Any errors that may exist in the foregoing pages must be attributed to the fact that no records were kept of many of the incidents mentioned, and to the conflict of opinions regarding the same. I submit them to the public in the hope that they may furnish material for the future and more able historian wherewith to weave a history worthy the perusal of our childrens' children. F. M. IRISH.

Rose Hill, October, 1868.

DAVENPORT, October 16th, 1868.

To the Editor of the Annals of Iowa :

DEAR SIR—It is stated on page 182 of the July number of the ANNALS OF IOWA, in an interesting article by Col. J. C. Parrott, that "the county of Lee was named for Lieut. Robert E. Lee (now General Lee)."

I have met with this statement elsewhere, but must doubt its correctness. You probably saw, not long since, General Lee's denial of all knowledge of any connection between his name and the name of Lee county; but this is not decisive. Dr. (Isaac?) Galland, who resided in Lee county and vicinity at least from 1833, when I first met him, till his death, was agent for a New York capitalist of the name of Lee, in purchasing half-breed claims in Lee county. He told me, probably twenty years ago, that members of the legislature of Iowa had proposed to him to give his name to Lee county, but that he suggested *Lee*, the name of the gentleman whose agent he was, and that his suggestion was adopted.

Truly yours, JULIUS A. REED.

NOVEMBER STAR-SHOWER.

The field now occupied by the science of Meteoric Astronomy is, perhaps, to the casual observer, a barren one. The appearance of a meteor is so sudden, it vanishes so soon, and everything that relates to its distance, its orbit and the quarter of the heavens from whence it comes, is so uncertain and apparently so varied for different cases, that it would seem a hopeless task to undertake to bring the phenomena within the pale of science. The voices that arose from the mixed multitude that retired from the building of Babel, were not more discordant to the ear than the paths and motions of these little meteors are to the eye. Yet, in this unpromising field, the labor of the scientific men of this century has met with a large reward. The full measure of the difficulty and perplexity that environs the subject, cannot here be explained.

As a suitable introduction to the special subject of this article, we will mention a few of the *inferences* that have been drawn and the *truths* that have been ascertained chiefly by the observations of the men of the present century. We shall commence with the most elementary operations, viz: those relating to the number of meteors visible per hour, per day, and per annum.

NUMBER OF SHOOTING STARS.

It is evident, at the outset, that one person cannot be looking, at the same time, to all quarters of the heavens, and therefore could not count all the meteors visible at his station. Two could not do it. Mr. Herrick, of Connecticut, after several years' experience, has concluded that, in order that no visible meteor may pass unnoticed, the corps of observers should consist of nine persons, each with his attention directed to a specific quarter. Hereafter when we speak of the number of meteors visible, we wish to be understood as indicating the number that could be seen by nine persons properly posted.

If we commence counting at 6 o'clock on a clear evening, in the absence of the moon, and continue to 6 o'clock in the morning, we shall find the whole number during the twelve hours to be on the average about 500, which would give 1,000 per day, or 365,000 per annum. This is the number visible at one station. As these little bodies must be near enough to pass through our atmosphere, only a small part of them can be seen from one station. Assuming that their average height at the middle of their visible paths is sixty miles, the total number that could be seen from all parts of the earth would be ten thousand times as many as could be seen from one station, which would give a daily average of ten million meteors entering our atmosphere, and large enough to be seen by the naked eye. The telescope has been used to aid in ascertaining the number of meteors. Using a magnifying power of not more than 60, we find not less than forty times as many meteors as could be seen without it. We will place these results in a tabular form:

METEORS VISIBLE TO THE EYE.

	At one station.	Over the whole earth.
Per day......................	1,000.....	10,000,000 ......
Per annum....................	365,000.....	3,650,000,000 ......

OR WITH A TELESCOPE, SIXTY POWER GLASS.

Per day......................	40,000.....	400,000,000 ......
Per annum....................	14,600,000.....	146,000,000,000 ......

When we come to examine hour by hour, and compare numbers, it will be seen that there is a gradual increase in the number of meteors from evening to morning. The ratio of this increase is such that there are three times as many seen from 5 to 6 o'clock in the morning, as from 6 to 7 o'clock in the evening.

The inference from this is; either the meteors are moving in a direction opposite to that of the earth in its orbit, and hence for the most part enter our atmosphere on that side which is most advanced, (the position we occupy in the morning): or, that they are going in the same direction, but moving more slowly than the earth, and hence are overtaken and enter the atmosphere on the side we occupy in the morning.

The first of these hypotheses is believed to be the correct one, because the velocity of the meteors seems to be greater than that of the earth.

When the account is kept by the month, a comparison at the end of the year shows that there were far less during the months from January to July, than in those from July to January. The minimum being reached in May, the maximum in August.

