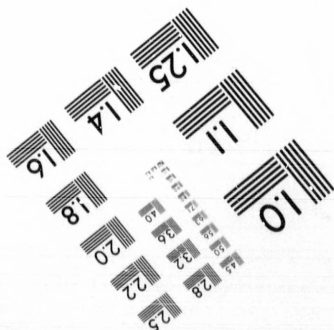
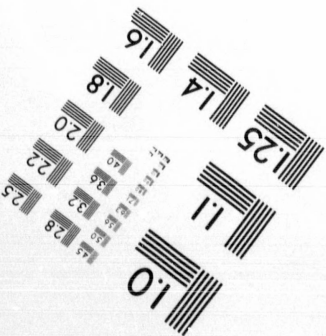
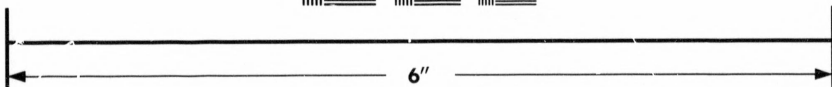
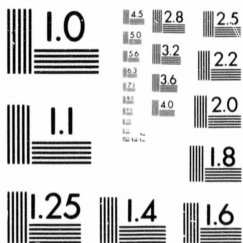


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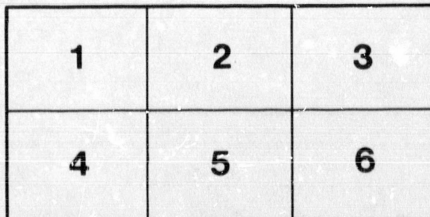
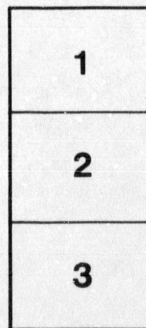
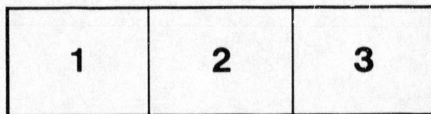
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FROM THE TRANSACTIONS OF THE ROYAL SOCIETY OF CANADA

SECOND SERIES—1896-97

VOLUME II

SECTION III

MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES.

THE DISTRIBUTION OF
AEROLITES IN SPACE

By ARTHUR HARVEY

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1896

VII.—*The Distribution of Aerolites in Space.*

By ARTHUR HARVEY.

(Read May 20, 1896.)

The periodicity of swarms of shooting stars is now generally admitted. The great fall of the 11th and 12th November, 1799, was described by Humboldt and Bonpland, who were in South America and found that a similar display had been seen on the same days, thirty-three years before. In 1831, 1832 and 1833, at the same period of the year, there was an abundance of these meteors, and Arago was induced to write, in 1835, that "there exists a zone composed of millions of small bodies whose orbit cuts the plane of the ecliptic at about the point which our earth annually occupies between the 11th and 13th of November. A new planetary-world is beginning to be revealed." Olbers investigated the subject and found the period of revolution of these meteorites to be a little over thirty-three years, while the most numerous aggregation in the orbit was that through which the earth had passed in 1766, 1799 and 1832, and he predicted a fine display for 1866. A brilliant shower was noted on the 13th and 14th November of that year, especially in England, and we may reasonably expect another in 1899. We see some of this swarm every year, but its orbit is not packed with equal thickness in all parts, and the numbers therefore vary. Necessarily, however, they seem to come from the same radiant point in the heavens, and as this is near γ Leonis, they are called Leonids. Many other swarms are now recognized as periodical, each having its separate radiant and its special days, each as the Geminids from 6-12 December, the Lyrids from 20-26 April, the Perseids about the 10th of August.

It was perceived about thirty years ago that the orbit of the Leonids is closely related to that of Tempel's comet, seen in 1866. A swarm on November 27th has the same elements as Biela's comet. The Perseids' orbit agrees with that of the bright comet 1862 III. The new astronomy therefore holds that there is an intimate connection between comets and shooting stars, and it is thought that through some repulsive action, which is most violent near perihelion, the loosely aggregated materials of comets get scattered into a long trail, if not into a complete ring. The incandescence of these materials, by friction in our atmosphere, when the earth in its revolution swoops through their path, is thought to give rise to the phenomenon of shooting stars.

Professor Newton, of Yale, calculates at seven and a half millions the number that daily fall, and the same astronomer has made another in-

teresting calculation based on the Bielids observed at Beyrout, Marseilles, and Montcalieri, in 1885. The number seen was some 75,000 an hour, and during that display the earth travelled 100,000 miles. This then was a very rich part of that meteor-stream. Even there, the calculation goes on to prove, and it is easy to repeat and check it, the meteors were on an average 20 miles apart.

Shooting stars are, however, like others—many more can be seen with a telescope than without one—and it would in the present state of our knowledge be rash to fix a limit to their number, and though their bulk is very small, it is enough to form an important part of the material lying on the deep sea bottom, far from shore, and has been estimated to add 100 tons a day to the weight of the earth. The material found is a mere dust of iron oxide.

They do not differ from one another in size alone. Some move much more rapidly than others, some have longer or broader trails, some trails appear to last longer, and they differ in colour too. In short, with a little experience, one may tell an Andromede from a Perseid, Leonid or Lyrid, without reference to its radiant.

