46
55	24.5	79	40	20.0	74	20	25.0	46
11 00	23.8	80	45	20.8	71	25	25.1	45
05	23.5	80	50	21.2	70	30	25.3	44
10	23.1	81	55	21.4	69	35	25.6	43
15	22.6	82	13 00	21.0	68	40	25.7	42
20	22.5	83	05	21.0	67	45	25.8	40
25	22.4	82	10	21.2	66	50	26.0	39
30	22.1	82	15	21.4	63	55	26.5	39
35	22.0	81	20	21.9	61	59	26.8	39
40	21.6	81						

^a The original table gave the values for every minute. Only the five-minute means are published here. The values at 10^h 01^m and 14^h 59^m are each the mean of three readings.—B.

NOS. 14, 15, 16, 17, 18.—OBSERVATIONS AT THE UNITED STATES
MAGNETIC OBSERVATORIES (PORTO RICO, CHELTENHAM,
TUCSON, SITKA, AND HONOLULU).

The results of the magnetic observations at these Observatories will be found in this journal, vol. 21, pp. 9-14.

NOS. 19, 20, 21, 22, 23.—MAGNETIC OBSERVATIONS BY THE DE-
PARTMENT OF TERRESTRIAL MAGNETISM.

The following observations were made in accordance with special instructions sent to the observers of the Department of Terrestrial Magnetism. Declination readings were made, as nearly as possible, on the full minute G. M. T. for every minute during the prescribed interval on August 21, 1914. Unfavorable weather

TABLES Nos. 19, 20, 21, 22, 23.—*Magnetic declinations on August 21, 1914.*

G. M. T.	No. 19 Washington, D. C.	No. 20 Burwell, Labrador	No. 21 Ruwe, Bel- gian Congo	No. 22 Dessié, Ab- yssiinia	No. 23 Canton, China
^h ^m	[°] [']	[°] [']	[°] [']	[°] [']	[°] [']
10 01	4 31.5W	41 21.5W	12 21.5W	1 42.2W	0 20.1W
05	32.0	19.3	21.3	42.1	20.2
10	32.4	17.8	21.2	42.1	20.3
15	32.7	21.8	21.2	41.9	20.3
20	32.8	26.3	20.9	41.7	20.3
25	32.6	27.1	20.9	41.7	20.3
30	32.1	27.5	20.7	41.8	20.3
35	31.7	23.2	20.5	42.0	20.3
40	31.4	20.7	20.4	42.1	20.4
45	31.2	21.2	20.3	42.0	20.4
50	31.0	24.5	20.2	41.9	20.5
55	30.5	25.7	20.1	41.9	20.6
11 00	30.0	26.6	19.9	41.9	20.9
05	29.7	30.0	19.7	42.1	21.1
10	29.5	32.0	19.6	42.1	21.2
15	29.0	32.5	19.6	42.3	21.3
20	28.9	32.1	19.5	42.3	21.4
25	28.9	34.4	19.4	42.3	21.6
30	28.6	33.5	19.1	42.2	21.7
35	28.5	35.6	19.0	42.1	21.7
40	28.1	36.7	18.9	42.1	21.7
45	27.7	39.7	18.8	41.9	22.0
50	27.4	41.1	18.7	41.7	21.9
55	27.4	41.3	18.6	41.5	22.0
12 00	27.4	39.9	18.5	41.5	21.9
05	27.2	36.0	18.3	41.3	22.0
10	27.3	37.3	18.3	41.2	22.1
15	26.9	36.6	18.3	41.1	21.8
20	26.5	35.9	18.3	41.1	21.6
25	26.4	37.7	18.4	41.1	21.5
30	26.5	36.5	18.4	41.3	21.4
35	26.5	36.7	18.5	41.2	21.3
40	26.4	38.7	18.4	41.2	21.1
45	26.8	41.3	18.5	41.1	20.8
50	27.2	41.3	18.4	41.0	20.6
55	27.4	42.9	18.4	40.9	20.3
13 00	27.3	43.2	18.4	40.9	20.3
05	27.2	38.9	18.4	40.8	20.3
10	27.3	40.5	18.5	40.8	20.3
15	27.3	40.5	18.6	40.9	20.3
20	27.8	40.9	18.6	40.8	20.3
25	28.1	43.4	18.5	40.8	20.3
30	28.6	....	18.5	40.6	20.3
35	28.6	....	18.5	40.6	20.3
40	29.0	....	18.4	40.4	20.3
45	28.9	....	18.4	40.2	20.3
50	29.0	....	18.4	40.1	20.3
55	29.2	....	18.4	40.0	20.4
14 00	29.7	....	18.5	39.9	20.3
05	30.1	....	18.5	39.7	20.4
10	30.7	....	18.6	39.8	20.3
15	30.9	....	18.6	40.0	20.3
20	31.2	....	18.7	40.1	20.3
25	31.4	....	18.8	40.3	20.3
30	31.7	....	18.9	40.4	20.3
35	31.7	....	18.9	40.5	20.3
40	31.9	....	19.1	40.7	20.3
45	32.0	....	19.2	40.8	20.2
50	31.9	....	19.4	40.9	20.1
55	32.1	....	19.5	40.9	20.1
59	32.3	....	19.6	40.9	20.2