The earth is nearest the sun, or is in *perihelion*, about the first of January, and is farthest from the sun, or in *aphelion*, the first of July. The above comparison then might be stated thus: The earth encounters more meteors in coming from aphelion to perihelion, than in going from perihelion to aphelion. (This is the usual way of stating this fact).

As to the numerical proportion of meteors during these two periods, there is not a perfect agreement. According to the estimate of M. Coulvier Gravier,* of Paris, the proportion is 1:2½. According to Prof. Loomis,† of Yale College, it is $1{:}1^{8}/_{10}$. According to the record kept by the Chinese and extending from A. D., 960 to 1275, a period of 315 years, the proportion is $1{:}2^{1}/_{5}$. These ratios, while not strictly harmonizing one with another in degree, are yet harmonious in kind, and unite in support of the above made statement.

HEIGHT OF METEORS.

When the same meteor has been seen at two or more stations, if its path has been carefully noted, a comparison of the observations will serve to show its height above the surface of the earth. Such comparison has often been made.

In Silliman's Journal, Vol. 38, pp 136–141, there is a catalogue containing a record of the height of 342 meteors that have been observed since A. D. 1798. From this catalogue it appears that these little bodies, for the most part, become visible at a height of not less than forty miles, nor over one hundred, and that they vanish at an altitude of from thirty to sixty miles. That the ground of this statement may be seen, we append an analysis of so much of that table as relates to observations made since 1848, giving in adjacent columns the numbers appearing and disappearing at the different altitudes:

TABLE OF ALTITUDES.

HEIGHT.	APPEARING.	DISAPPEARING.
Over 100 miles	16	1
From 90–100 miles	6	1
" 80–90 "	11	1
" 70–80 "	12	7
" 60–70 "	21	14
" 50–60 "	14	20
" 40–50 "	24	33
" 30–40 "	13	24
" 20–30 "	4	16
Total No.	121	117

*Arago Popular Astronomy, Vol. II. †Loomis Meteorology, 1868.

Of whatever materials then these meteors may be composed, whether solid or gaseous: and whether they come from the regions of space or originate in the outer boundaries of the atmosphere; it seems that, during their brief existence of a second or two, they make an approach of several miles toward the earth's surface, and either burn out or are dissipated before they come into the denser parts of our atmosphere.

To these most elementary, but at the same time interesting truths elicited, we may add something in reference to the form and chemical composition of meteors.

With reference to those that never reach the earth, we shall not undertake to speak. The vast proportion of those entering the atmosphere are either entirely dissipated in it, or, passing through it without striking the earth, go on their way. It does sometimes occur, however, that a meteor, of perhaps more than ordinary size or density, forces its way through our aerial envelope, and is brought to rest upon the surface of the earth. During the past 50 years, the fall of 115 such meteors has been recorded.* These falls occurred upon but a small portion of the earth's surface. As there is no reason for supposing that they descend more frequently upon thickly inhabited land than upon the uninhabited wastes of the earth, and upon the sea, if we make a calculation upon the number 115, and the district in which they fell, compared with the whole surface of the earth—we should have about 600 falls per annum. And if their weight is equal to that of those that fell in this country, during the period mentioned, the earth must be receiving an additional weight from this source, amounting to 18 tons annually.

The formation of aerolites, as these meteors are generally called, is peculiar. They have no element in them that has not been found in terrestrial minerals; *but these elements exist in the aerolite, in a manner never yet found in any native terrestrial compound.*

1st. They always contain iron, *not in the ore, but in its metallic state*, (rarely found in nature), and this iron *always*

*Loomis Meteorology.

contains some *nickel* with small portions of cobalt, copper, tin and chrome. *Such a composition has never been found in any native compound.*

2nd. They contain a certain compound of iron, nickel and phosphorus—called *schreibersite*; and this substance has never been found, except in aerolites.

3d. Meteoric iron possesses a highly crystalline structure, so that if its surface be carefully polished and treated with a solution of nitric acid, it will afterward be found to be covered with groups of regular triangles. These are called Widmannstatian figures, from the name of their discoverer. These figures are only found in aerolites, and in masses of iron of volcanic origin.

4th. The surface, particularly of these of a stony composition, is composed of a thin *vitreous shell.* Where this is not the case the surface is pitted, as if little scales had snapped off. Where the aerolite has burst into fragments just before reaching the earth the lines of fracture do not exhibit the vitreous shell, but upon placing the different pieces together again, those parts which constituted the original surface, have this shell. A case in point is that of the aerolite that fell in Linn county, Iowa, February 25, 1847. Fragments of this stone are now in the University Cabinet, and also in that of the State Historical Society. The entire mass would have weighed about seventy-five pounds.* The outer shell is very thin and black, not vitreous. There is also in the Historical Society collections, a small fragment of the New Concord meteor, hereafter mentioned. This specimen shows the outer vitreous shell very plainly on one side.