It may be here mentioned that the writer, availing himself of a Barton electric furnace, placed at his disposal, applied the intense heat of the electric arc to the surface of several kinds of minerals—chiefly quartz and spar containing particles of various metallic ores. They became incandescent in a flash; numerous fragments splintered off at a white heat, showing how trails are formed and how their colours vary, also how the "crust" on meteorites is formed. The wonder is how any meteors can reach the earth except as cosmic dust.

The present writer, observing shooting stars in 1893, was surprised to find Perseids in July, continuing well into September. In 1894 they were fairly abundant during the last week in July, while on their special day they were very sparse. A similar observation was being made at Pultava, and it stands to reason that the ring, if formed from the materials of comets, must be enormously diffuse. The tails of these bodies are seen to flicker—to emit streams in several directions. There must be successive emissions, perhaps several at each perihelion passage, and the planets affect them and cause a direct motion of their perihelia and of the perihelia of their swarm rings. If we were to reduce the orbits of the various Perseids we encounter to one set of co-ordinates and place the eye at the nodal region, we should see their paths, diverging like brushes of rays, to cover an enormous extent in space. Prof. Newton says the disintegrating force must be in the plane of the earth's orbit, but it seems to the writer that if it emanates from the sun, the earth does not at all control it—the materials would be thrown from the comet in the shape of a cone, whose apex is at the comet and whose base is enormously expanded. How full space now begins to seem; not an

empty void in which seven or eight planets pursue their solitary circlings, but a *plenum*, with numberless streams of matter circulating through it, each composed of countless bodies of all sizes. It takes the earth close upon two months to go through that part of its orbit crossed by the disintegrated particles of comet 1862 III.

These paragraphs lead to the proper consideration of the present inquiry—whether there is a periodicity among aerolites, and whether aerolites are connected with shooting stars and recognized comets. Many writers assume that bolides, aerolites and shooting stars are identical. The writer has come to believe that aerolites are not all the discards of comets, but rather small comets themselves. To arrive at a conclusion on this point, 357 have been classified according to the days they fell, and it would be difficult to distribute the supply more evenly throughout the months or the days of the year. January comes a little short, while May is unusually well supplied, but there seems no special reason for attaching weight to the differences, which are doubtless accidental. The whole list is appended, but the summary by months is sufficient to prove this statement:

January.....	24	May.....	42	September.....	31
February.....	28	June.....	31	October.....	28
March.....	28	July.....	26	November.....	29
April.....	29	August.....	29	December.....	32
				—	
				Total.....	
				.....357	

The next classification made refers to the hours of their fall. This important detail is not given in half the cases, but we find for these

Between 6 a.m. and 6 p.m.....	127
“ 6 p.m. and 6 a.m.....	37
—	
164	

The reason for the difference is worth inquiring into, and it is to be hoped that the importance of the subject to the study of physical astronomy will cause more careful records to be kept of all nocturnal bolides as well as of diurnal aerolites.

It is evident that as a general rule aerolites which strike us in the day time are on their way from the sun—these which fall at night on their way to it. If they were flying directly to or from it, they would be most numerous at about noon or at about midnight, for at other hours, equal areas on the earth's surface are obliquely inclined to the sun and present a smaller target to such missiles. But they are affected by the attraction of the earth, and their paths become bent, generally so as to follow the earth in its course. Their velocity, we must remember, is enormous. A recent committee of the British Association reports that

"fire balls appear at a height of between 20 and 130 miles and have a velocity of between 17 and 80 miles per second, averaging 34.4 miles per second." The earth travels in its orbit 18.3 miles per second. Gravity, from the furthest confines of the sun's power, would only account for half the velocity of the average meteor, so their proper motion may be from 30 to 40 miles per second in some cases, while in others it may be much less. We should therefore expect that the following of the earth would be very noticeable—that most diurnal meteorites would fall in the afternoon and most nocturnal ones after midnight. We find the table confirm this reasoning for the day observations, not for the others, but the numbers tabulated are scarcely enough to form a fair average, even in the former case. The table is given to show how much there is yet to do, and the work, which is difficult at a provincial centre, is easier where works of reference are more accessible.

AEROLITES FALLING.

From midnight to 1 a.m.....	0	From 11 p.m. to midnight.....	1
" 1 a.m. " 2 "	0	" 10 " " 11.....	1
" 2 " " 3 "	3	" 9 " " 10.....	2
" 3 " " 4 "	2	" 8 " " 9.....	8
" 4 " " 5 "	0	" 7 " " 8.....	5
" 5 " " 6 "	7	" 6 " " 7.....	8
" 6 " " 7 "	5	" 5 " " 6.....	11
" 7 " " 8 "	7	" 4 " " 5.....	18
" 8 " " 9 "	7	" 3 " " 4.....	23
" 9 " " 10 "	7	" 2 " " 3.....	6
" 10 " " 11 "	8	" 1 " " 2.....	11
" 11 " noon	8	" noon " 1.....	16

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We may further arrange them thus :

Falling from midnight to 6 a.m.	12
" " 6 a.m. to noon	42
" " noon to 6 p.m.	85
" " 6 p.m. to midnight.....	25

