Dr. Alden March
With the Results
of J. Henry

[*Extract from the Report of the Regents of the University of the State of New-York, to the Legislature*, 1832.]

ON A DISTURBANCE OF THE EARTH'S MAGNETISM,

IN CONNEXION WITH THE APPEARANCE OF

AN AURORA BOREALIS,

AS OBSERVED AT ALBANY,

APRIL 19, 1831.

By JOSEPH HENRY,
Of the Albany Academy.

[Communicated to the Albany Institute, January 26, 1832.]

That the aurora has some connexion with the magnetism of the earth, was asserted as early as the middle of the last century; and since that time, many observations have been recorded, tending to confirm this position. 1. It has been observed, that when the aurora appears near the northern horizon in the form of an arch, the middle of this is not in the direction of the true north, but in that of the magnetic needle at the place of observation; and that when the arch rises towards the zenith, it constantly crosses the heavens at right angles, not to the true, but to the magnetic meridian. This fact is most obvious where the variation of the needle is great. 2. When the beams of the aurora shoot up so as to pass the zenith, which is sometimes the case, the point of their convergence is in the direction of the prolongation of the dipping needle at the place of observation. 3. It has also been observed, that during the appearance of an active and brilliant aurora, the magnetic needle often becomes restless, varies sometimes several degrees, and does not resume its former position until after several hours.

From the above facts, it has been generally inferred that the aurora is in some way connected with the magnetism of the earth; and that the simultaneous appearance of the meteor, and the disturbance of the needle, are either related as cause and effect, or as the common result of some more general and unknown cause.

The subject is, however, involved in much obscurity; and there are some facts which tend to throw doubt on the connection of the two phenomena. The accurate and valuable observations of Col. Beaufoy in England, continued for several years, add nothing towards establishing the fact of the magnetic influence of the aurora; and in the scientific expeditions under Capt. Parry, to the north, in the peculiar regions, as it would appear, of this meteor, no unusual disturbance of the needle was observed to accompany the aurora, although the apparatus was visited every hour in the day, and sometimes oftener, when any thing rendered it desirable. Indeed, so far from producing a disturbing effect, Dr. Brewster concludes, from a comparison of the observations, that the aurora, in the arctic regions, seems rather to exercise a sedative influence.*

On the other hand, Dr. Richardson states, from his own observations, made at Bear Lake, during six successive months of the years 1825–6, and again in 1826–7, that the aurora does influence the magnetic needle. "A careful review of the daily register," says he, "has led me to form the following conclusion: That brilliant and active coruscations cause a deflection of the needle almost invariably, if they appear through a foggy atmosphere, and if prismatic colours are exhibited; on the contrary, when the atmosphere is clear, and the aurora presents a dense steady light of a yellow colour, and without motion, the needle is often unaffected."†

In this state of knowledge, every additional fact becomes of some importance. The following communication, it is therefore hoped, may be useful, either in directing the attention of observers in this country to the subject, or in corroborating similar observations made in other quarters of the globe.

In September, 1830, I commenced a series of observations, for Professor Renwick, of Columbia College, to determine the magnetic intensity at Albany. In the course of these, I unexpectedly witnessed a disturbance of the magnetism of the earth, in connexion with an appearance of an aurora, which on some accounts appears interesting.

The needles used in these observations, were those mentioned in Capt. Sabine's letter to Prof. Renwick, published in the 17th

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* Edinburgh Philosophical Journal, vol. 8.
† Edinburgh New Philosophical Journal, vol. 5.

volume of the American Journal of Science. One of these, it will be recollected, formerly belonged to Prof. Hansteen of Norway, and the other to Capt. Sabine. They were suspended, according to the method of Hansteen, in a small mahogany box, by a single fibre of raw silk. The box was furnished with a glass cover, and had a graduated arc of ivory on the bottom, to mark the amplitude of the vibrations: It had also two small circular windows, diametrically opposite to each other, through which the oscillations of the needle could be seen.