The size of these aerolites ranges all the way from a few grains up to several tons. Prof. Loomis gives a list of eleven meteoric masses weighing from 2,000 to 35,000 pounds.

The readers of the ANNALS will remember the fall of several meteoric stones in Harrison county, Indiana, March 28, 1859, and at New Concord, Ohio, May 1, 1860. The total weight

*I will be obliged to any one who will give me authentic information concerning the fall of this aerolite. N. R. L.

of the fragments of the meteor last mentioned, is about 700 pounds. When these aerolites arrive they are sometimes so hot that they cannot be handled for hours; and they generally come with such force as to penetrate some distance into the earth. Those falling at New Concord penetrated to the depth of from two to three feet.

VELOCITY.

The average velocity of the meteors is greater than that of the earth in its orbit; though the result of observations in any single instance could not generally be relied upon, yet the concurrent testimony afforded by many cases cannot be disregarded. Nor should it be forgotten that observers are almost certain to over-estimate the time during which a meteor is in sight, and hence give it too little velocity. The average velocity of those meteors which appear as large as the planet Jupiter, is thought to be about thirty miles per second. In view of the above suggestion about over-estimating the time of visibility, we would consider thirty miles to be rather under than over the truth. (The velocity of the earth is eighteen miles per second).

The inference from this, or rather the necessary consequence of this volocity is, that they must be revolving in orbits much more eccentric than that of the earth, more eccentric indeed than that of any of the planets; the only bodies with which they can be compared in this respect, are the comets; and as the latter revolve, some in ellipses of moderate eccentricity, others in very long ellipses parabolos, or hyperbolas; so the velocities of different meteors vary, that some of them would seem to be moving in one and some on another of these curves, with the farther similarity that comets and meteors, each seem to move in orbits, having any inclination whatever to the plane of the earth's path; while the planets all move very nearly in the same plane with the earth.

We have given the preceeding review of the state of meteoric astronomy, considered apart from the light thrown upon the subject by the so called "meteoric showers.'

Hoping that with this preface the few facts that we have to state, may be seen to better advantage.

The development of the subject thus far has not shown any relation of the meteors one to another. They are seen as independent bodies, with nothing pointing to a common origin or path of motion, and nothing to indicate with certainty whether they ever return to us again. The question of their celestial origin even, would scarcely be settled in the minds of some, were it not for the evidence afforded by "star showers." The regular occurrence of these phenomena has set these questions at rest, and shown that there are systems of meteors: one system moving along one channel in space, intersecting the earth's path at some certain angle; while another system moves in another channel and at another angle with the path of the earth. In short, that order, not confusion, reigns in this department of nature's domains.

NOVEMBER STAR SHOWER.

In the realm of meteoric astronomy, the November "star shower" holds the most important place. It deserves this prominence for two reasons: the one founded upon the unequaled grandeur of its appearance, and the other arising from the important discoveries to which it has led. It will be our object in this article, to give a short account of the shower itself, and notice the great conclusions reached through its instrumentality.

This shower is not a modern institution. We have authentic accounts of its existence that date back to the close of the ninth century. True, these accounts are somewhat meagre, and colored by the superstitions of those who wrote them; but they are reliable as to the main fact of which they treat, viz: the occurrence of a "shower." They are valuable to us for the further reason that they afford us aid in determining the interval by which these great displays are separated, and it is this consideration only that leads us to refer to them here.

PERIOD OF THE NOVEMBER STAR SHOWER.

To determine this we will rely mainly on the more recent observations. The star shower of 1867 occurred on the morning of November 14. That of 1833, on the morning of November 13; the interval is 34 years and 1 day. That of 1799 occurred on the morning of November 12; the interval here is again 34 years and 1 day. Taking this as the true period, there should have been a "shower" in 1765, another in 1731, and still another in 1697. No mention, however, has been made of any at either of these dates; but in 1698 there was. This interval then from 1698 to 1799, was only one year less than three times 34 years. Of the intervals that precede this, two are each twice 34 years, and one other is, (like the interval from 1698 to 1799), but one year less than three times 34. The total interval from A. D. 902, (said to be the most probable date of the first record), to A. D. 1799, is 897 years, which divided by 34 would give 26 as the number of intermediate periods, with a surplus of 15 years, or 27 periods with a deficiency of 21 years. As there is a deficiency, noticed above, of 1 year from 1698 to 1799, and a further deficiency of 6 years immediately preceeding 1698, or from 1602 to 1698, it would seem probable that 27 is the proper expression for the number of periods between 902 and 1799. It is also evident that owing to perturbations or some other unexplained cause, the uniformity of interval that has been observed during the 18th and 19th centuries, does not prevail through the 700 years that precede them. For the present time the period may be regarded as 34 years and 1 day.