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There is but one case known to the author of a meteorite falling during a display of shooting stars, viz., a stone that fell at Mazapil, Mexico, during a shower of Bielids. This was perhaps a coincidence, and is so considered by Stanislas Meunier, of the Paris Museum d'Histoire Naturelle, in a paper sent to the Scientific Society of Chili, on Chili meteorites. It is of interest to note the analogy between recently observed comets and some aerolites. The comets the writer has observed seem

to have a nebulous glimmer surrounding a softly shining but fairly defined luminous cloud, in which a somewhat more brilliant nucleus or several nuclei may be seen. Telescopic stars can be seen through them. Photographic representations represent a bladder or bubble containing or inclosing something, with a bright glow about the nucleus and some wisps of light to form the trail. They may well be assemblages of meteoric stones flying in a swarm, which would not obstruct the view of the heavens beyond. Such may have been the aerolites which fell at L'Aigle, in Normandy, reported on by Biot, 1803. They appeared like a small rectangular cloud, and a vast number of stones weighing 10, 11 and even 17 lbs., fell to the ground,—two or three thousand of them, covering an elliptical area $7\frac{1}{2}$ miles long by 3 miles broad. Such was probably the aerolite of 1876, which was seen in Texas, Kansas, Missouri, Illinois, Indiana and Ohio, and is described as “a fireball surpassing the moon in apparent size, followed by a great number of smaller meteors, certainly “100 of them, many of which were larger than Venus or Jupiter.” One fell and was found near Bloomington, O., others may have fallen too, but the majority sailed away across Lake Erie “like a flock of wild geese, * * * moving with about the same velocity and grace of regularity.” Such were the thousands that fell at Winnebago, Minn., and very many others. These bodies were probably too small to be emitting light of themselves (such light in the case of visible comets being perhaps due to heat caused by the clashing of their parts in concentration or in frequent collisions) or if luminous, too small to attract the attention of a comet seeker, but they nevertheless seem to have been small comets, whose career of growth or of disintegration was suddenly cut short by collision with our planet.

A careful inspection of the table shows that in at least three cases two aerolites have fallen on the same day in places widely separated. Where they fall only a few miles apart, they may perhaps have been parts of one body, and the explosion may have caused the separation, also a change in the direction of flight, which the resistance of the air, acting on the changed shape of the missiles, may have increased. These reasons, however, do not account for such distances as between the two which fell on May 26th, 1826—one near Ajen in France, the other, near Ecaterneslaw in Russia—or the two of May 13th, 1895, one at Moestel Pank, Isle of Oesel, in the Baltic, the other at Gnarrenburg, Hanover. From the similarity of the analysis of some siderites that have been found in the United States, at considerable distances apart, Mr. G. F. Kunz has already inferred that they may have been parts of the same meteorite, which was broken up after entering the air. My table gives strength to that inference and leads much farther. When it is completed as to the past and has received the additions of another generation, it will perhaps be seen that aerolites do not always fly in single file or in closely packed

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clusters, but that there are doubles and triples and double clusters, too, among them as well as among the stars, their relatives.

Those which the little earth thus intercepts can, however, be both a small portion of the whole. All the other planets must receive their share, and the sun himself yet more. Perhaps almost all that are by the planets (which deflect without catching them) imprisoned within the solar system, must ultimately fall into the sun, as a boat is swallowed by a whirlpool. Those, however, which with a high initial velocity come into the sun's range and are not deflected by some planet, can have no resting place among our family of worlds. Like wandering Jews they can have no home, but must travel without ceasing. Whirling around or past the sun, they must move on and ever on, with retarded speed, in dim starlight and inconceivable cold, until they feel the incipient influence of another stellar mass. Then, like a canoe above Niagara, their rate of motion will increase, at first imperceptibly, but there can be no drawing back. Feeling the throb of a new life they must again be hurried on, and so thread their way from one star's vicinity to another, adding perhaps a nodule here or some dust elsewhere. Time fades into nothingness on such journeys. Light, at 187,000 miles a second, takes years to travel from star to star, and almost an infinity must be consumed by the meteors, much of whose swiftness is lost in the struggle to get away from this to other systems. Perchance, however, some of them may grow, increasing until they have mass enough to crush all their particles within themselves into coherence, when they would melt with the fervent heat evolved, and at some such stage become self-luminous and join the celestial family as stars, as some of the new splendours yet lying in the womb of Cosmos.

It is perhaps much to build so lofty a theory on a statistical table, which is as imperfect as the Carlisle tables of mortality, and, like them, needs to be extended over many years in many countries. Yet these figures lead directly to the inference, which is in line with other reasonings and observations, that aerolites are evenly distributed throughout space, that they move at various angles with the plane of the ecliptic, that the universe is a *plenum*, in which change and therefore growth and dissolution must be going on. And this, while adding another proof of the universality and unity of Law, does allow some privileges to one who is tempted to gild the hard prose of fact with the poetry of imagination.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