In using this apparatus, the time of 300 vibrations was noted by a quarter second watch, well regulated to mean time; a register being made at the end of every tenth vibration, and a mean deduced from the whole, taken as the true time of the 300 vibrations. Experiments carefully made with this apparatus, were found susceptible of considerable accuracy; as the individual observations, after a small correction for temperature, give a result, except in a few instances, differing from the mean of a number made under similar circumstances, by a quantity not greater than one part in nearly a thousand.

The observations were repeated daily, when the weather would permit, from the latter part of September to the last of November, either at the hours of 12 at noon, or between 5 and 6 P. M.* I was always assisted in making them by the same person, my relative, Mr. Stephen Alexander, to whose skill and experience I am much indebted for any accuracy they may possess.

In April, 1831, a new series was commenced, to determine if the needles still indicated the same degree of magnetic intensity. No material difference was observed, except in the following instance, when a remarkable anomaly was exhibited.

On the 19th of April, at 12 o'clock at noon, an observation was made with the Hansteen needle, the result of which differed only the fractional part of a second from the usual mean rate of this needle. At 6 o'clock P. M. the same day, another observation was made with the same needle, and apparently under the same circumstances; but a remarkable change was now observed in the time of its making 300 vibrations, indicating a great increase in the magnetic intensity of the earth. It was at first supposed that the

* These times were chosen only on account of being most convenient.

needle had accidentally been placed contiguous to some ferruginous substance; but on a most careful investigation, nothing could be discovered which would tend in the least degree to explain the cause of the phenomenon. The experiment was made at the usual place, with the box containing the needle resting on a post permanently fixed for the purpose, in the Academy Park, at a sufficient distance from every disturbing object, and with the usual precaution of divesting the person of all articles of iron, such as keys, knives, &c.

At about 9 o'clock in the evening, or three hours after the above observation, an unusual appearance was noticed in the *southern* part of the heavens, which was shortly afterwards recognized as an arch of the aurora. It was about 9 degrees in breadth, with the vertex of the arch 20 degrees above the horizon. At this time the northern part of the sky was covered with light fleecy clouds. At 45 minutes past nine, the clouds partially disappeared, and disclosed the whole northern hemisphere entirely occupied with coruscations of the aurora, shooting up past the zenith, and apparently all converging to the same point. The actual formation of a *corona* might probably have been observed, but for a dark cloud which remained stationary a little south of the zenith. The idea for the first time now occurred to me, that this uncommonly brilliant appearance of the aurora might possibly be connected with the magnetic disturbance observed at 6 o'clock; and in order to test this, the apparatus was again placed on the post in the Academy Park, and an observation made during the most active appearance of the meteor. The result of the observation was, however, entirely different from that anticipated; for *instead of still indicating, as at 6 o'clock, an uncommonly high degree of magnetic intensity, it now showed an intensity considerably lower than usual.*

Observations were also made on the 20th and 21st, but no disturbance was again noticed; the intensity had resumed its former state.

The following table exhibits the observed times of 300 vibrations, with the mean temperature and aspect of the weather during each observation :

DAY.	Time of 300 vibrations.	Mean temperature.	Weather.
April 19th, 12 h. noon.	980″·75	66½°	Cloudy, rain A. M.
" 19th, 6 h. p. m.	968″·65	61°	Clear.
" 19th, 10 h. p. m.	982″·20	52°	Broken clouds.
" 20th, 6 h. p. m.	978″·68	51½°	Clear.

The above observations may be reduced approximately to the uniform temperature of 60°, by the formula,

$$T = T'[1 \pm 0.000165(t' \pm t)],^*$$

(T being time, t temperature in degrees of Fahrenheit,) which was deduced from experiments on a similar needle. The relative intensities may also be readily calculated, since they are reciprocally as the squares of the times of the vibrations. In this way, by assuming as unity the time observed on the 20th, we have the following results:

DAY.	Time of 300 vibrations at temperature of 60.	Relative intensities.
April 19th, 12 h. noon.	979″·94	1·00022
" 19th, 6 h. p. m.	968″·49	1·02401
" 19th, 10 h. p. m.	983″·50	0·99299
" 20th, 6 h. p. m.	980″·05	1·00000

From the mean of several observations made with this needle in April, I consider its time of 300 vibrations for this month, and in an undisturbed state of terrestrial magnetic intensity, to be 979 seconds. The accidental errors in the above observations do not probably exceed, in any case, one second.