interfered somewhat with the observational program at Burwell, Labrador. There are some slight uncertainties in the times of the readings at stations Nos. 20, 21, and 22, owing either to lack of precise knowledge of longitude of station, or because of failure to secure time observations on account of bad weather. In the table the five-minute mean results are given.

The stations, instruments, and observers are as follows:

No.	Station	Magnetometer	Observer
19	Washington, D.C.	C. I. W. No. 7	J. A. Fleming
20	Burwell, Labrador	C. I. W. No. 13	W. J. Peters and D. W. Berky
21	Ruwe, Belgian Congo	C. I. W. No. 16	D. M. Wise
22	Dessié, Abyssinia	C. I. W. No. 10	W. F. Wallis
23	Canton (Honglok), China	C. I. W. No. 12	C. K. Edmunds

ON THE ATMOSPHERIC-ELECTRIC OBSERVATIONS MADE DURING
THE SOLAR ECLIPSE OF AUGUST 21, 1914, AT KEW AND
ESKDALEMUIR.

(*Abstract of Preliminary Report by Dr. W. F. G. Swann.*)

The records of the observations received from Kew and Eskdalemuir observatories have been examined, and plotted. The general irregularities of the curves make it very difficult to draw any conclusions as to the effect of the eclipse. Perhaps the nearest approach to a definite indication of a relation was found in the case of the *potential-gradient*. Here, both in the case of the observations at Eskdalemuir and at Kew, the element showed a depression with a minimum at the time of the maximum obscuration. This minimum was absent in the Eskdalemuir observations for August 20, and, while it was present on August 22, it was much less pronounced than on August 21.

The *conductivity curve* for Eskdalemuir shows a minimum during the first half of the period of the obscuration, but as this minimum also occurred on August 20 and 22, it cannot be definitely associated with the eclipse. Analogous remarks apply to the curves for the air-earth current and for the average charge density, $\frac{1}{2}(E_+ + E_-)$.

Since the variations which atmospheric-electric quantities are apt to show in a short period of time are so large (being of an order of magnitude equal to that of the whole of the quantity measured), it is felt that only after the accumulation of data from many sets of

eclipse observations will it be possible to speak with anything like certainty regarding the influence of the eclipse on such phenomena.

ATMOSPHERIC-ELECTRIC OBSERVATIONS MADE AT THE LABORATORY
OF THE DEPARTMENT OF TERRESTRIAL MAGNETISM,
WASHINGTON, D. C., DURING THE SOLAR ECLIPSE
OF AUGUST 21, 1914.

(Abstract of Report by Dr. W. F. G. Swann.)