The two terms in this period should be kept separate—the years and the days. The reason for this division may be seen thus: the occurrence of the shower on the morning of November 13, in 1833, and on the morning of November 14, 1867, shows that the point in the earth's annual path where we encounter the meteors, has a forward motion amounting to about 48,000 miles per annum, or amounting in 34 years to 1 day's journey for the earth. The division of the period, as we propose, shows very little discrepancy in the days on which the shower should occur. In A. D. 1799, it was on November 12; in A. D. 934, it was October 15—a difference of 28 days for 26 intervals.

The meaning of the other term, or the 34 years, is, that as the earth every year passes through that part of space where the shower occurs, it only finds it occupied by any large quantity of meteoric matter once in 34 years.

An unusual number of meteors have been seen on the 13th and 14th of November for several years preceding 1867. In 1866 the meteoric display in Asia and Europe appears to have exceeded that of 1867, as seen in this country. It is probable that a meteoric shower of considerable magnitude may be seen this year over a region extending from the Sandwich Islands over to the interior of Asia, or perhaps farther west; and that everywhere we may expect to see a larger number of meteors on that night than we see on ordinary days of the year. Such was the experience of those who observed during the years preceding and following 1833. A meteoric shower was seen in Europe in 1832, and an unusual number on the 12th and 13th of November for several years before and after the date mentioned.

EXISTENCE AND POSITION OF RADIANT.

To the casual observer of a "star shower," the meteors appear to be flying at random. It was, however, noticed in 1833, by Prof. Olmsted, of New Haven, that if the paths of the meteors were traced back, they would intersect within a certain very small space in the constellation Leo. Conceiving, then, that they had all issued from this point and radiated thence toward every point of the compass, he called it the *radiant point*, or, as we term it for the sake of brevity, *the radiant.*

We will insert here a report of the observations made upon the November star shower of 1867. The extract is copied from the *American Journal of Science* for March, 1868:

At Iowa City (lat. 41° 40', lon. W. 14° 40'), by Pres. N. R. Leonard. A company of the students of the State University had been formed some three weeks previous to the 14th of November, for the purpose of watching for the meteor shower, and making observations upon it, if it made its appearance.

The lookout was commenced on the morning of Saturday, Nov. 9, and continued each clear night till the evening of Nov. 13, four persons keeping watch at a time, or one for each cardinal point of the compass. With the exception of the mornings of Nov. 9, and Nov. 12, no more meteors were visible than may be seen on any ordinary night.

On the evening of the 13th, the prospect for a clear sky was very poor. A sort of haze seemed to prevail and light clouds spread over the heavens; these dispersed slowly until toward midnight all had disappeared. The moon, then but little past its full, arose before the hour for commencing operations, and under its light all stars below the third degree paled away and became invisible. I noticed the Pleiades then just beyond a lunar-halo, but so feeble was their light, that only by looking steadily in the direction in which they were known to be, could they be perceived. I do not believe that a meteor of the average brightness of the Pleiades would have been visible.

The company of observers was divided into three sections of twelve each, to watch respectively, from 10 o'clock to 12, from 12 to 2, and from 2 to 4 o'clock. The position chosen for an observatory, was an octagonal room in the cupola of the University. In each side of this room there is a window having an exterior column on either side, so that when the sash and shutters were removed, eight observers, stationed one at each of these windows, would command the entire circuit without any considerable overlapping of their fields of view.

One person was stationed at each of these positions, and two others were placed in a reclining posture on platforms outside, to watch for any meteoric flights that might occur near the zenith. One man stood at a desk within to make a record of the observations, while the twelfth was to act as occasion might require.

The paper for the recorder was ruled thus:

Quarter of compass.	Direction of motion.	Conformity.	Time visible.	Arc of motion.	Remarks.

The following is the record of the numbers counted, and of their conformity or non-conformity in direction to a line proceeding from the constellation Leo:

Hour.	Conformable.	Unconformable.	Total.
10 to 11................	2	5	7
11 to 12................	6	7	12
12 to 1................	35	16	51
1 to 2................	102	17	119
2 to 4............	Nearly all conformable,		5,000

During the last two hours the number actually counted was 4,748, but through mistake on the part of the person stationed at the west window, he only continued to call out to the recorder the direction, &c., of the brightest, without keeping in his own mind the total number of those seen. The division of the time between 2 and 4 o'clock was not noticed, so that the last two hours have to be given together.

In regard to their conformability, as soon as Leo had attained an altitude sufficient to admit of careful observation, it was found that nearly all the meteors seemed either to issue forth from a point marked on our globe by the star 97 near the center of the sickle in Leo, or that, if their courses should be traced back, they would intersect at that point. For a few minutes, about 3h 15m A. M., we carefully noticed those appearing in this quarter of the heavens, and they seemed to indicate a radiant point at the star mentioned; at about 3½ o'clock it seemed that the radiant was a line, or, at most, a very narrow ellipse, having its center at this star, and extending in the direction of the star zeta in the sickle.