January.	Place of Fall.	Hour.
1, 1869.....	Hessle ¹.....Arno.....Sweden.....	12.30 p.m.
1, 1887.....	Biela.....Krymitchoe.....Russia.....	
2, 1825.....	Arezzo.....Italy.....	
3, 1877.....	Warrenton.....Missouri.....U. S. A.....	
4, 1797.....	Bjelaya.....Zerkow.....Russia.....	
7, 1856.....	I. of Wight.....England.....	
8, 1834.....	Volhynia.....Russia.....	9.30 a.m.
10, 1622.....	.....Devonshire.....England.....	
13, 1824.....	Rinalzo.....Italy.....Italy.....	8.30 p.m.
19, 1865.....	Supuhee ².....Goruckpur.....India.....	
19, 1867.....	Khetrie.....Rajpootana.....“.....	9.00 a.m.
20, 1891.....	Novara.....Italy.....	
21, 1887.....	Decewsville.....Ontario.....Canada.....	
23, 1814.....	Scholakoff.....Russia.....	
23, 1852.....	Nellore.....Madras.....India.....	4.30 p.m.
23, 1872.....	Yatour ³“.....“.....	
23, 1870.....	Nedagolla.....Vezigapatam.....“.....	
23, 1877.....	Cyntheana ⁴.....Ky.....U. S. A.....	4.00 p.m.
25, 1845.....	La Pressoir.....France.....	3.00 p.m.
27, 1886.....	Nammianthal.....Madras.....India.....	
28, 1883.....	St. Caprais.....Gironde.....France.....	2.45 p.m.
29, 1838.....	Kake.....Oude.....India.....	
30, 1869.....	Pultusk.....Russia.....	7.00 p.m.
31, 1836.....	Mascombes.....France.....	
31, 1879.....	La Becasse.....Indre.....“.....	
25 ⁵		

¹ Described by Nordenskiöld. Thousands fell—area not distinctly elliptical. Heaviest stones flew furthest.

² In the Paris Catalogue this is given as 23rd May, 1865.

³ This may be a misprint both in the name and year of fall and is omitted in the summary.

⁴ No common interval exists between any of these of the 23rd January, and none have been seen since 1877. The presumption therefore is against periodicity and in favour of coincidence. The date is worth examining further. The material of each is different, viz.: Scholakoff is Lucéite; Nellore is Bellajite; Nedagolla is Burlingtonite; Cyntheana is Parnallite.

⁵ Summarised as 24.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

February.	Place of Fall.	Hour.
2, 1785.....	Witness Bavaria.....Germany	
3, 1860.....	Alexandria Italy	11.45 a.m.
3, 1882.....	Mocs..... Transylvania Austria-Hungary	
4, 1871.....	Koniska ¹ Minn U. S. A	
6, 1818.....	Swaffham England	
19, 1825.....	Nanjemoy Md. U. S. A.....	12.00 m.
10, 1853.....	Girgenti Sicily Italy	1.00 p.m.
10, 1874.....	Estherville..... Iowa..... U. S. A.....	
12, 1875.....	Iowa Co..... " "	10.15 p.m.
13, 1839.....	Little Piney Mo..... "	3.30 p.m.
14, 1861.....	Tocane St. Apre..... France	
14, 1873.....	New Haven ² Conn..... U. S. A.....	
15, 1848.....	Dhawar India	
16, 1883.....	Alfanello..... Brescia Italy	3.00 p.m.
16, 1827.....	Mhow..... India	3.00 p.m.
16, 1876.....	Judesgherry Mysore "	
18, 1815.....	Durala "	12.00 m.
18, 1815.....	Bachmut Ecaterineslaw.....Russia.....	
18, 1824.....	Timoschin Smolensk "	
18, 1880.....	Tajima Japan.....	5.30 a.m.
19, 1796.....	³ Spain.....	
19, 1884.....	Pirthalla..... Hissar Funjaub, India.....	
19, 1785.....	Eichstadt..... Bavaria.....Germany	
24, 1886.....	Assisi..... Perugia..... Italy.....	
25, 1841.....	Chanteloup..... France	
25, 1847.....	Linn Co..... Iowa. U. S. A.....	
28, 1857.....	Parnallee Madras India	12.00 m.
29, 1868.....	Motta di Conti.....Piedmont Italy.....	11.00 a.m.
28 ⁴		

¹ Heard and seen—not found.² Group seen near Venus—not heard or found.³ A huge fireball seen all over Spain and Portugal—not found.⁴ Two on 18th, 1815, may be parts of one fall.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

Month.	Place of Fall.	Hour.
4, 1875	Sitathali..... India	
6, 1853	Seegowlee Bengal " "	
8, 1798	Villefranche ¹ France	6.00 p.m.
12, 1811	Poltava Russia	11.00 a.m.
12, 1891	Compiègne France	
13, 1859	Aix " "	
14, 1881	Penn's Siding Middleboro England	3.30 p.m.
15, 1806	Alais France	5.00 p.m.
16, 1853	²	
16, 1863	Pulsora Indore India	
18, 1877	Wener Sweden	
19, 1718	³ England	
19, 1882	Fukutomi Japan	1.00 p.m.
19, 1884	Djati Pengilon Java	
20, 1868	Daniel's Kuill Griqualand Africa	
21, 1676 ...	⁴ Italy	
22, 1841	Gruneberg Silesia Germany	3.30 p.m.
22, 1846	Bagnere de Luchon France	
24, 1857	Stavropol Caucasus Russia	5.00 p.m.
25, 1807	Timoschin ⁵ " "	
25, 1843	Bishopville South Carolina U.S.A	
26, 1865	Vernon Co Wisconsin " "	9.00 p.m.
27, 1886	Cedar Creek Arkansas " "	3.00 p.m.
28, 1859	Harrison Co. Indiana " "	4.00 p.m.
28, 1860	Bhurtpur India	
30, 1818	Zaborzygy Volhynia Russia	
30, 1866	St. Mesmin Aube France	
31, 1875	Zsadany Temesvar Austria-Hungary	
28		