Although the city of Washington was far removed from the belt of totality, being in fact just within the eclipse limits, it was considered desirable to attempt observations. These observations comprised measurements of the potential-gradient and of the conductivities (λ_+ and λ_-) for positive and negative ions, but the measurements of the potential-gradient were only relative. The observations extended from a time just prior to commencement of the eclipse to about 1.5 hours after its completion.

The potential-gradient was on the average somewhat smaller during the period of the eclipse than it was immediately before and after, but the variation was not large enough, compared with the natural irregularities, to warrant any certainty as to a connection between the phenomena. λ_+ showed a slight increase during the period of the eclipse, while λ_- showed a tendency in the reverse direction. Here again, however, the magnitudes of the changes were not so marked but that one might naturally attribute them to phenomena independent of the eclipse.

PRELIMINARY REVIEW OF MAGNETIC RESULTS.

We have plotted according to Greenwich mean time the curves showing the changes of the magnetic elements at the various stations for which the data are published in this report. It appears that August 21, 1914, was not wholly undisturbed, which fact was shown, however, to any marked extent, only at extreme northerly stations like Sitka, Alaska, and Burwell, Labrador. Various observers called attention to the good-sized Sun-spot seen on this day.³

³ Regarding this spot, F. C. DENNETT reports in the October, 1914, issue of *Knowledge* (p. 379) as follows:

"No. 24.—A fine spot, first seen on August 13, 1914, within the northeastern limb, followed by a faculic area. From August 16-22 some small pores clustered round its eastern half; none, however, were very persistent. There were also some penumbral extensions, which, on August 21, reached a maximum diameter of 36,000 miles; but the usual diameter of the spot was 26,000 miles, and the length of the group, 45,000 miles. On August 18, the umbra was almost broken into three by very pale bridges. A bright tongue projected into it from the east, August 19-21. The northern part of the umbra was quite cut off on August 23-25. The spot was last seen on August 26. . . . During the eclipse on August 21, No. 24 was a beautiful object. Its dark umbra was, however, markedly less dark than the advancing rugged limb of the Moon, which presently covered it. It was of large size, but the spectroscope showed comparatively little disturbance."

In general, for the stations considered, the effect of any magnetic disturbance, which may have to be associated rather with the Sun-spot than with the solar eclipse, was of a moderate character; the mean "magnetic character" of August 21 was only 0.3.⁴

Table A gives the geographic positions of the various stations, the data respecting the phase of maximum obscuration, and the approximate magnetic elements, as applying to the solar eclipse of August 21, 1914. Unfortunately, in our present list there are no stations within the belt of totality. However, there were several such stations, if the European war did not prevent the carrying out of the various proposed plans. The data from these stations will doubtless be included in the reports and discussions by others. Of our list, Rude Skov, near Copenhagen, Denmark, and Ksara, Syria, were nearest to the totality belt. The degree of obscuration (see Table A) at these stations was nearly 0.9, at the stations in Great Britain, 0.6 to 0.7, and at Ekaterinburg, 0.7.

In accordance with previous experience, a possible eclipse magnetic effect will make itself felt differently according to the position of the station with reference to the belt of totality, the time of day when the maximum phase occurs, the direction of motion of the shadow cone, etc. Generally speaking, the effect is to cause a retardation, or alteration, in the usual course of the magnetic diurnal variation. For the four stations, Eskdalemuir, Stonyhurst, Kew, and Rude Skov, the maximum phase of the eclipse occurred at about the time when the declination needle is approaching its maximum westerly position for the day. Fig. 4 shows the declination changes for these four stations during the period 10^h to 15^h (3 P. M.) Greenwich civil mean time, August 21, 1914. The approximate times of the maximum obscuration are shown on the various curves by a heavy vertical mark.