The exact number of conformable meteors for the last two hours cannot be given. Out of 1,638 counted by three observers having their attention directed to this subject, only 22 were noted as unconformable.

At twenty minutes before 1 o'clock, it was found that one person could not record fast enough, and the unemployed man undertook the record for one half of the circuit.

At quarter past two, both recorders were unable to keep a full record and from this time forward each observer counted to himself the number appearing in his quarter, and only called out the most remarkable for record. Some time before 3 o'clock a second observer took his place at the S. E., and soon after a second upon the east. The result of their counting will be seen in the quarter table.

QUARTER TABLE.

Hour.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Total.
10–11	0	2	3	2	0	0	0	0	7
11–12	1	1	1	3	0	5	1	0	12
12–1	8	15	5	5	4	10	3	6	56
1–2	25	35	20	16	3	6	4	6	151
2–3				150		No count.			
3–4	693	635	721	1100	507	336	158	448	4748
Total,	727	688	750	1276	514	357	166	560	4938

The maximum of the display as to numbers was from 3h 15m to about 3h 40m A. M. During this period, other parties of nine each were formed and counted the stars issuing from the constellation Leo, finding on the average about 40 per minute. After 3h 45m the diminution was rapid, as may be seen by this comparison; the number counted in five minutes being—from 3h 21m to 3h 26m, 222; from 3h 41m to 3h 46m, 135; from 3h 50m to 3h 55m, 106; from 3h 56m to 4h 01m, 72; and from 4h 03m to 4h 8m, 50.

Those stationed on the southeast quarter, counted by hundreds from 3 to 4 o'clock, with the following result: Time of first 100 was 7 minutes; of the second, 5 minutes; the third, 6 minutes; fourth, 3 minutes; fifth, 3 minutes; sixth, 3 minutes; seventh, 2 minutes; eighth, 2 minutes; ninth, 2½ minutes: tenth, 4 minutes; eleventh, 10 minutes—closing the count at 3h 55m A. M. It will be found by adding these times that they lost 7½ minutes. Most of this loss occurred after the eighth hundred, at 3h 31, when they were unable to count reliably because of the great number that appeared, so that their maximum would be about 3 hours aud 35 minutes by their time, which was 7½ minutes too fast.

Of the 1,100, they considered that only 5 were unconformable.

Color of the trains.—Record was kept of 155 of the most luminous trains, with this result:

Green,	49	Very Green,	9	Total,	58
Red,	35	Very Red,	14	"	49
White,	24			"	24
Train and meteor of different color,					24
					155

As to the green there was some disagreement—some calling that blue which others pronounced green.

In regard to the color, it is my impression that the proportions given by the above figures is not true, save for the brighest meteors—for of the hundreds that left trains behind them the greater number seemed to be of a green color—very many yellow at the middle and gradually changing to green at the margin—a color a little darker than the flame of the metal barium, and not far from the hue of copperas. On comparing this statement with the views of several observers, I find all agreeing thereto.

There were several particular observations taken. The first to be mentioned is, that in some instances a separation took place between the meteor and its train, before the former disappeared.

At 9 minutes to 3, a meteor started from the radiant and proceeded directly over the star *Dubhe* (the northernmost of the two pointers) followed by a broad train about 5 degrees long. The separation of the meteor and train took place just as the former crossed the star named. The train remained visible for the space of 4 minutes, drifting meanwhile to the S. E. shortening up as it went, without, however, growing much if any narrower, and disappeared after retreating about 7 degrees. The last glimpses that I had of it gave me the idea of a spiral form, but I could not be very positive about it.

At 4 minutes to 3, another meteor left the radiant and proceeded to the star *Zeta Draconis*, leaving there a train, behaving just as the last described, retreating 2 degrees in 3 minutes. At 3 minutes after 3 another passed over *Mizar*, (the middle star in the handle of the dipper) leaving there a train that retreated 1½ degrees in 2 minutes.

At 8 minutes after 3, a very large meteor passed over to the head of Orion, leaving there a train 11 degrees long, and almost immediately afterward was seen to separate into several parts and disappear. The train floated a little to the east of south, a distance of 11 degrees, the middle moving more rapidly than the extremities, so that it took up the form of a crescent, with the horns pointing N.W. It should be noted that this train appeared near to the full moon, so that its period of visibility was thereby much shortened. From this train, before the separation, one observer thought he saw three small black streaks descending for a short distance, and curved backward toward the bottom.

At 1 minute after 4, another meteor passed over to Sirius, leaving midway from Leo a train that exhibited the same movements as the last, giving the crescent shape before disappearance.

A change of course in the path of a meteor was carefully noted in one instance. A little after 3½ o'clock, a deep red meteor was seen passing very rapidly through Leo Minor toward the N. W., describing an arc of 15 degrees in ¼ of a second. About midway of its course it turned abruptly toward the west, at an angle of 15 or 20 degrees with its previous direction.

