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When either of these four radiometers is heated by a hot shade or plunged into hot water, rotation is always produced in the opposite direction to that caused by the light. On removing the source of heat the motion rapidly stops, and then commences in the opposite direction (*i. e.* as it would rotate under the influence of light), the rotation continuing as long as the fly is cooling. Chilling one of these radiometers with ether has the opposite action to exposing it to dark heat.

The vanes of radiometers have also been formed of metal cones, and of cups and cones of plain mica, roasted mica, pith, paper, &c.; and they have been used either plain or blacked on one or both surfaces. These have also been balanced against each other, and against metal plates, cups, and cones. The results are of considerable interest, but too complicated to explain without great expenditure of time and numerous diagrams. The broad facts are contained in the above selections from my experiments.

The action of light on the cup-shaped vanes of a radiometer probably requires more experimental investigation before it can be properly understood. Some of the phenomena may be explained on the assumption that the molecular pressure acts chiefly in a direction normal to the surface of the vanes. A convex surface would therefore cause greater pressure to be exerted between itself and the bounding surface of glass than would a concave surface. In this way the behaviour of the cup-shaped radiometer with both surfaces bright, No. 1035, can be understood, and perhaps also that of Nos. 1038 and 1039. It would not be difficult to test this view experimentally, by placing a small mica screen in the focus of a concave cup where the molecular force should be concentrated. But it is not easy to see how such an hypothesis can explain the behaviour of No. 1037, where the action of the bright convex surface more than overcomes the superior absorptive and radiating power of the concave black surface; and the explanation entirely fails to account for the powerful attraction which a lighted candle is seen to exert on the concave surfaces in Nos. 1035, 1037, and 1039.

II. "Magnetic Observations made at Stonyhurst College Observatory from April 1870 to March 1876." By the Rev. S. J. Perry, S.J., F.R.S. Received July 31, 1876.

A double series of magnetic observations are being carried on continuously at this Observatory. The monthly determinations of the absolute elements date from the year 1863, but the uninterrupted photographic record of the variations of the Declination and of the components of the Intensity was only commenced in 1867. The photographic curves of the Declination and Horizontal Force have all been measured, and are in course of reduction; and the Vertical-Force curves will soon be taken in hand. The results of the first seven years' observations of the Dip and Horizontal Force appeared in the Philosophical Transactions for 1871, and the present paper contains a precisely similar, and therefore comparable, reduction for the following six years of all the elements of terrestrial magnetism. In the former paper the general result was somewhat at variance with the conclusions arrived at by Sir Edward Sabine from a discussion of the Kew observations; and hence the necessity for this second paper, to discover whether local influences or mere accidental errors would account for the discrepancies. The change of the station of observation during the period from 1863 to 1870 introduced a probable source of error into the first Stonyhurst series; but that uncertainty is now removed, as all the observations since 1868 have been taken in the fixed magnetic hut. It will be unnecessary here to repeat what was said in the former paper on the subject of the instruments used in the observations, as these have remained unchanged since 1863. The only alteration in the observations themselves has been the substitution of weekly in lieu of monthly readings of the Declination from the beginning of the year 1872.

The Horizontal Force.

TABLE I.—Monthly mean values of the Horizontal Force.

Summer Months.	1870.	1871.	1872.	1873.	1874.	1875.	Mean of six years.
April	3·6151	3·6354	3·6275	3·6305	3·6388	3·6459	3·6322
May	3·6164	3·6242	3·6290	3·6353	3·6400	3·6481	3·6322
June	3·6256	3·6250	3·6262	3·6314	3·6390	3·6418	3·6315
July	3·6273	3·6211	3·6309	3·6303	3·6377	3·6399	3·6312
August	3·6229	3·6218	3·6298	3·6333	3·6425	3·6442	3·6324
September	3·6009	3·6370	3·6297	3·6311	[3·6446]	3·6524	3·6326
Means	3·6180	3·6276	3·6289	3·6320	3·6404	3·6454	3·6321
Winter Months.	**1870–71.**	**1871–72.**	**1872–73.**	**1873–74.**	**1874–75.**	**1875–76.**	**Mean of six years.**
October	3·6207	3·6249	3·6341	3·6366	3·6466	3·6448	3·6346
November	3·6183	3·6303	3·6356	3·6298	3·6468	3·6492	3·6350
December	3·6249	3·6340	3·6401	3·6351	[3·6480]	3·6504	3·6388
January	3·6256	3·6300	3·6289	3·6466	3·6492	3·6485	3·6381
February	3·6207	3·6328	3·6330	3·6410	3·6447	3·6482	3·6367
March	3·6229	3·6321	3·6218	3·6412	3·6414	3·6443	3·6340
Means	3·6222	3·6307	3·6323	3·6384	3·6461	3·6476	3·6362
Yearly means	3·6201	3·6292	3·6306	3·6352	3·6433	3·6465	3·6342

The figures for September and December 1874 are interpolations.