Examining Fig. 4 it will be seen that a bay occurred at each station a few minutes before the time of maximum obscuration. As the result of this bay, the customary progression towards a

⁴ From the table of international "magnetic character numbers" for 1914 (*Terr. Mag.*, vol. 20, p. 137), the following data are extracted for the period during which the particular Sun-spot group here considered was visible:

Date 1914	Mag. Char.	Date 1914	Mag. Char.	Date 1914	Mag. Char.	Date 1914	Mag. Char.	Date 1914	Mag. Char.
Aug. 13	0.4	Aug. 16	0.1	Aug. 19	0.9	Aug. 22	0.1	Aug. 25	0.8
14	0.1	17	0.4	20	0.9	23	1.2	26	0.6
15	0.2	18	0.6	21	0.3	24	0.5		

These numbers show that, on the whole, August 21 was fairly quiet. In fact only about 20 per cent of the magnetic observatories (most of these, too, being outside of the region of visibility of the eclipse) assigned the number 1 (moderately disturbed) to August 21.

TABLE A.—Data pertaining to the various stations.

No.	Station	Country	Geographical Position			Max. Observation			Approx. Mag El.		
			Lat. ^a	Long. fr. Gr. ^b		Degree ^c	G. M. T.	L. M. T.	D	H	Z ^e
			° /	° /	h m		h m	h m	°	cgs	cgs
15	Cheltenham.	Maryland	+38 44	- 76 50	- 5 07	About	sun rise		6.0W	.195	+.558
13	Agincourt...	Canada	+43 47	- 79 16	- 5 17	0.1	10 42	25 25	6.4W	.161	+.588
1	Eskdalemuir	Scotland	+55 19	- 3 12	- 0 13	0.69	12 02	11 50	17.8W	.168	+.452
2	Stonyhurst...	England	+53 51	- 2 28	- 0 10	0.67	12 05	11 55	16.8W	.173	+.445
3	Kew.....	England	+51 28	- 0 19	- 0 01	0.64	12 10	12 09	15.5W	.185	+.433
4	Rude Skov...	Denmark	+55 51	+ 12 27	+ 0 50	0.87	12 18	13 08	8.9W	.173	+.446
5	Ksara.....	Syria	+33 49	+ 35 53	+ 2 24	0.87	13 22	15 46	0.3W	.....	.....
6	Ekaterinburg	Russia	+56 50	+ 60 38	+ 4 02	0.69	12 46	16 49	11.0E	.173	+.509
8	Alibag.....	India	+18 38	+ 72 52	+ 4 52	After	sun-	set	0.7E	.369	+.166
9	Dehra Dun...	India	+30 19	+ 78 03	+ 5 12	After	sun-	set	2.3E	.332	+.325
10	Kodaikanal.	India	+10 14	+ 77 28	+ 5 10	After	sun-	set	1.3W	.375	+.028
7	Mauritius...	Mauritius	-20 06	+ 57 33	+ 3 50	Out-	side	zone	9.6W	.232	-.310
11	Lukiapang...	China	+31 19	+121 02	+ 8 04	Out-	side	zone	3.1W	.331	+.338
12	Antipolo....	Philippines	+14 36	+121 10	+ 8 05	Out-	side	zone	0.6E	.382	+.112
18	Honolulu....	Hawaii	+21 19	-158 04	-10 32	Out-	side	zone	9.7E	.290	+.239
17	Sitka.....	Alaska	+57 03	-135 20	- 9 01	Out-	side	zone	30.4E	.156	+.560
16	Tucson.....	Arizona	+32 15	-110 50	- 7 23	Out-	side	zone	13.7E	.272	+.459
14	Porto Rico...	Porto Rico	+18 09	- 65 27	- 4 22	Out-	side	zone	3.0W	.284	+.345
19	Washington.	Dis.Columbia	+38 58	- 77 04	- 5 08	About	sun-	rise	4.5W	.191	+.555
20	Burwell.....	Labrador	+60 25	- 64 52	- 4 19	0.5	10.5	6.2	46.0W	.083	+.592
21	Ruwe.....	Belg'n Congo	-10 41	+ 25 34	- 1 42	Out-	side	zone	12.3W	.252	-.233
22	Dessié.....	Abyssinia	+11 06	+ 39 35	+ 2 38	0.5	14.2	16.8	1.7W	.350	+.016
23	Canton.....	China	+23 06	+113 19	+ 7 33	Out-	side	zone	0.3W	.373	+.234