At the time of registering the above observations, I had not seen the following remark of Prof. Hansteen, which was subsequently met with in the 12th volume of the Edinburgh Philosophical Journal:—"A short time before the aurora borealis appears," says Prof. Hansteen, "the intensity of the magnetism of the earth is apt to rise to an uncommon height; but so soon as the aurora begins, in proportion as its force increases, the intensity of the magnetism of the earth decreases, recovering its former strength by degrees, often not till the end of twenty-four hours."† This state-

* This formula was obtained by Hansteen.

† I find the same observation has also been made by Humboldt; and also a similar one by Van Swinden, who remarks, that the variation of the needle increases when the aurora borealis is approaching. Journal Royal Institution. Young's Natural Philosophy, vol. 2, p. 442.

ment, founded on observations made in Norway, is a precise description of the phenomenon observed in Albany; and should it be found a general, or even a frequent occurrence, that a great increase of intensity precedes the appearance of the aurora, it would perhaps reconcile many apparent discrepancies in the different accounts of the magnetic influence of the meteor.

Prof. Hansteen also remarks, in the same paper, that "the polar lights seem to be the effect of an uncommonly high magnetic intensity, which lets itself off, as it were, by the aurora, and thus sinks under its common strength." Nothing, however, can with certainty be deduced from these observations, in reference to this supposition; since the magnetic intensity at any place, as exhibited by the vibrations of the horizontal needle, may change while the absolute force or intensity of the whole earth remains the same. If we represent by F the whole force in the direction of the dipping needle, by δ the dip in degrees, and by H the horizontal force, we shall have, by a well known law,

$$F = \frac{H}{\text{cosin } \delta}.$$

In this formula, it is evident that F may remain constant, although H is caused to vary by a change in the value of *cosin* δ. The fact, therefore, of a variation in the absolute intensity, can only be determined by combining the observations of the vibrations of the horizontal needle with simultaneous observations on the dipping needle.

If we suppose F constant during the change of horizontal intensity as observed at Albany, we may, by means of the above formula, calculate the change in declination or dip required to produce the observed difference in the horizontal intensity. Assuming $\delta = 75°$, (the dip at Albany nearly,) and $H =$ to the horizontal intensity observed at 6 o'clock, we can readily find the value of F; and since this value is supposed constant, by substituting it in the expression

$$\text{cosin } \delta' = \frac{H'}{F},$$

in which H' represents the intensity observed at 10 o'clock, we shall have the value of δ' (the dip) corresponding to the latter intensity. In this way, the change observed in the horizontal intensity at the time of the aurora, gives 28′ 48″ as the deviation of the needle in the plane of the dip.

The aurora which appeared in connexion with this magnetic disturbance, was probably one of the most interesting ever observed in this country, particularly from the circumstance of the actual formation of a *corona*, which was seen in several parts of this State. My friend Prof. Joslin, of Union College, who happened to be in New-York at the time, has furnished me with the following account:

"The aurora borealis of 19th April, as it appeared in the city of New-York at 9 P. M. was peculiarly interesting, on account of the meeting of the luminous columns in the magnetic meridian, at the point in the direction of the dipping needle towards which they usually tend. The luminous matter occupied the whole northern half of the visible celestial hemisphere, and was very much condensed near the point of convergence. Some of the eastern coruscations were at times transiently curved, as though their middle parts (as was probably the case) were driven eastward by the impulse of the westerly breeze which was blowing at the time. A luminous band was at one time extended across the heavens, at right angles to the meridian, and 30° south of the zenith. This had at times an oscillatory motion in a north and south direction. It passed near the moon, around which was one of the large halos. The sky had been previously clear. The converging rays appeared to meet at the star δ Leonis."