From the above Table we have for the epoch April 1st, 1873,

The mean Horizontal Force $=3{\cdot}6342$,
With a secular acceleration of $+0{\cdot}0053$.

Comparing this with results of previous years, we find the secular acceleration to be on the increase, having been only 0·0042 for October 1st, 1866, and 0·0047 for January 1st, 1870.

The above value of the secular acceleration is almost identical with that found by Mr. Whipple from a similar discussion of the Kew observations.

With the values given in Table I. we can readily calculate the semiannual inequality.

TABLE II.—Semiannual inequality of the Horizontal Force.

Date.	Correction for secular variation.	Mean value ± secular variation.	Observed values.	Observed – Computed.	
				Summer.	Winter.
July 1, 1870	−0·0145	3·6197	3·6180	−0·0017	
Jan. 1, 1871	−0·0119	3·6223	3·6222	....	−0·0001
July 1, 1871	−0·0092	3·6250	3·6276	+0·0026	
Jan. 1, 1872	−0·0066	3·6276	3·6307	....	+0·0031
July 1, 1872	−0·0040	3·6302	3·6289	−0·0013	
Jan. 1, 1873	−0·0013	3·6329	3·6323	....	−0·0006
July 1, 1873	+0·0013	3·6355	3·6320	−0·0035	
Jan. 1, 1874	+0·0040	3·6382	3·6384	....	+0·0002
July 1, 1874	+0·0066	3·6408	3·6404	−0·0004	
Jan. 1, 1875	+0·0092	3·6434	3·6461	....	+0·0027
July 1, 1875	+0·0119	3·6461	3·6454	−0·0007	
Jan. 1, 1876	+0·0145	3·6487	3·6476	....	−0·0011
Mean differences in the semiannual periods				−0·00083	+0·00070

These numbers give an annual variation of 0·00153, the force being greater when the sun is nearer the earth, which bears out the conclusion arrived at by Sir E. Sabine from similar observations at Toronto, Hobarton, and Kew. The discussion of subsequent Kew observations by Dr. Stewart, and afterwards by Mr. Whipple, shows no semiannual inequality, whereas the first Kew series gave the value 0·0026, which is almost double the above number. The previous series of Stonyhurst observations led to a contrary result; but considerable uncertainty was attached to those observations on account of the correction for change of observing station, which objection cannot be urged against the present series. Unfortunately the significant digits in the number 0·00041 were accidentally transposed in the former paper; but this affected the result as to amount only, and not as to direction.

TABLE III.—Residual errors in the monthly values of the Horizontal Force.

Summer months.	1870.	1871.	1872.	1873.	1874.	1875.	Mean.	Semiannual mean.
April	− 27	+123	− 9	−32	− 1	+17	+0·00118	
May	− 19	+ 7	+ 2	+12	+ 6	+35	+0·00072	
June	+ 69	+ 10	−31	−31	− 8	−33	−0·00040	−0·00010
July	+ 82	− 33	+12	−47	−26	−56	−0·00113	
August	+ 33	− 31	− 3	−21	+18	−18	−0·00037	
September ...	−191	+117	− 9	−48	+35	+60	−0·00060	
Winter months.	**1870–71.**	**1871–72.**	**1872–73.**	**1873–74.**	**1874–75.**	**1875–76.**	**Mean.**	**Semiannual mean.**
October	−13	−24	+ 16	−12	+35	−36	−0·00057	
November ...	−41	+26	+ 26	−85	+33	+ 4	−0·00062	
December ...	+20	+59	+ 67	−36	+40	+11	+0·00268	−0·00009
January......	+23	+14	− 50	+75	+48	−12	+0·00163	
February ...	−31	+38	− 13	+14	− 2	−20	−0·00023	
March	−13	+26	−130	+12	−39	−63	−0·00345	
Yearly means	− 9	+28	− 10	−17	+12	− 9		

The probable errors deduced from this Table are $\pm 0{\cdot}0033$ for each monthly determination, and $\pm$ 0·0004 for the resulting mean.

The Magnetic Dip.

TABLE I.—Monthly mean values of the Dip.