^a North latitude designated by +. ^b East longitude designated by +. ^c Taking diameter of Sun as unit. ^d Sunrise occurred at about 5^h 12^m L. M. T. ^e North magnetic hemisphere designated as +.

westerly extreme was interrupted, and a retrograde movement occurred which continued for some time. Of the four stations, the bay was most developed at Rude Skov, the nearest one, of the present stations, to the belt of totality. The total range of this minor oscillation was at Rude Skov, about 2', or the amplitude was 1', which is the order of magnitude of similar oscillations observed at some previous eclipses.⁵

Fig. 4 would apparently also indicate that the Greenwich mean time of the lowest point of the bay occurred later and later in passing from Eskdalemuir to Rude Skov, and approximately according to the same rate that the phase of maximum obscuration progressed from station to station (see almost parallel course of the two lines passing, respectively, through the lowest points of the bays and through the maximum-obscurations marks). The

⁵ See, for example, L. A. BAUER's articles in *Terr. Mag.*, vol. 5, 1900, pp. 143-165, and vol. 7, 1902, pp. 155-192.

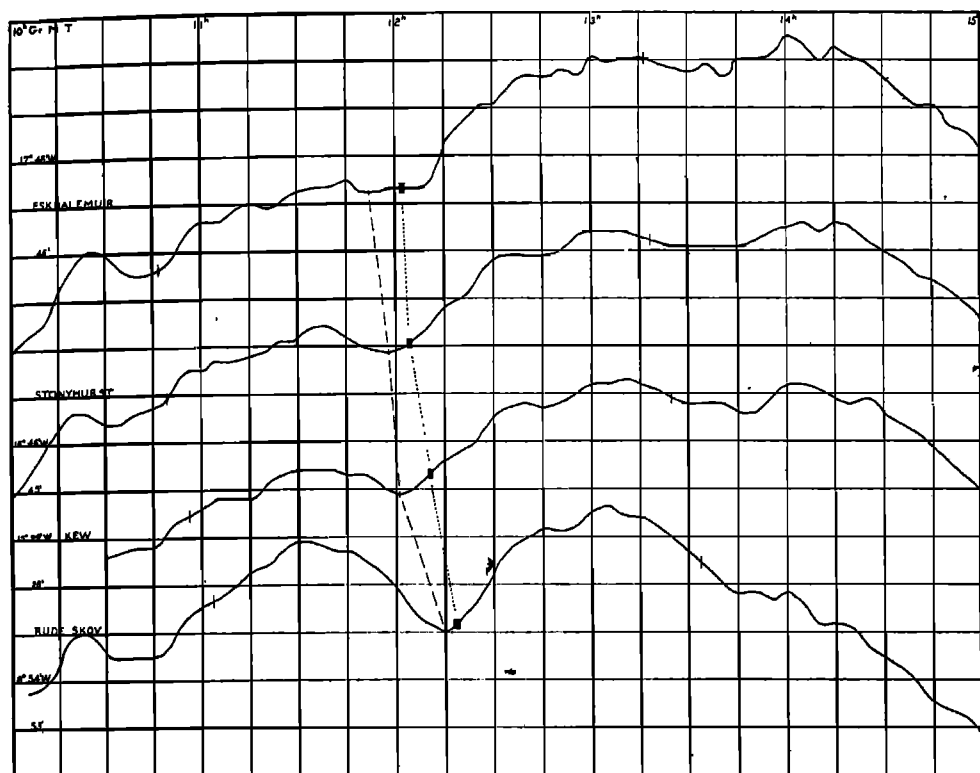


FIG. 4.—Magnetic Declination Changes at Eskdalemuir, Stonyhurst, Kew and Rude Skov, August 21, 1914.