By computing the position of δ leonis for 9 o'clock on the evening of the 19th, its altitude was found to be 70° 25′, and its azimuth 11° 27′ east. A small error in time, however, would make a great difference in the azimuth. The dip of the needle at New-York is 73°, and the variation probably between 4 and 5 degrees, as it is $6\frac{3}{4}$ degrees at Albany.

The aurora was also seen by Dr. William Campbell, at Cherry-Valley. He describes it as very brilliant, and assuming a variety of forms; at one time appearing as a stupendous arch, crossing the heavens from east to west; at another, radiating from a point south of the zenith. The Rev. Mr. Thummel, of the Hartwick Seminary, at his residence in Otsego county, likewise observed the same aurora. He describes it as radiating in every direction from a nucleus near the zenith, which appeared clear and compact for some time, when it began to move, and darted forth rays in every direction like chrystals.

March 6, 1832.

Since the foregoing was communicated to the Institute, several particulars have been learned in reference to the subject, which, on some accounts, are deemed interesting. The Annual Meteorological Reports of the different Academies in the State of New-York, to the Regents of the University, have been received; and from them it appears that the aurora of the 19th of April was visible over the whole extent of the State, and probably considerably west of it. It is described as being very brilliant at Lewiston on the Niagara river, extending high, and farther to the south than any before observed. In the eastern part of the State, it was seen at most of the Academies along the Hudson, and at Erasmus Hall on Long Island. It also appeared brilliant at Potsdam in St. Lawrence county, the most northern Academy in the State. It was probably not seen very extensively in the States east of New-York, as I am informed the weather in the eastern part of New-England was cloudy at the time, accompanied with rain. The aurora is described as shooting up to the zenith at North-Salem; and at Middlebury, as consisting of coruscations in almost every part of the visible heavens. At Fairfield, it illuminated nearly the whole heavens; a number of bows, commencing in the northwest, passed south of the zenith, and terminated in the northeast. An interesting account is given of its appearance at Utica, where it is described as rising at one time in streams of light, of purple, yellow, green and other colours, and exhibiting a rapid horizontal motion, passing and repassing like a company of dancers. The actual intersection of the beams so as to form the appearance called the *corona*, is mentioned as having been seen at the city of New-York, at Hartwick, Cherry-Valley, Hudson, and Prattsburgh in Steuben county.

The only plausible explanation of the formation of the *corona*, is that which supposes the beams of the aurora to consist of cylyndrical portions of some kind of matter, which becomes luminous as it passes into the higher regions of the atmosphere; and that the cylindrical beams shoot up from many points of the earth's surface, nearly parallel to each other, and in the direction of the dipping needle. Being at different distances from the observer, they appear of different elevations; and sometimes, when seeming to overlap each other, they form continued streaks of light in every part of the visible heavens. The corona, according to this hypo-

thesis, is the perspective projection on the sky, of the beams which are shooting up at the same instant on all sides of the observer, and which, being all parallel to the dipping needle, appear to converge as it were to a vanishing point, situated, in the State of New-York, about 15 degrees south of the zenith. If this hypothesis be correct, and it seems a strict geometrical deduction from actual appearances, it would follow, that on the evening of the 19th of April, beams of auroral matter were shooting up from every part of the surface of the State of New-York.

But the most interesting circumstance in reference to this aurora, is that which I have learned from the December number of the Journal of the Royal Institution of Great Britain, viz. the fact of a disturbance of terrestrial magnetism being observed by Mr. Christie in England, on the same evening, and at nearly the same time the disturbance was witnessed at Albany, and that too in connection with the appearance of an aurora.