Summer months.	1870.	1871.	1872.	1873.	1874.	1875.	Mean of six years.
April	69° 33′ 6″	69° 35′ 12″	69° 33′ 15″	69° 29′ 13″	69° 27′ 55″	69° 19′ 58″	69° 29′ 47″
May	40 25	33 17	29 19	32 10	23 4	21 37	29 59
June	37 47	32 33	31 24	30 11	28 50	21 35	30 23
July	39 30	32 55	29 56	28 34	27 54	20 8	29 50
August	36 36	32 57	29 31	33 45	25 51	22 21	30 10
September ...	40 26	30 57	32 8	30 0	[26 14]	24 8	30 39
Means	69 37 58	69 32 59	69 30 56	69 30 39	69 26 38	69 21 38	69 30 8

TABLE I. (*continued*).

Winter months.	1870–71.	1871–72.	1872–73.	1873–74.	1874–75.	1875–76.	Mean of six years.
October	69° 38′ 25″	69° 27′ 52″	69° 31′ 50″	69° 29′ 37″	69° 26′ 36″	69° 18′ 48″	69° 28′ 51″
November ...	38 22	29 53	31 22	30 15	27 17	19 58	29 31
December......	38 17	30 59	32 27	33 6	[26 55]	21 48	30 35
January	40 8	32 13	30 28	29 11	26 32	25 45	30 43
February	35 26	32 45	31 36	25 36	21 35	24 25	28 34
March	31 53	34 53	30 20	29 19	24 39	24 25	29 15
Means	69 37 5	69 31 26	69 31 21	69 29 31	69 25 36	69 22 32	69 29 35
Yearly means	69 37 32	69 32 13	69 31 9	69 30 5	69 26 7	69 22 5	69 29 52

The numbers for September and December 1874 are interpolated.

We have therefore for April 1st, 1873,

$$\text{The mean dip} \qquad = 69^\circ\ 29'\ 52'',$$
$$\text{With a secular variation} = - \quad 3'\ 5''\cdot 4.$$

The amount of annual diminution from the preceding seven years' observations was only 1′ 49″·2; the dip would therefore appear to be decreasing more rapidly at present; but the value −2′·15, given last year by the Kew results, shows that the Stonyhurst number is probably too large.

TABLE II.—Semiannual inequality of the Dip.

Date.	Correction for secular variation.	Mean Value ± secular variation.	Observed Values.	Observed—Computed. Summer.	Observed—Computed. Winter.
July 1, 1870...............	+8′ 30″	69° 38′ 22″	69° 37′ 58″	−0′ 24″	′ ″
Jan. 1, 1871............	+6 57	36 49	37 5	....	+0 16
July 1, 1871...............	+5 24	35 16	32 59	−2 17	
Jan. 1, 1872............	+3 52	33 44	31 26	....	−2 8
July 1, 1872...............	+2 19	32 11	30 56	−1 15	
Jan. 1, 1873............	+0 46	30 38	31 21	....	+0 43
July 1, 1873...............	−0 46	29 6	30 39	+1 33	
Jan. 1, 1874............	−2 19	27 33	29 31	....	+1 58
July 1, 1874.............	−3 52	26 0	26 38	+0 38	
Jan. 1, 1875............	−5 24	24 28	25 36	....	+1 8
July 1, 1875...............	−6 57	22 55	21 38	−1 17	
Jan. 1, 1876............	−8 30	21 22	22 32	....	+1 10
Mean differences in the semiannual periods				−0 30	+0 31

This Table gives the winter period an excess of 1′ 1″ over that of summer, which agrees well with the mean of the values 1′·31 and 0′·80 found by Gen. Sabine and by Mr. Whipple from the Kew observations. The value obtained by Dr. Stewart for the period 1863 to 1869 is less than any of the above, and the result from the Stonyhurst observations taken during the same period is considerably below that of Dr. Stewart; but still every series makes the winter number greater than that for the summer.

TABLE III.—Residual errors in the monthly values of the Dip.

