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municate with the brass ball A, from which the leaf is suspended, the latter ought to be attracted by that knob, which receives from the series an opposite excitement. Hence, the excitement of the electrified body being known, that of the poles may be detected; or the latter being known, the excitement of the body may be discovered. This application of the electric series, is not, however, a new idea. I saw many years ago a notice of an electrometer, associated with an electric column, in such manner, as to be used as an electrical discriminator.

The great difficulty in resorting to this means of discrimination, is, that an electrified body may, by induction, produce in a conductor alternately, opposite states of electrical excitement. As it approximates the conductor, it may cause it to receive, or give out electricity; of course, when retracted, the conductor will have the opposite excitement to that consequent to approximation. Supposing the brass ball of the electrometer in question, to be affected in the mode just described, the leaf suspended from it, must be successively attracted by each pole. Besides, the excitement may be so strong, as to render that of the series nugatory; as in the case of a powerful magnet, which will attract either pole of a feeble one.

The direction of the first pulsation of the leaf, is the best criterion; but reliance should not be accorded to one experiment, especially when so easily repeated. I find that a gilt pith ball, if suspended in place of the leaf, will vibrate for a time. It is, however, like the leaf, liable to have its movements arrested by an adherence, to one or other of the knobs.

Note of the effect upon the Magnetic Needle, of the Aurora Borealis, visible at Philadelphia, on the 17th of May, 1833,

By A. D. BACHE, Professor of Natural Philosophy and Chemistry in the University of Pennsylvania.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—Circumstances having prevented me from witnessing more than a very small part of the unusually brilliant aurora which was visible on the evening of the 17th of May last, I am indebted for the following description of it to my friend J. P. Espy, Esq., who has kindly furnished it to me from his journal.

“On the 17th of May, 1833, the temperature of the air being 68°, and the dew point 66°, a brilliant aurora appeared in the north, about twenty or thirty degrees above the horizon, and extending about thirty or forty degrees on each side of the north point.

“I first saw it a few minutes after nine o’clock, when it was brighter than it appeared afterwards. Streamers, not in motion, were distinctly visible, rising from a dense light below, which seemed to rest on

dark clouds underneath, reaching the horizon. All the rest of the sky was clear, and had been so all the afternoon. In a few minutes the streamers disappeared, clouds, which suddenly formed, seeming to take their places, the northern lights still appearing nearly the same, only interrupted in part by a greater number of clouds. I continued to observe the aurora with intervals of but few minutes, and at nearly ten o'clock I discovered that a very brilliant arch had been formed, passing through the zenith, and terminated by the horizon, about twenty degrees south of east, and the same number north of west.

"This arch was much denser, brighter, and narrower, near the horizon than in the zenith. It passed gradually towards the south, and disappeared, at twenty minutes past ten, about eleven degrees south of Lyra. The clouds, at the time of the disappearance, were rapidly forming north of the arch, all the south being yet clear: in fifteen minutes afterwards the whole heaven was overcast, and the light in the north was hardly visible through the clouds. The air had been coming from the north in the morning, and had changed round by the west, and at the time of the occurrence of the arch it is believed was nearly south-west; below, the direction of the clouds was not observed.

"The dew-point had risen, since the preceding day, twelve degrees Fah. It is highly probable that an upper current (not the uppermost) of air, was moving in the direction in which the arch moved, as the air had been moving in that direction a few hours before, and I have frequently observed, when the wind changes, the lower strata next the earth, change first. From the 10th until the afternoon of the 15th of May, the wind had constantly been, by night and day, almost exactly south, with a high dew-point, carrying an immense quantity of vapour to the north; on the evening of the 15th, and until the night of the 16th, the wind was NE. with rain, and on the morning of the 17th the wind was north."

On returning home at eleven o'clock, on the evening just referred to, and observing the different magnetic needles which I have arranged for observations on the diurnal variation, a considerable disturbance was indicated. The journal of the hourly observations, kept during my absence in the evening, confirmed that what I had witnessed was but a part of the disturbance which had actually taken place, and which seems to have affected the horizontal needle especially.