Mr. Christie had adjusted a magnetic needle for the express purpose of observing the effect when an aurora should appear, but was not so fortunate as to be able to make any observations with it until the evening of the 19th of April. His apparatus consisted of a light needle six inches long, suspended within a compass-box by a fine brass wire $\frac{1}{600}$ of an inch in diameter, and 23 inches long. The needle was deflected from the magnetic meridian by the repulsive action of two bar magnets placed on opposite sides of it; so that, instead of pointing to the magnetic north, it settled in the direction of N. 37° W. As the needle assumed this position in consequence of the attractive force of the earth, and the repulsive force of the magnets, a deviation from the north towards the west would indicate a diminution in the terrestrial horizontal intensity, and a deviation towards the north an increase in that intensity, the intensity of the magnets remaining the same. At 10 o'clock P. M. on the evening of the 19th, during the appearance of the aurora, Mr. Christie found the needle vibrating between N. 43° 40′ W. and N. 42° 40′ W. At 10h. 15m. its direction was N. 34° W. It continued to approach the north until 10h. 37½m. when it pointed N. 33° 30′ W. It again receded from the pole, and at 10h. 40m. vibrated between N. 37° W. and N. 36° W. The next morning at 7h. 20m. the needle pointed N. 40° W. From this brief abstract of Mr. Christie's observations, it will be seen that the horizontal intensity was less than usual at 10 o'clock; that it

increased until 10h. 37½m. when it was greater than in its undisturbed state; and that it again decreased, and was less than usual the next morning at 7h. 20m.

By adding five hours to the time of the observations made at Albany, we will have nearly the corresponding time at Mr. Christie's residence in Woolwich. These times being 6h. and 10. P. M. will therefore correspond with 11h. P. M. and 3h. A. M. of time at Woolwich. From this it appears, that the observations at Albany were made at a period of absolute time between the last observation of Mr. Christie on the evening of the 19th, and the morning of the 20th. The only interesting result, however, which apparently can be drawn from a comparison of the observations, is, that at both places there was a disturbance of terrestrial intensity at the same time; the intensity rising above and sinking below its usual state at each, although these changes did not occur in the same order at both places.

I am not aware that a simultaneous disturbance of terrestrial magnetism, in connection with an aurora, has ever before been noted at two places so distant from each other. Nor do I think the coincidence in this case is in the least degree accidental. On the contrary, it appears to me highly probable that the disturbing cause was not only common to both places, but was also active at the same time in a great portion of the northern part of the globe. A brilliant aurora is by no means a local phenomenon. That of the 28th of August, 1827, was visible over nearly the whole of the northern States, in Canada, and also from some part of the Atlantic ocean. But what places the extensive and simultaneous appearance of the aurora in a more striking point of view than any in which it perhaps was ever before exhibited, is the comparison of the notices of the aurora given under the monthly meteorological reports in the Annals of Philosophy for 1830 and 1831, and the Reports of the Regents of the University of the State of New-York for the same period. By inspecting these two publications, it will be seen, that from April 1830, to April 1831, inclusive, the aurora borealis was remarkably frequent and brilliant, both in Europe and in this country; and *that most of the auroras described in the Annals for this time, particularly the brilliant ones, were seen on the same evening in England and in the State of New-York.*

The particular days on which the aurora appeared in England, are not mentioned in the Annals, except when the aurora is con-

sidered on some accounts interesting. By comparing those which are thus noticed, with the Regents' Reports, the following results are obtained:

The first aurora mentioned in the Annals for 1830, occurred on the 19th of April. A particular description is given of its appearance in England, and also a notice of its being seen in Scotland. In the State of New-York, a brilliant aurora was extensively seen on the same evening. Accounts are given of it from Auburn, Cambridge, Canajoharie, Cayuga, Franklin, Hudson, Lansingburgh, Lowville, Oxford, Pompey, Rochester, Union, Cazenovia and Utica.

The second aurora noticed in the Annals, is that of the 20th of August. An aurora was also seen in the State of New-York, at Lowville, Pompey, Cazenovia, and is particularly described as presenting an unusual appearance at Utica.

The next aurora which appeared worthy of a particular notice in the Annals, happened on the 7th of September; and the same evening, an aurora was seen at Lewiston in Niagara county. On the 17th of the same month, an aurora was also observed in England, and at the same time at Pompey, St. Lawrence and Utica.