Summer months.	1870.	1871.	1872.	1873.	1874.	1875.	Mean.	Semi-annual mean.
April	−5′ 24″	−0′ 13″	+0′ 56″	−0′ 1″	+1′ 47″	−3′ 5″	−1′ 0″	+0′ 1″·8
May	+2 10	−1 52	−2 45	+3 12	−2 49	−1 10	−0 32	
June	−0 12	−2 21	−0 24	+1 28	+3 13	−0 57	+0 8	
July	+1 46	−1 43	−1 37	+0 7	+2 32	−2 8	−0 11	
August	−0 52	−1 26	−1 46	+5 33	+0 45	+0 20	+0 26	
September ...	+3 13	−3 10	+1 6	+2 4	+1 23	+3 23	+1 20	
Winter months.	**1870–71.**	**1871–72.**	**1872–73.**	**1873–74.**	**1874–75.**	**1875–76.**	**Mean.**	**Semi-annual mean.**
October	+0′ 27″	−7′ 1″	+0′ 2″	+0′ 55″	+0′ 59″	−3′ 43″	−1′ 24″	−0′ 1″·3
November ...	+0 39	−4 44	−0 10	+1 49	+1 56	−2 17	−0 28	
December ...	+0 50	−3 23	+1 10	+4 55	+0 49	−0 12	+0 42	
January	+2 56	−1 54	−0 33	+1 15	+1 42	+4 0	+1 14	
February ...	−1 31	−1 6	+0 50	−2 4	−3 0	+2 56	−0 39	
March	−4 48	+1 17	−0 10	+2 54	+0 20	+3 11	+0 27	
Yearly means	−0 4	−2 18	−0 17	+1 51	+0 40	+0 2		

From these figures we conclude that the probable error of each monthly value is ± 1′ 40″, whilst that of the mean is ± 0′ 12″.

The Total Force.

We are now in a position to test the semiannual variation of the Total Force, or the Intensity of the earth's magnetism. Referring back to Table I., we find for the summer periods the mean Horizontal Force = 3·6321, and the mean Dip = 69° 30′ 8″; whilst for the winter periods we get 3·6362 and 69° 29′ 35″. If, then, we apply to the winter epoch the necessary corrections for secular variation, we obtain for the common epoch of January 1st, 1873—

	H. F.	Dip.	T. F.	V. F.
Summer periods	3·6321	69° 30′ 8″	10·3724	9·7152
Winter periods	3·6336	69 31 9	10·3843	9·7280
Excess in winter	0·0015	1 1	0·0119	0·0128

Contrary to the results of the former paper, these figures show a very large excess in the intensity for the winter months, thus strongly confirming the conclusion of the increase of the earth's magnetic force with the nearer approach of the sun. The late Kew reductions lead to the same conclusion, but the difference for the seasons is not so large.

The Magnetic Declination.

To complete the reduction of the absolute magnetic elements, I will now subjoin a discussion of the Declination observations, although the Dip and Intensity were alone included in the former paper. It has been thought advisable not to apply any correction to the observed Declinations, either for disturbances or for diurnal range, especially as the readings were always taken within a short interval from 9 A.M.

TABLE I.—Monthly mean values of the Declination.

Summer months.	1870.	1871.	1872.	1873.	1874.	1875.	Mean of six years.
April	21° 43′ 13″	21° 42′ 9″	21° 21′ 55″	21° 20′ 42″	21° 3′ 12″	20° 59′ 34″	21° 21′ 48″
May	38 23	31 51	23 53	21 29	8 1	54 21	19 40
June	47 20	32 21	21 4	20 42	9 26	59 26	21 43
July	39 24	28 21	22 57	18 29	12 51	57 7	19 52
August	43 16	30 21	27 35	23 17	8 7	54 41	21 13
September	39 21	35 43	25 5	18 19	10 46	21 0 3	21 33
Means	21 41 50	21 33 28	21 23 45	21 20 30	21 8 44	20 57 32	21 20 59
Winter months.	**1870–71.**	**1871–72.**	**1872–73.**	**1873–74.**	**1874–75.**	**1875–76.**	**Mean of six years.**
October	21° 34′ 19″	21° 36′ 27″	21° 21′ 6″	21° 15′ 40″	21° 13′ 4″	21° 1′ 33″	21° 20′ 22″
November	41 18	31 33	26 1	17 2	12 24	20 53 9	20 15
December	43 56	29 58	30 12	20 29	10 41	48 59	20 43
January	50 35	31 5	28 18	19 53	6 28	53 14	21 36
February	59 6	26 10	29 40	12 31	7 45	54 26	21 36
March	35 48	27 41	23 31	9 2	1 47	52 39	15 5
Means	21 44 10	21 30 29	21 26 28	21 15 46	21 8 42	20 54 0	21 19 56
Yearly means...	21 43 0	21 31 59	21 25 7	21 18 8	21 8 43	20 55 46	21 20 27

The figures in this Table give for the epoch April 1st, 1873—

The mean Declination $= 21° 20' 27''$ W.
With a secular variation of $-$ $9' 27''$.

As might be suspected from the geographical positions, this amount of secular diminution is somewhat in excess of that found at Kew for the same epoch, which was $-8' 5''\cdot72$.