The needles to which I have referred are three in number, two long horizontal needles, of which one is within-doors, and the other* is under cover in the yard attached to my residence, and a long dipping needle with a knife edge suspension, contained in a small observatory, constructed for the purpose, and also in the yard of my dwelling house. The observations of the horizontal needle, within doors, were made very regularly, and also of the dipping needle out of doors, but the observer not being aware of the appearance of the aurora, did not take the corresponding hourly observations of the horizontal needle out of doors, throughout the whole of the evening.

* A complete description of this needle is given in a paper read before the American Philosophical Society, in November last

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In order to convey a better idea of the variation on the evening in question, I precede the observations by those made on the following day and night, on which the changes of variation and dip were nearly the regular mean diurnal changes at this time of the year. The variation is referred to the mean variation for the day, or to a point nearly corresponding to this, the sign + being prefixed to the positions *west* of this line of mean variation, and the sign — to those *east* of the same line. The height of the thermometers contained in the boxes with the needles is given.

Time of observation.	HORIZONTAL NEEDLES.				DIPPING NEEDLES.		Weather.
	Diurnal changes of variation. Needle out of doors.		Diurnal changes of variation. Needle in doors.		Dip of the needle.	Thermometer attached.	
	Minutes	Fah. °	Minutes	Fah. °			
A.M. 8 $\frac{1}{4}$	— 7.5		0.0	72°	71 40	71.4	Cloudy.
9	— 16.5	70°	0.0	73	„ 36	72.5	Do.
10 $\frac{1}{4}$	— 7.5	72	— 1.5	73	„ 36	72.5	Do.
11	— 4.5	74	— 3.0	74	„ 36	74.2	Do.
12	+ 0.5	74	0.0	74	„ 36	75.3	Do.
P.M. 1	+ 13.5	77	0.0	74	„ 33	78.1	{ Sun out occa- sionally.
2 $\frac{1}{2}$	+ 12.5	82	+ 3.0	75	„ 30	82.1	Sun out. Clear.
3	+ 15.0	83	+ 3.0	75	„	82.6	
4 $\frac{1}{2}$	+ 13.5	82	+ 3.0	76	„ 42	83.8	Clear.
5 $\frac{1}{4}$	+ 6.0	82	— 1.5	76	„ 42	82.6	Do.
6	+ 1.5	81	— 3.0	76	„ 48	81.5	Do.
7	— 4.5	79	— 3.0	75	„ 51	79.3	Do.
8			0.0	75	„ 45	75.9	{ Light fleeces. (Cirrus.)
9 $\frac{1}{2}$	— 10.5	76	0.0	74	„ 48	74.8	Clear.
10 $\frac{1}{2}$	— 10.5	74	0.0	74	„ 48	74.8	
11	— 3.5	74			„ 42	74.0	

From the table just given it appears that on the 18th of May, the westerly variation, as given by the horizontal needle out of doors, had two distinct points of minimum, the first at 9, A. M., and the latter between 9 $\frac{1}{4}$ and 10 $\frac{1}{2}$, P. M., and two points of maximum, the first at 3, P. M., and the second at some period, not ascertained, after 11, P. M. The same variation shown by the needle within doors, had its minima at 11, A. M., and from 6 to 7, P. M., its maxima between 2 $\frac{1}{2}$ and 4 $\frac{1}{2}$, P. M., and at some hour of the night which was not ascertained. The temperatures of the two

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needles being very different, the effect of changes of temperature should be ascertained to render the results strictly comparable; a remark which suggests the object, in part, of the observations upon these two needles, so differently situated.

In the dip we find a minimum at 2½, P. M., as the only point very decidedly marked: there is an apparent maximum at 7, which the subsequent observations seem to indicate to have been the result of causes foreign to those producing the regular diurnal changes of dip.

The observed changes for this day, just given, are not entirely regular, and should be considered, of course, in the light of particular results affording merely a term of comparison, which is sufficiently accurate for the purpose in view.