Several bright meteors were seen to *flash out*, remain stationary, or nearly so, for an instant, and then disappear. As a rule, it may be stated that the nearer these were to the radiant point, the less was their motion.

From a careful examination of the records made, there appears to be a difference in the *length* of the arc of flight, which has some connection with the quarter in which the meteor was seen. The following table exhibits the average length for the last two hours:

LENGTH OF ARC BY QUARTERS.

Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	
2–3	16°	13°	6°	14°	28°	20°	17°	15°	Found from 107 ob'sd arcs.
3–4	18		11	12	23	15	16	20	" " 125 " "
Average for night	17	19	10	14	20	17	19	18	" " 350 " "

The arcs described in the N.E., E. and S.E., are thus seen to be shorter than the average, but their *time of visibility* was a trifle *greater* than for other quarters.

In noticing the *rate* of motion, a difference will be found with respect both to the *hours* and the points of the compass. Thus, by hours:

10–11....16° per sec.	12–1....19° per sec.	2–3....21° per sec.
11–12....15 "	1–2....28 "	3–4....19 "

BY QUARTERS OF COMPASS.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
20°	18°	20°	17°	25°	20°	21°	20°

Very few were timed during the last two hours in the first four of the above quarters. From the few, we shall derive a series of numbers much smaller than the above. In the last four, a considerable number were timed, and the resulting velocity arcs are greater, thus:

N.	NE.	E.	S.E.	S.	S.W.	W.	N.W.
12°	10°		17°	30°	22°	21°	23°

I will conclude this article with a table showing the direction of the flights of the meteors, arranged according to the quarters whence they issued:

Direction of flights commencing at 12 o'clock, 1 denoting 1st hour, 2 the 2d hour, &c.

DIRECTION TABLE.

Origin of Meteor.	Hour	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
N.	1	1	1	.	..	..	3	..	1
N.	2	1	1	..	..	..	..	4	9
N.	3	2	..	..	..	..	..	13	1
N.	4	..	..	..	..	..	..	3	2
N.E.	1	..	4	..	..	..	1	5	2
N.E.	2	9	6	..	..	..	..	2	6
N.E.	3	3	3	..	..	..	2	..	1
N.E.	4	..	..	..	..	..	..	1	..
E.	1	..	1	..	2	..	3	1	..
E.	2	..	1	2	6	2	..	1	..
E.	3	1	9	5	4	..	..	1	1
E.	4	2	9	6	3	..	..	..	3
S.E.	1	..	..	..	..	2	2	1	..
S.E.	2	1	..	..	4	4	3	2	..
S.E.	3	..	..	1	..	5	12	..	..
S.E.	4	..	..	..	1	1	1	..	..
S.	1	..	..	..	..	..	3	..	..
S.	2	..	..	..	..	..	1	.	..
S.	3	..	..	..	1	..	15	1	..
S.	4	..	..	..	..	2	27	..	..
S.W	1	..	..	..	..	1	..	6	2
S.W	2	..	..	..	..	..	2	3	..
S.W	3	..	..	..	..	..	6	3	..
S.W	4	..	..	..	..	..	3	17	..
W.	1	..	..	..	..	..	1	1	..
W.	2	..	..	..	..	..	2	1	..
W.	2	1	..	..	..	..	2	9	..
W.	4	..	..	..	..	1	..	9	..
N W	1	..	..	..	..	..	1	1	2
N W	2	..	..	..	..	..	1	..	3
N W	3	..	..	..	..	..	5	4	6
N W	4	1	..	..	..	..	..	29	16
Totals for these columns:		22	35	14	21	18	96	118	55

But few were described as to direction during the last hour, at the first four stations. However, enough is presented to show three things:

1st. That the greatest uniformity as to direction is to be found in those quarters farthest removed from the radiant.

2d. If the breadth of this table be increased two-fold, and the sheet wrapped on a cylinder, it will readily be seen that the line of maximum direction runs around it from top to bottom, like the coil of a helix.

3d. The prevailing direction of motion is toward the west, or a little south of west.

A careful record was made of the times of appearance, &c., of several hundred meteors, in the hope that kindred observations were being made in other places, and that a comparison of their observations with ours might enable us to ascertain the height and velocity of some of the meteors. In this, however, we were disappointed. The fruitless watchings of three or four years past had apparently discouraged our Hawkeye friends of neighboring towns, until they had made up their minds that star showers were too uncertain to warrant the loss of rest in looking out for them.