¹ Dated the 12th in Meunier's catalogue.² Great fire ball seen all over Western Europe.³ A huge fire ball seen throughout England.⁴ Seen everywhere in N. Italy.⁵ Possibly some misprint. See previous date, February 18th, 1824.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

April.	Place of Fall.	Hour.
1, 1857.....	San José.....Costa Rica.....	
2, 1882.....	Paulofka.....Saratov.....Russia.....	
4, 1859.....	Mexico.....Luzon.....Phillipine Ids.....	
5, 1804.....	Possil.....Glasgow.....Scotland.....	
6, 1805.....	Doroninsk.....Siberia.....Russia.....	5.00 p.m.
6, 1885.....	Chandpur.....India.....	
7, 1887.....	Lalitpur.....Nyagong.....“.....	
9, 1628.....	.....Berkshire.....England.....	
9, 1844.....	Killeter.....Tyrone.....Ireland.....	
10, 1802.....	Toulouse.....France.....	
10, 1818.....	.....Volhynia.....Russia.....	
11, 1715.....	Schellin.....Prussia.....Germany.....	4.00 p.m.
12, 1812.....	Toulouse.....France.....	1.30 p.m.
12, 1864.....	Nerft.....Courland.....Russia.....	4.45 a.m.
15, 1812.....	Erzleben.....Prussia.....Germany.....	4.00 p.m.
15, 1857.....	Kaba.....Austria-Hungary.....	10.30 p.m.
17, 1621.....	Lahore.....India.....	
17, 1851.....	Güttersloh.....Prussia.....Germany.....	8.00 p.m.
18, 1838.....	Akburpur.....India.....	
18, 1895.....	Niagara Falls ¹.....New York.....U.S.A.....	2.00 a.m.
19, 1808.....	Borgo S. Donino.....Parma.....Italy.....	12.00 m.
20, 1876.....	Rowton.....Shropshire.....England.....	3.15 p.m.
24, 1875.....	Nageria.....India.....	
26, 1803.....	L'Aigle.....Normandy.....France.....	1.00 p.m.
26, 1842.....	Pusinsko-Selo.....Croatia.....Austria-Hungary.....	3.00 p.m.
27, 1840.....	Karakol ².....Russia.....	12.00 m.
29, 1877.....	Lulea.....Sweden.....	3.30 p.m.
29, 1844.....	Killeter ³.....Tyrone.....Ireland.....	
30, 1873.....	Rome.....Italy.....	
29		

¹ Lighted up the whole sky. Not seen to fall.

² Given elsewhere as of 9th May, 1880. Perhaps difference between old style and new style accounts for difference.

³ Possibly wrong, see April 9th, *supra*.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

May.	Place of Fall.			Hour.
1, 1860....	New Concord	Ohio	U. S. A.	12.45 p.m.
2, 1890....	Winnebago	Iowa	"	
5, 1869....	Krähenberg	Bavaria	Germany	6.30 p.m.
7, 1618....	Paris		France	
8, 1829....	Forsyth	Georgia	U. S. A.	3.30 p.m.
8, 1846....	Monte Milone		Italy	9.30 a.m.
8, 1872....	Dyalpur	Oude	India	
9, 1827....	Nashville	Tennessee	U. S. A.	4.00 p.m.
10, 1879....	Estherville	Iowa	"	5.00 p.m.
11, 1874....	Sevrukoro ¹	Koursk	Russia	11.45 p.m.
12, 1861....	Gootka		India	
12, 1855....	Moestel Pank ²	I. of Oesel	Russia	3.30 p.m.
12, 1855....	Gnarrenburg	Hanover	Germany	5.00 p.m.
13, 1861....	Poitiers		France	
14, 1861....	Canellas		Spain	1.00 p.m.
14, 1864....	Orgueil		France	8.00 p.m.
14, 1874....	Nash Co.	N. Carolina	U. S. A.	2.30 p.m.
15, 1874....	Harbour Grace ³		Newfoundland	
17, 1830....	Perth		Scotland	
17, 1855....	Igust	Livonia	Russia	
17, 1877....	Heugel	Hesse	Germany	
17, 1879....	Gnadenfrei	Silesia	"	
18, 1860....	London ⁴		England	4.00 p.m.
19, 1826....	Galapian ⁵	Ajen	France	
19, 1826....	Paulograd	Ecaterinoslaw	Russia	
19, 1858....	Kekova		Austria-Hungary	8.00 a.m.
20, 1848....	Castine	Maine	U. S. A.	4.15 a.m.
20, 1874....	Virba	Widdin	Turkey	
20, 1884....	Tysne	Bergen	Norway	
21, 1871....	Searsmont ⁶	Maine	U. S. A.	8.15 a.m.
21, 1808....	Stannern	Moravia	Austria	6.00 a.m.
21, 1867....	Sommer Co.		U. S. A.	
21, 1868....	Sloavetic	Agram	Austria-Hungary	10.30 a.m.
22, 1869....	Kernouve	Morbihan	France	10.00 p.m.
23, 1865....	Gopalpur	Jessore	India	6.00 p.m.
23, 1869....	Clarac	Morbihan	France	
24, 1892....	Cross Roads	N. Carolina	U. S. A.	5.00 a.m.
26, 1751....	Hradshina	Croatia	Austria-Hungary	6.00 p.m.
26, 1893....	Beaver Creek	B. Columbia	Canada	
27, 1866....	Pokra	Bustee	India	
30, 1866....	St. Mesmin ⁷	Troyes	France	
30, 1887....	Powder Mill Creek	Tennessee	U. S. A.	
42				