I now give a table of some of the observations for May 17th, with a column of remarks, the portion of which relating to the aurora is drawn from the description by Mr. Espy, already given.

Hour of observation.	HORIZONTAL NEEDLES.				DIPPING NEEDLE.		Remarks.
	Changes of variation, Needle out of doors.	Attached Thermo-meter.	Changes of variation, Needle within doors.	Attached Thermo-meter.	Changes of dip.	Attached Thermo-meter.	
	Minutes	Fah.°	Minutes	Fah.°	° ' "	Fah.°	
A. M. 8½	— 1.5	60	— 9.0	70	71 33	59.6	Cloudy.
11			— 1.0	70½			Sun out.
P. M. 1			+ 7.0	71			
3			+ 7.0	72	„ 12	74.8	Cloudy.
4	+ 15.0	67	+ 7.0	72	„ 09	75.9	Sun out.
5	+ 1.5	77	+ 5.5	72	„ 18	75.9	Clear.
7½					„ 36	73.4	
8½			— 3.0	72	„ 30	71.9	
9			— 1.5	72	„ 34	71.4	Aurora bright; streamers; arch forms about 10, P. M.; arch disappears 10h.20m
10½			— 13.5	72	„ 30	70.3	
11	— 13.5	68			„ 36	69.1	sky overcast. Low stratus.

By comparing the third column of this table with the corresponding column of the first table, we find throughout the day the general accordance in the relative positions of the needle a minimum of westerly variation at about 8, A. M., a maximum between 1, P. M. and 4, P. M., a second minimum about 8, P. M., a tendency towards a second maximum, which was interrupted by the aurora. There does not appear to have been any marked change from 8½, P. M., to 9; so that the first part of the phenomenon

does not seem to have affected the variation. Observations are wanting to show when the effect began to be felt, and when it was at the greatest, and the near coincidence of the observation at half past ten with the time of the disappearance of the arch, must, of course, be regarded as accidental. In the interval of an hour and a half, between 9 and 10½, P. M., the needle had moved to the eastward 12', or one-fifth of a degree; and the observations during the early part of the phenomena tend to show, if they do not prove, that this motion took place in the latter part of the interval, the mean hourly rate of motion, as shown by the observations at 8½ and 9, P. M., being only three minutes. I regret that the observations were not more regular; but as no particular interest attached to the evening, the observer, as I have already stated, not being aware of the presence of the aurora, I considered myself fortunate in the frequency of those observations which were made; this being a part of the evening in which, usually, there is nothing to require regular observations, being the interval between the evening minimum and the night maximum.

The observations on the horizontal needle out of doors do not contradict any of the remarks just made, and they show further that at 11, P. M., forty minutes after the disappearance of the arch, the effect on the needle was still strongly marked; the westerly variation at 11, P. M., having been 10 minutes less than on the same hour of the next succeeding evening. The very rapid formation and disappearance of clouds during the evening, and the low stratus which formed about eleven o'clock, would all, in ordinary cases, have produced slightly marked changes in the variation, but nothing of the character of those noted in the table. The temperature having remained stationary, within doors, during the evening, no part of the changes in the position of the horizontal needle noted in the third column, were due to variations of temperature. The results, in the absence of correction for these changes, are therefore the more valuable.

The dip, recorded in the fifth column of the table last given, has its minimum at 4, P. M., a rise then begins, which is so very irregular as not to permit any inference from it; diminishing between 7½ and 8½, P. M., it increases between 8½ and 9, decreases between 9 and 10½, and subsequently increases to 11 o'clock. These changes do not seem to attach to the different phases of the aurora, and are not more considerable than ordinary meteorological phenomena would produce, such, for example as are recorded in the first table.

My aim having been merely to establish that a decided disturbance of the horizontal needle was produced by the aurora of the 17th, I have not thought it necessary to apply the corrections for the temperature of the needles which the successful establishment of the changes in diurnal variation will require.

Jennison's Compressor and Foveats.

In our list of patents for August last, we noticed one obtained by Mr. T. L. Jennison, for a *compressor and foveats*; our remarks re-