Others in other places were more fortunate. Prof. Newcomb, of the U. S. Naval Academy at Washington, and Prof. Harkness, of Richmond, Va., by comparing their observations found that eleven meteors had been seen by both observers. Two of these were not seen in such a way as to enable them to make any computations in regard to them. The following is the result as to the remaining nine:

No.	Height at beginning.	Height at ending.
1	72 miles.	30 miles.
2	108 "	55 "
3	74 "	47 "
4	82 "	38 "
5	90 "	50 "
6	104 "	41 "
7	115 "	58 "
8	79 "	41 "
9	198 "	65 "
Mean,	102 "	47 "

Prof. Newcomb adds: "It appears from the observations, that the mean height of the meteors, at first appearance, was 102 miles, and at disappearance 47 miles. The motion being oblique, at an angle of 35° from the perpendicular, the actual mean length of the path of the meteors would appear to be 67 miles. But this length must be too great, since the meteors certainly went through their course in one second or less, probably in half a second. Their velocity being 44 miles per second, the mean length of path can hardly exceed 22 miles. This very great discrepancy is accounted for by the tendency of the eye to assign to a swiftly darting body, which suddenly appears and disappears, a range of motion much wider than its actual range, and especially to place its point of beginning too far back. Allowing for this, I conceive that, on the average, the brighter meteors first appeared at an average height of 75 miles, and were extinguished at an average height of 55 miles above the earth. I would also remark, that there is no positive evidence that any one meteor commenced at a greater height than 100 miles."

From the report of the Royal Astronomical Society of England, on the November shower of 1865, (a small shower compared with those of 1866–7), we learn that 15 meteors were simultaneously observed by Prof. Adams, of Cambridge, and Mr. A. Herschel, at Hawkhurst.

The following results were given for 5 out of the 15.

No.	Height at beginning.	Height at close.
1.	75 miles.	54 miles.
2.	72 "	55 "
3.	68 "	44 "
4.	89 "	57 "
5.	114 "	86 "

The rest of the 15 not given in this manner, but it is stated that the average height of the middle point of their arcs was 83 miles.

In November, 1863, observations were made at New Haven, Haverford College, Philadelphia, and the Naval Observatory at Washington, which resulted in computations for the altitude of 78 meteors, with the following average heights: At first appearance, 96.2 miles; at disappearance, 60.8* miles.

From these observations we may conclude that the visible range of the November meteors lies at an altitude of from 40 to 100 miles, averaging 60–70 miles. From some computations that have been made in reference to the August shower, the range is thought to be from 50 to 85 miles, averaging about 60 miles, or a little lower than that of the November meteors.

These regions are above the limits formerly assigned to the atmosphere. Do they indicate that we have been mistaken in regard to its extent? As bearing upon this point, notice the

*American Journal Science, September, 1865.

observation made in regard to the trains which separated from the meteors and floated off in a direction out of the line of its original motion.

Those noticed here, though some were seen in the north and others in the south, yet in all cases they floated toward the S. E. and hence must have been borne by a current of air or something else, toward that point of the compass. This floating away of a train has several times been noticed. The train itself seems to be only a cloud of vapor and finely comminuted particles of the meteor itself, expelled by the great heat arising from atmospheric resistance. Moreover, we have made mention of the great heat of aerolites, that have descended to the earth. That they do not come into our atmosphere in this condition, seems to be proved by the fact that in cases of the larger aerolites the heat is found to be only on the surface. The interior is intensely cold. They do not then approach the earth in a glowing condition, and hence become visible to us before entering the atmosphere; neither are they seen, as the moon and planets are, by the reflected light of the sun, for they are so near the earth that they must be in its shadow. They only show themselves after they have been heated to a glowing condition, by atmospheric resistance or some other resistance that answers the same purpose.

There are several points in reference to the observations upon this shower, that ought to be particularly noted.

1st. The existence of a radiant point has been fully confirmed by the observations of the showers of 1866 and 1867. The position of this radiant in 1867, was near the center of the sickle in the constellation Leo. Its position in 1833, was thought to be near the star Gamma in the same constellation, showing a change of position in 34 years, amounting to about 3°. The existence of such a point shows that the meteors approach the earth from the same quarter of the heavens; that they exist in the form of a stream, or very much elongated cloud of meteoric matter.

2d. Since an unusual number of meteors have been visible on the night of the 13–14th of November, for several years before the shower of 1866–7, and since on the night of November 12–13; for several years both before and after the shower of 1833, an unusual number were seen—it follows, that this stream, this cosmical or meteoric cloud, must be of extreme length. If, as would seem to be the case, the duration from first to last of these unusual displays in November, before and after the year of the "great shower," is ten years, and the period from shower to shower is 34 years, we may calculate the orbit in which they move and the length of the cloud or stream. To assist the general reader in forming a conception of the subject as it now appears to those who have reasoned upon data similiar to the above, we would advise the construction of the following diagram:

Procure a card or drawing board 40 inches square, take a point at the center of this to represent the sun; around this center draw a circle, with a radius of 1 inch; this will represent the orbit of the earth; around the same center, with a radius of 5 inches, draw another circle to represent the orbit of Jupiter; also, another with a radius of 9½ inches for Saturn and one with 19¼ inches radius to represent Uranus. Now take a ruler 21 inches long and lay it upon the diagram so that its edge shall pass through the center, and one end of the ruler extend beyond the center a distance of 98.100ths of an inch, you will then see that the other end lies a little beyond the orbit of Uranus; draw a line along the ruler from end to end; then taking up the ruler, place it across this line so as to bisect it at right angles, and draw a cross line 8 inches in length—4 inches on either side of the first line; upon these two lines as axes, describe an ellipse, and you will have before you a view of the probable orbit of the November meteors. Commencing on one side of this line not more than an inch inside of the orbit of Uranus, and proceeding toward the earth's orbit, you may, with a sharp pointed pencil, begin to make little dots along the arc of the ellipse and close by it on either side, making them comparatively few in number and far apart at first, but as you proceed along let them increase in number and proximity, until you have gone over nearly half the distance to the earth's orbit, then let them diminish about in the same way that they increased, and terminate the dotting when you reach the orbit of the earth; now imagine this ellipse to stand at an angle of $17°.44\frac{1}{2}'$ with the plane of the paper. You will then have a representation of the cosmical or meteoric cloud itself as it is conceived to lie in space at the commencement of the November displays, or about 5 years before the "shower," say in 1862. One year after, or in 1863, this cloud has moved along toward the sun, the half nearest the sun has been very much lengthened and the earth crosses the cloud at some distance from the vertex. In about 5 years it crosses the central parts, which are certainly much more dense than the extremities, and we have a shower. In ten years from the commencement, the cloud has moved on so that the earth passes through what was at first the farther extremity of the cloud, and through an interval of 24 succeeding years it will meet but few if any more when it crosses this line than at other points of its orbit. I cannot conclude this article without making reference to a striking analogy between the orbit described above by the November meteors, and that pursued by a comet, discovered by Mr. Tempel, in December, 1865.

If, upon the diagram already spoken of, you undertake to lay down the orbit of this comet you will find, 1st. That it crosses the path of the earth at the same place with the meteoric stream. 2d. That its perihelion point, (the inner extremity of the longer axis of its orbit,) is within $^{7}/_{100}$ of an inch of the perihelion point of the meteors, and its aphelion point out beyond Uranus, almost precisely the same as for the meteors. 3d. That while the meteoric stream is thought to intersect the earth's orbit at an angle of $17°.44\frac{1}{2}'$; the comet intersects at an angle of $17°.18^{1}/_{10}'$; and 4th. That the direction of both the comet and the meteors is contrary to that of the earth.

These coincidences are too close and too many in number to justify the belief that they are accidental. Moreover, a similar correspondence has been found to exist between the

August meteors and a comet called comet III, of 1862. The almost necessary conclusion is that Temple's comet is only a November meteor of unusual size, and that in general the distinction between comets and meteors exists only in respect to their magnitude. In the meteoric stream laid down on your diagram, place Tempel's comet then at a point a little forward of the center, and you will have figured before you the ultimate conclusions thus far reached in the investigation of the November star shower.

EDITORIAL NOTES AND NOTICES.

HISTORY OF JOHNSON COUNTY.

Captain Irish concludes in this number the history of Johnson County. All in all it is an excellent history. Personally we can judge of the merit of that portion descriptive of the early settlement, only by its style and apparent fairness. Old settlers tell us that it is essentially correct.

Of course there is much omitted in its narrative portions, which would have given to it additional interest for the general reader. Many amusing sketches of of frontier life have been left out; many exciting scenes of the intensely earnest transactions of those days have not been described; many mirth-producing incidents which have been recounted a hundred times by the cabin fireside of the settler, are still unwritten. Entertaining as these would have been to such who came later, and are consequently unfamilliar with them, there are serious objections to their introduction.

First. This class of history would have extended the work to a very great length, compelling its continuance through many future numbers of the ANNALS, or requiring more space than our crowded contributor's list now permits.

Another and the paramonnt objection is, that with the greatest of care injustice is liable to be done. For there is scarcely a story of interest of those times that its point or zest does not consist in the fact that some person has been made the subject of a depreciative practical joke; the butt of ridicule; or his character compromised.

These parties still live, or their friends are here, or if dead, their memories have become dear; covered and redeemed a thousand times, by the good which after circumstances developed in them, and which won them the after respect and love of their neighbors and fellow citizens. To transmit then these foibles or mistakes which made them the subjects of jest or criticism for the passing hour, to the future, for the simple sake of giving an enhanced entertaining quality to the work, would have been unjust.

We have no authority for saying that such were the motives which induced the author to withhold the numerous anecdotes with which he is so successful in entertaining his hearers in social intercourse; yet we can readily understand