¹ Given by Meunier as of the 12th May, 1875.² Probably connected with the same group as the next.³ Seen and heard—not found. ⁴ Seen—not found.⁵ Probably the same fall or collection as the next.⁶ Given by Meunier as at 31st inst.⁷ Probably the same as given at 30th March.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

June.	Place of Fall.	Hour.
2, 1843.....	Utrecht Holland.....	8.00 p.m.
2, 1863.....	Scheikahr Statten... Courland Russia	7.30 a.m.
3, 1822.....	Angers ¹ France	8.30 p.m.
4, 1828.....	Richmond Virginia U. S. A	8.30 a.m.
4, 1842.....	Aumières. France .....	.....
6, 1838.....	Chandakapur..... India	12.00 m.
7, 1855.....	St. Denis Westrem..... Belgium.....	7.45 p.m.
7, 1876.....	Vavilovka Cherson Russia .....	.....
9, 1896.....	Knyahinya Austria-Hungary	5.00 p.m.
9, 1867.....	Tadjera Sétif Algiers	10.30 p.m.
11, 1878.....	La Charca Mexico	11.30 a.m.
12, 1840.....	Uden Brabant Holland.....	10.30 a.m.
12, 1834.....	Charnsallas Delhi India	8.00 a.m.
12, 1841.....	Chateau Renard..... France	1.30 p.m.
13, 1819.....	Saint-Onge "	6.00 a.m.
13, 1850.....	Kegen Japan	dawn.
15, 1821.....	Juvinas..... France	3.30 p.m.
16, 1794.....	Siena Italy	7.00 p.m.
16, 1860.....	Kaseuli India	5.00 a.m.
17, 1870.....	Ibbenbühen..... Prussia Germany	2.00 p.m.
19, 1688.....	Verona Italy .....	.....
19, 1876.....	Vavilovka Kherson Russia.....	.....
22, 1723.....	Ploschkowitz..... Bohemia Austria.....	.....
25, 1876.....	Kansas City..... Missouri U. S. A .....	.....
25, 1890.....	Farmington Kansas "	12.55 p.m.
26, 1864.....	Dolgowla..... Volhynia Russia	7.00 a.m.
28, 1861.....	Mikenskoi ² Caucasus "	7.00 p.m.
28, 1872.....	Tennasilm..... Esthonia..... "	12.00 m.
28, 1876.....	Ställdalen Sweden	11.30 a.m.
29, 1843.....	Mannegaum..... India .....	.....
30, 1886.....	Nagaya Conception Argentina.....	.....
31		

¹ Some authority gives this on the 9th; Meunier gives the 2nd June.² Also reported from Grosnaya on 16th. Difference between old and new style?

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

ur.	July.	Place of Fall.	Hour.
p.m.	3, 1753	Krawin Bohemia Austria	8.00 p.m.
a.m.	4, 1842	Logrono Spain	
p.m.	4, 1848	Marmanda France	
a.m.	5, 1825	Torretillos de Campo Spain	
.....	7, 1855	St. Denis Westren (a) Belgium	
m.	8, 1811	Berlanguillas Spain	8.00 p.m.
p.m.	8, 1874	Franklin Co. Kentucky U. S. A	
.....	11, 1868	Ornans Doubs France	
p.m.	12, 1820	Lasdany Russia	5.30 p.m.
p.m.	14, 1845	La Vivionnère Manche France	3.00 p.m.
a.m.	14, 1847	Brannau Germany	3.45 a.m.
a.m.	14, 1860	Dhurmsala India	2.30 p.m.
a.m.	15, 1878	Tieschietz Moravia Austria	1.45 p.m.
p.m.	16, 1771	..... France ¹	
a.m.	17, 1840	Cereseto Piedmont Italy	7.30 a.m.
n.	18, 1831	Voullé France	
p.m.	18, 1889	Ferguson N. Carolina U. S. A	6.00 p.m.
p.m.	19, 1894	Boice ² Greece	
a.m.	20, 1860	..... New York ³ U. S. A	
p.m.	22, 1838	Montlivault France	
.....	23, 1872	Lancé Orleans "	5.30 p.m.
.....	24, 1790	Barbotan "	9.00 p.m.
.....	24, 1837	Gross Divina Austria-Hungary	11.30 a.m.
.....	27, 1894	Lick Observatory ⁴ . California U. S. A	
p.m.	31, 1708	Sherness England	
a.m.	31, 1859	Montpreis Styria Austria	
p.m.	26		

(a) Given as 7th June by Meunier.

¹ A fire ball seen over a large part of France.

² Seen and heard, not found.

³ Seen over New York and the Central States.