Under the report of the meteorology for the month of October, in the Annals, two auroras are described as appearing, one on the evening of the 5th, and the other on that of the 16th. These were both seen in the State of New-York, the first at Utica, and the second at Lowville.

Two auroras are particularly mentioned as appearing in England in November; but no corresponding ones are noticed in the Report of the Regents, as having been seen in the State of New-York.

In the meteorological reports for the month of December, in the Annals, there are five auroras mentioned. The most interesting of these happened on the 11th, and exhibited peculiar appearances. At one time, from a segment of the horizon of 70 degrees in extent, there emanated several flame-colored perpendicular columns, some of which were 2 degrees wide and 30 degrees in altitude: these were succeeded by others, which ultimately exhibited red and purple tints. Many persons in England saw the aurora, and described it as exhibiting an awful appearance from a mixture

of the colours. The most brilliant aurora which appeared in the State of New-York during 1830, happened on the same evening. At Albany, it extended nearly 90 degrees around the northern horizon; and at one time, a row of bright columns rose from an arch, and extended upwards, some of them nearly to the north star. The columns from the western limb of the arch were slightly tinged with redness; all the others were white. At Lowville, flashes of light are described as rising from the north to the zenith, and thence descending half way to the southern horizon. It was brilliant at Auburn, Dutchess, Erasmus Hall, Lansingburgh, Hartwick, Lewiston, North-Salem, Plattsburgh, Rochester, St. Lawrence, Union and Utica. An aurora also appeared on the 12th of the same month, and a brilliant one was likewise seen in the State of New-York, at Auburn, Dutchess, Franklin, Fredonia, Ithaca, Lansingburgh, Lewiston, Middlebury, North-Salem, Plattsburgh, Pompey, St. Lawrence, Utica. Faint auroras are also mentioned as appearing in England on the 13th and 14th, and another on the evening of the 25th; but no corresponding ones are described in the Regents' Report.

In 1831, the first aurora described in the Annals, is that of the 7th of January; "and of all the auroræ boreales," says the author, "that have been observed here (in England) the last twenty years, (some say forty,) this was the most extensive, the most beautiful in colours, and the most interesting on account of the singular phenomena which it displayed, in the number of distinct luminous bows which were presented in the course of the night." Several communications are given on the subject of this aurora, in the Annals of Philosophy, and the Journal of the Royal Institution. It was seen at Paris, and at Brussels. A particular description is given of its appearance in Utrecht, by Prof. Moll. On inspecting the Reports for 1831, I find an aurora was seen in the State of New-York, at places in the extreme east and west parts of the State—at North-Salem on the east side of the Hudson river, and Fredonia near Lake Erie; and intermediate to these places, at Utica and Pompey. The Annals also mention that faint auroras were seen on the evening preceding and following, and also an aurora on the 11th. An aurora was noticed at several places in New-York on the evening of the 6th, but none on that of the 8th or 11th.

No auroras are mentioned in the Annals under the meteorology for February, but three are noticed for March; the first, an interesting one, appeared on the 7th; the second, on the 8th; and the third, a bright one, on the 11th. By referring to the Reports of the Regents, it will be seen that auroras were observed on the same evenings at several places in the State of New-York.

The next aurora mentioned in the Annals, is that of the 19th of April, which has been the principal subject of this paper. An interesting account is given of its appearance in England, which states that at one time there was a grand display of about ten long active streamers along an arch of the aurora, several of which ascended to an altitude of 60 degrees; and when most active, many passed beyond the zenith, exhibiting at the same time several prismatic colours. At 10 o'clock, the arch of the aurora extended 150 degrees. The extensive appearance of this aurora in the State of New-York, and the magnetic disturbance accompanying it, have already been sufficiently described.