TABLE II.—Semiannual inequality of the Declination.

Date.	Correction for secular variation.	Mean value ± secular variation.	Observed values.	Observed – Calculated. Summer.	Winter.
	′ ″	° ′ ″	° ′ ″	′ ″	′ ″
July 1, 1870	+25 59	21 46 26	21 41 50	−4 36	
Jan. 1, 1871	+21 15	41 42	44 10	....	+2 28
July 1, 1871	+16 32	36 59	33 28	−3 31	
Jan. 1, 1872	+11 49	32 16	30 29	....	−1 47
July 1, 1872	+ 7 5	27 32	23 45	−3 47	
Jan. 1, 1873	+ 2 22	22 49	26 28	....	+3 39
July 1, 1873	− 2 22	18 5	20 30	+2 25	
Jan. 1, 1874	− 7 5	13 22	15 46	....	+2 24
July 1, 1874	−11 49	8 38	8 44	+0 6	
Jan. 1, 1875	−16 32	3 55	8 42	....	+4 47
July 1, 1875	−21 15	20 59 12	20 57 32	−1 40	
Jan. 1, 1876	−25 59	54 28	54 0	....	−0 28
Mean differences in the semiannual periods				−1 50·5	+1 50·5

Here again the winter is in excess of the summer period, the annual variation being $3' 41''$. This agrees also with the Kew results; but the amount found by Mr. Whipple is only $1' 21''\cdot80$.

TABLE III.—Residual errors in the monthly values of the Declination.

Summer months.	1870.	1871.	1872.	1873.	1874.	1875.	Mean.	Semi-annual mean.
April	−3 20	+5 2	−5 45	+2 29	−5 34	+0 15	−1 6	
May	−7 23	−4 28	−3 0	+4 3	+0 2	−4 11	−2 30	
June	+2 21	−3 11	−5 1	+3 3	+2 14	+1 41	+0 11	+0 0·2
July	−4 48	−6 24	−2 21	+2 38	+6 26	+0 19	−0 42	
August	−0 8	−3 37	+3 4	+8 13	+2 30	−1 30	+1 25	
September	−3 16	+2 33	+2 21	+4 2	+5 56	+4 40	+2 43	

TABLE III. (*continued*).

Winter months.	1870–71.	1871–72.	1872–73.	1873–74.	1874–75.	1875–76.	Mean.	Semi-annual mean.
October	−11′ 12″	+0′ 23″	−5′ 31″	−1′ 31″	+5′ 20″	+3′ 16″	−1′ 33″	−0′ 0″·2
November ...	− 3 26	−3 44	+0 11	+0 39	+5 27	−4 21	−0 52	
December ...	0 0	−4 32	+5 9	+4 53	+4 32	−7 44	+0 23	
January	+ 7 26	−2 37	+4 2	+5 4	+1 6	−2 41	+2 3	
February ...	+16 44	−6 45	+6 12	−1 31	+3 10	−0 42	+2 51	
March	− 5 47	−4 27	+0 50	−4 12	−2 1	−1 42	−2 53	
Yearly means	− 1 4	−2 40	+0 1	+2 18	+2 26	−1 3		

This Table shows that we can only rely on the monthly determinations to within 2′ 55″, even excluding the result for February 1871; but the mean value for the whole epoch has only a probable error of 21″. The weekly readings that are now being taken will, it is hoped, sufficiently reduce the probable error of the monthly means.

Summing up the general results of the observations with respect to the main point at issue, viz. the existence of a semiannual inequality in the magnetic elements, it is satisfactory to find a complete confirmation of the conclusion of Sir E. Sabine, that a nearer approach of the sun in the winter months produces a very sensible increase in all the elements of terrestrial magnetism.

III. "On Electrical Conductivity and Electrolysis in Chemical Compounds." By Dr. L. BLEEKRODE. Communicated by WARREN DE LA RUE, D.C.L., F.R.S. Received October 2, 1876.

§ 1. *Introduction.*

In presenting this communication to the Royal Society I wish to state that it is only an abstract of a more extensive paper on the same subject which I hope to publish shortly, and which contains an account of experiments with nearly seventy substances, most of which were never used before for such an investigation. I tried also nearly all the liquefied gases, and a considerable time was spent in preparing them for this kind of research, that was often interrupted by fearful explosions. The invaluable opportunity which Mr. Warren De La Rue, F.R.S., granted me some time ago to try the same compounds with his very powerful battery, led to results which I hope the Society will not consider devoid of interest.

I entered on these experiments with the purpose of establishing, if possible, a relation between electrical conductivity and chemical consti-