⁴ Seen, heard, figured and described, not found.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

August.	Place of Fall.	Hour.
1, 1835.....	Charlotte.....Tennessee.....U. S. A.....	
1, 1879.....	Nagaya.....Argentina.....	
1, 1862.....	Morlans.....France.....	
2, 1882.....	Paulovka.....Russia.....	4.30 p.m.
4, 1835.....	Cirencester.....England.....	4.30 p.m.
5, 1812.....	Chantonnay.....Vendée.....France.....	2.00 a.m.
5, 1856.....	Oviedo.....Spain.....	
5, 1855.....	Petersburg.....Tennessee.....U. S. A.....	3.30 p.m.
7, 1823.....	Nobleboro'.....Maine.....“.....	4.30 p.m.
7, 1822.....	Radanah.....Agra.....India.....	
8, 1863.....	Pillitsfer.....Livonia.....Russia.....	12.30 p.m.
10, 1818.....	Smolensk.....“.....	
10, 1863.....	Putney ¹.....England.....	
10, 1885.....	Grozac.....France.....	
11, 1859.....	Bethlehem.....New York.....U. S. A.....	
11, 1863.....	Shytal.....Dacca.....India.....	
12, 1865.....	Dundrum.....Ireland.....	7.00 p.m.
13, 1852.....	Sidmouth.....England.....	
14, 1829.....	Deal.....N. Jersey.....U. S. A.....	11.30 p.m.
14, 1846.....	Cape Girardeau.....Missouri.....“.....	3.00 p.m.
16, 1875.....	Feid-chair.....La Calle.....Algeria.....	12.00 m.
18, 1783.....	.....Europe ²	
18, 1870.....	Cahezzo de Mayo.....Murcia.....Spain.....	
20, 1864.....	Phalerum.....Greece.....	
25, 1865.....	Umjhiawar.....Behar.....India.....	9.00 a.m.
26, 1865.....	Aumale.....Algeria.....	11.00 a.m.
29, 1892.....	Bath.....Dakota.....U. S. A.....	4.00 p.m.
30, 1887.....	Taborg.....Perm.....Russia.....	
31, 1892.....	Orvinio.....Rone.....Italy.....	5.15 a.m.
29		

¹ Seen—not found.² Throughout northwestern Europe—1,000 miles of a course.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

September	Place of Fall.	Hour.
3, 1808.....	Lizza Bohemia Austria-Hungary	3.30 p.m.
4, 1852.....	Mező Madares..... Transylvania " "	4.30 p.m.
4, 1857.....	Krasnoslobodsk Russia.....	
5, 1814.....	Agen France.....	12.00 m.
5, 1854.....	Lenum Prussia..... Germany.....	
5, 1878.....	Dandapur Gorukpur..... India.....	
7, 1753.....	Liponas ¹ Ain France.....	1.00 p.m.
7, 1865.....	Muddoor..... India.....	
8, 1868.....	Sanguis St. Etienne. B. Pyrenées..... France.....	2.30 a.m.
9, 1829.....	Krasnoj Ugal..... Russia.....	2.00 p.m.
9, 1831.....	Znorow Moravia Austria-Hungary	3.30 p.m.
10, 1813.....	Limerick Ireland.....	6.00 a.m.
10, 1825.....	Liancourt France.....	
13, 1768.....	Lucé Sarthe ".....	4.30 p.m.
13, 1822.....	La Baffe, Epinal..... Vosges..... ".....	7.00 a.m.
13, 1858.....	Renne ".....	
14, 1511.....	Crema..... Italy.....	
14, 1825.....	Honolulu..... Sandwich Ids....	10.30 a.m.
15, 1814.....	Ekaterineslaw..... Russia.....	12.00 m.
16, 1843.....	Kleinwarden Prussia Germany.....	4.30 p.m.
19, 1869.....	Tjabé Pandanjau Java.....	9.00 p.m.
20, 1676.....	..... England ²	
21, 1885.....	Muddoor Mysore India.....	7.00 a.m.
22, 1887.....	Phu-Heng Binkchank Cochin China.....	
22, 1851.....	London England.....	
22, 1873.....	Nowo Urei ³ Penza..... Russia.....	
22, 1893.....	Zabrodje Wilna ".....	
23, 1873.....	Khaipur..... Moulton India.....	
24, 1864.....	Mont de Marsan..... France.....	
26, 1873.....	Santa Barbara..... Brazil.....	
26, 1885.....	Washington Co ⁴ Pennsylvania U. S. A.....	
31		

¹ Given by Meunier as of the 8th.² Seen throughout the midland counties.³ This is the aerolite in which diamonds were found.⁴ Heard and seen, not found.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

October.	Place of Fall.	Hour.
1, 1868.....	Lodran .....Moulton India	
3, 1815.....	Chassigny.....France	8.00 a.m.
3, 1819.....	Politz Gera .....Reuss Germany	
3, 1865.....	Moffat .....Scotland	
3, 1883.....	Ngawe .....Java	
4, 1857.....	Des Ormes ¹ .....Yonne.....France.....	
5, 1852.....	Namur.....Belgium	
5, 1866.....	Jamkeir .....Ahmednuggur .....India	
6, 1827.....	Bialystock .....Poland	9.30 a.m.
6, 1869.....	Lumpkin.....Georgia .....U. S. A.....	11.45 a.m.
7, 1861.....	Klein Menow .....Mecklenburg.....Germany	1.30 p.m.
8, 1803.....	Saurette.....France	10.00 a.m.
10, 1857.....	Ohaba .....Transylvania... ..Austria-Hungary	12 m.
13, 1838.....	Tulbagh .....Kold Bokkeveld...C. of Good Hope.	9.00 a.m.
13, 1787.....	Kharkov.....Russia.....	3.00 p.m.
13, 1819.....	Politz.....Germany	8.00 a.m.
13, 1852.....	Burkut .....Hungary .....Austria-Hungary	3.00 p.m.
13, 1877.....	Sarbanovic ² .....Serbia	2.00 p.m.
14, 1824.....	Zabruk.....Bohemia .....Austria-Hungary	8.00 a.m.
18, 1854.....	Toberg .....Germany	
19, 1863.....	Athens ³ .....Greece.....	
21, 1844.....	Favars .....France	6.45 a.m.
21, 1876.....	Rochester.....Indiana .....U. S. A.....	8.45 p.m.
25, 1859.....	.....England ⁴	
29,	Presigné .....France	
30, 1883.....	Ngawie.....Java	
31, 1872.....	Orvinio .....Rome.....Italy.....	
31, 1849.....	Monroe.....N. Carolina .....U. S. A.....	3.00 p.m.