occurrence of a magnetic effect at various stations, not at the same absolute time nor at the same local time, but related in some manner to the rate of progress of the shadow cone, may have to be regarded as one of the chief characteristics of a possible eclipse effect.⁵ This fact serves to differentiate an eclipse magnetic effect from a general, or terrestrial, effect such as might be associated with Sun-spot activity. The approximate times at which the magnetic effect corresponding to the lowest point of the bay occurred are as follows:

	Magnetic Effect (Decl'n)		Max. Obscuration	
	G. M. T.	L. M. T.	G. M. T.	L. M. T.
	h m	h m	h m	h m
1. Eskdalemuir,	11 52	11 39	12 02	11 50
2. Stonyhurst,	11 58	11 48	12 05	11 55
3. Kew,	12 01	12 00	12 10	12 09
I. Mean of Nos. 1, 2, 3,	11 57	11 49	12 06	11 58
4. Rude Skov,	12 15	13 05	12 18	13 08
Difference (No I.—No. 4),	— 0 18	— 1 16	— 0 12	— 1 10

It is thus seen that the difference in G. M. T. for the average of the three observatories in Great Britain and the Danish Observatory is 18^m , and that it is in the same direction as the difference in time of the phase of maximum obscuration of the eclipse. The difference in local mean time, as seen, is $1^h 16^m$. When data from stations in the totality belt are available, the difference in time of the magnetic effect may be further investigated.

The declination bay shown in Fig. 4 is not found developed in the same manner at the stations outside the zone of visibility of the eclipse.⁶ This fact leads to the presumption that it was not an effect due to the disturbance of the magnetic state of the entire Earth, but was more or less restricted approximately to the region in which the eclipse was visible.

Dr. Chree has made the interesting observation that the Kew *D*-curve on August 20, 1914, showed some bays similar to the one at the time of the eclipse on the following day.⁷ Some abnormal effects might reasonably be expected on August 20, as it was a more *disturbed* day than August 21, the daily magnetic character numbers being, respectively, 0.9 and 0.3, which fact is confirmed by special information pertaining to the United States magnetic observatories supplied by Superintendent Jones of the Coast and Geodetic Survey. Moreover, it has not been contended that a possible eclipse magnetic effect is distinctly different from an effect which may occur at *any* time. See, for example, the paper in *Terr. Mag.*, vol. 20, pp. 143-158, from which it appears that it is quite possible to have magnetic effects concomitant with solar changes, as revealed by values of the solar constant, having some of the same characteristics as an eclipse magnetic effect. The causes are identical, only the manner of their origin is different. Thus during an eclipse solar radiation is cut off from a portion of the Earth by the intervention of the Moon between the Sun and the Earth. In the other case, we may have solar radiation diminished by a cooling layer in the solar atmosphere. The chief conclusion⁸ drawn from our previous investigation was that the eclipse magnetic variation "is analogous in its nature to the solar-diurnal variation, differing from it only in degree."

⁶ At Lukiapang, China, there occurred a bay in the declination curve (see Fig. 3) on August 21, but the time of the lowest point is $13^h 01^m$ G. M. T., hence about an hour after the mean time of the bay noticed at the four stations enumerated in Table B.

⁷ *Terr. Mag.*, vol. 20, p. 72, and Fig. 1.

⁸ *Terr. Mag.*, vol. 7, 1902, p. 192.

At Ksara, Syria, where the maximum obscuration (about 0.87) occurred approximately at 3^h 46^m P. M., local mean time, the effect of the eclipse, apparently, was to retard the afternoon declination extreme two hours or more. (See Berloty's account, p. 67.)

The changes in declination at Ekaterinburg, if compared with the bi-hourly data for five quiet days before and after the eclipse (August 14, 15, 16, 17, 18, 22, 24, 25, 26, 27), kindly communicated by Director Abels, would appear to have reached a crest near the time (12^h 46^m G. M. T.) of maximum obscuration. Thus the deflection of the needle towards the east was at 11^h G. M. T., + 1.4; at 13^h, + 3.5; and at 15^h, + 1.0.