The above coincidences appear too numerous to admit the supposition that they are merely accidental, particularly when it is recollected that there are many causes to prevent the cotemporaneous appearance of an aurora being recorded at two distant places, although it exists at both. While it is observed at one place, it may be obscured by clouds, or may escape the notice of the meteorological observer, at the other. Besides this, the coincidences occurred on the evenings when the aurora was most brilliant, and consequently when its action might be supposed most extensive. These simultaneous appearances of the meteor in Europe and America would therefore seem to warrant the conclusion, that the aurora borealis cannot be classed among the ordinary local meteorological phenomena, but that it must be referred to some cause connected with the general physical principles of the globe; and that the more energetic actions of this cause, whatever it may be, affects simultaneously a great portion of the northern hemisphere.

OBSERVATIONS OF LUNAR OCCULTATIONS OF THE PLANETS AND FIXED STARS, 1831.

Mean Time, (civil reckoning,) at the Academy, Albany.

By STEPHEN ALEXANDER, A.M.

June 17th.—Occultation of 1 γ ♍.

Immersion at $11^h\ 39^m\ 13.7^s$ P. M.

The star, for rather more than a second previous to the immersion, appeared to suffer a sensible diminution of light; and a faint brush of light, of a reddish hue, remained visible for about $\frac{1}{4}$ of a second after the immersion. The diminution of light was also noticed by Prof. Henry, who used a telescope of smaller power. The star is a double one.

August 29th and 30th.—Occultation of γ ♉.

Immersion on the 29th, at $11^h\ 46^m\ 44.9^s$ P. M.
Emersion on the 30th, at $0\ 31\ 53.9$ A. M.

The star became, apparently, tremulous for about 2^s previous to the immersion: Its disappearance was nevertheless visibly instantaneous. A very small and thin cloud passed over the moon at the registered instant of emersion: As, however, the star was afterwards visible through a cloud of greater density, and the longitude deduced from the emersion is almost exactly the same with that deduced from the immersion, the time is supposed to have been correctly noted.

October 21st.—Occultation of 1 μ Ceti.

Immersion at $11^h\ 7^m\ 16.7^s$ P. M.

The foregoing observations were made with a Dollond's achromatic telescope, magnifying 120 times. For want of a better instrument, a good eight-day clock was used for noting the time: Its error from mean time, and temporary rate, were ascertained by corresponding altitudes of the sun. The longitude of the Academy, deduced from these observations, is 73° 44′ 28″ W. of Greenwich Royal Observatory, if the moon's diameter be in every case diminished 2″ for inflexion; but if this correction be neglected, the resulting longitude will be 73° 44′ 6″.

In making the following observations, the same instruments were used, with the exception of the time-keeper; the Hon. Stephen Van Rensselaer having favored me with the loan of an excellent chronometer, by Messrs. Parkinson and Frodsham.

December 9th.—Occultation of the Planet Jupiter and his Satellites.

Indentation of 4's limb first perceived at	6h	20m	8.2s	P. M.
Immersion 4's centre, ...	6	20	49.7	
Total immersion, ...	6	21	46.3	
Immersion of the 1st satellite, ...	6	25	40.2	
2d do.	6	26	16.2	
3d do.	6	28	11.2	
Contact of the nearest limbs of the ☉ & 4,	7	34	30.8	
Emersion of 4's centre, ...	7	35	12.3	
Total emersion, ...	7	35	55.0	

A *very thin* cloud, of a density sufficient to conceal the moon's dark limb and the belts of Jupiter, prevented the observation of the precise time of the first external contact. From a continuance of the same obstruction, neither the immersion of the 4th, nor the emersion of any one of the satellites, could be observed. For a few seconds after the commencement of its emersion, the appearance of the visible portion of the primary planet was evidently distorted; being precisely that of a somewhat sharp-pointed mountain projecting from the edge of the lunar disc. Prof. Henry noticed the same phenomenon: The telescope which he used, magnified about 40 times.

December 17th.—Occultation of Aldebaran.

Immersion at	4h	43m	47.4s	P. M.
Emersion at	5	37	27.0	

The instant of the immersion was very exactly ascertained; that of the emersion may possibly be a second in error.