28

¹ Meunier gives this date, elsewhere stated as the 1st.² Meunier gives same date in 1872.³ Am. Journ. of Science gives 18th.⁴ Seen over all England.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

November.	Place of Fall.	Hour.
2, 1836	Maceo ¹ R. del Norte Brazil	
4, 1879	Kalumba Salhara India	
5, 18	Nulles Spain	5.30 p.m.
8, 1878	Rakafka Tula Russia	
10, 1886	Malme Japan	5.00 a.m.
12, 1856	Trenzana Lombardy Italy	4.00 p.m.
12, 1843	Verkne Tschirskaya Russia	
13, 1835	Belmont France	
14, 1825	Leith Scotland	
15, 1860	Denisville N. Jersey U. S. A	
16, 1492	Ensisheim Alsace Germany	12.30 p.m.
17, 1887	. . . . . . . . . . Ireland ²	
17, 1793	Gigina Spain	12.30 a.m.
19, 1881	Gross Lieben Thal Odessa Russia	6.30 a.m.
19, 1856	Trenzano Brescia Italy	
20, 1768	Mauerkirchen Bavaria Germany	4.00 p.m.
23, 1810	Charsonville France	1.30 p.m.
24, 1804	St. Louis Potosi Mexico	
25, 1833	Brünn Moravia Austria-Hungary	6.30 p.m.
25, 1857	Blanko " "	
26, 1758	. . . . . . . . . . Scotland ³	
26, 1846	Schönenberg Bavaria Germany	2.45 p.m.
26, 1874	Kerilis Cotes du Nord France	10.30 a.m.
27, 1627	Mont Vaisins "	
27, 1824	Prague Bohemia	
27, 1868	Danville Alabama U. S. A	5.00 a.m.
27, 1885	Dhulia Kandeish India	6.00 p.m.
30, 1822	Allahabad "	6.00 p.m.
30, 1850	Shalka Bengal "	4.30 p.m.
29		

¹ Given as the 8th in one account.² The whole of Ireland.³ All the North of Scotland.

LIST OF AEROLITES, CLASSIFIED BY THE DATE OF THEIR FALL.

December.	Place of Fall.	Hour.
1, 1825.....	Berlin Prussia Germany	
2, 1852.....	Bustee ¹ India	
5, 1842.....	Epinal. France	
5, 1863.....	East of England and Scotland.....	
5, 1868.....	Frankfort Alabama..... U. S. A.....	
9, 1866.....	Cangas de Onis..... Santander..... Spain.....	
7, 1863.....	Touraine la Grosse .. Louvain Belgium 11.00 a.m.	
5, 1861.....	Midland Counties..... England.....	
8, 1863.....	London..... "	
9, 1858.....	Montrejeau Haute Garonne... France..... 7.30 a.m.	
10, 1863.....	Inly Trebizond.... Turkey	
10, 1871.....	Bandong..... Java..... 1.30 p.m.	
11, 1741.....	London..... England.....	
11, 1864.....	Putney Lodge "	
12, 1872.....	Louisville..... Kentucky.....	
13, 1795.....	Wold Cottage England..... 3.30 p.m.	
13, 1798.....	Krahut India 8.00 p.m.	
13, 1813.....	Luotolaks Finland Russia.....	
13, 1803.....	St. Nicholas Bavaria Germany 10.30 a.m.	
13, 1852.....	Borkut Austria Hungary.....	
3, 1863.....	Putney England.....	
14, 1807.....	Weston Connecticut U. S. A..... 6.30 a.m.	
17, 1852.....	Dover England.....	
17, 1863.....	Newcastle-on-Tyne "	
19, 1798.....	Benares..... India	
21, 1876.....	Rochester ² Indiana U. S. A.....	
22, 1863.....	Mamboom Bengal India 9.00 a.m.	
22, 1868.....	Motecka Nugla..... Bhurtpur "	
24, 1858.....	Molina Murcia Spain.....	
25, 1869.....	Moursouk Arabia.....	
27, 1848.....	Schie Norway.....	
27, 1853.....	The Channel..... England.....	
27, 1857.....	Queng Yonk..... Pegu 2.30 a.m.	
32 ³		

¹ A white meteorite with pink grains.² Given at this date in *October* in Harvard catalogue. This is Meunier's date.³ Rochester meteor, 21st not included; it was counted in October.