There were also apparently some changes in the horizontal and in the vertical intensity during the time of the eclipse, but these can be investigated more successfully when additional data are available. Thus at Kew, the horizontal intensity on August 21, as compared with the values on three preceding and three succeeding quiet days (see Tables 1 and 2, *Terr. Mag.*, vol. 20, pp. 72-73), was about 3 γ high at the beginning of the eclipse, near the phase of maximum obscuration it was, on the average, 5 γ high and at the end of the eclipse 7 γ low.

Fig. 5 gives the XY vector diagram at Rude Skov for the period 10^h to 14^h 25^m, G. M. T., as drawn with the aid of the north (X) and west (-Y) components, derived from the observed declinations and horizontal intensities. The times of the beginning of the eclipse (B), of the maximum phase (M), and of the ending (E) of the eclipse will be found indicated on the diagram. It will be noticed that during the eclipse the regular course of the curve was interrupted and a loop was described, the point E almost coinciding with B. Similar loops were described at Kew and Eskdalemuir for which vector diagrams have been drawn, though the times of the loops are slightly different than for Rude Skov as they should be if the effect was not terrestrial in its extent. In this connection the reader may be referred, for example, to the formation also of a loop in the vector diagram during the total solar eclipse at Rocky Mount, North Carolina, on May 28, 1900 (*Terr. Mag.*, vol. 5, 1900, p. 157, Fig. 4).

There appears to be good reason for believing that an observable magnetic effect occurred during the time of the solar eclipse of August 21, 1914, at stations within the region of visibility, the effect being larger for stations near the belt of totality than for those

farther away. The subject is of sufficient theoretical importance to merit further careful investigation. A favorable opportunity will occur again in the United States during the total solar eclipse of June 8, 1918.

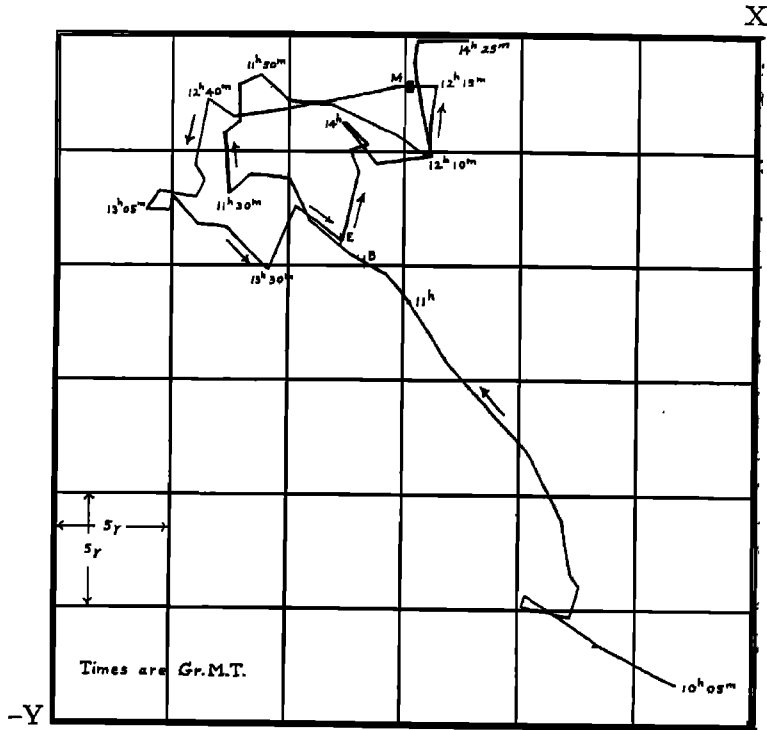


FIG. 5.—XY—Vector Diagram for Rude Skov, August 21, 1914.