

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 OCTOBER 3-9

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on October 3

Sun rises, 6h. 6m.; souths, 11h. 49m. 17s.; sets, 17h. 32m.; decl. on meridian, 4° 2' S.: Sidereal Time at Sunset, 18h. 21m.

Moon (at First Quarter October 4) rises, 12h. 26m.; souths, 16h. 54m.; sets, 21h. 20m.; decl. on meridian, 18° 28' S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian
Mercury	6 26	12 5	17 44	4 52 S.
Venus	4 34	10 55	17 16	3 23 N.
Mars	10 44	14 55	19 6	20 45 S.
Jupiter	6 30	12 8	17 46	4 54 S.
Saturn	22 43*	6 46	14 48	21 24 N.

* Indicates that the rising is that of the preceding evening.

Ocultations of Stars by the Moon (visible at Greenwich)

Oct.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
6	B.A.C. 7097	6	22 33	23 42	142° 31' 20"
8	ε ² Aquarii	5½	22 29	near approach	39 —

Oct. 9 ... 17 ... Jupiter in conjunction with the Sun.

Variable Stars

Star	R.A.	Decl.	h. m.	h. m.
Algol	3 0'8"	40 31' N.	Oct. 4,	21 20 m
λ Tauri	3 54'4"	12 10' N.	6,	4 9 m
ζ Geminorum	6 57'4"	20 44' N.	4,	2 0 M
δ Libræ	14 54'9"	8 4' S.	5,	1 19 m
U Coronæ	15 13'6"	32 4' N.	5,	21 10 m
S Scorpii	16 10'9"	22 37' S.	9,	M
U Ophiuchi	17 10'8"	1 20' N.	3,	2 6 m
and at intervals of 20 8				
U Sagittarii	18 25'2"	19 12' S.	Oct. 5,	0 0 m
			8,	0 0 M
β Lyræ	18 45'9"	33 14' N.	5,	3 0 m
R Aquilæ	19 0'9"	8 4' N.	6,	M
δ Cephei	22 24'9"	57 50' N.	9,	0 0 M

M signifies maximum; m minimum.

Meteor Showers

The coming week is usually a somewhat less fruitful one for meteors than the one just past. The *Arietids*, October 7, R.A. 31°, Decl. 9° N., form the principal shower; a radiant in Musca, R.A. 46°, Decl. 26° N., and another near Polaris, R.A. 133°, Decl. 79° N., are also active at this time.

METEORITES, METEORS, AND SHOOTING-STARS¹

YOU are kindly giving to me an hour to-night in which I may speak to you. I do not have enough confidence in myself to justify me in speaking to such an audience as this upon one of those broad subjects that belong equally to all Sections of the Association. The progress, the encouragements, and the difficulties in each field are best known to the workers in the field, and I should do you little good by trying to sum up and recount them. Let me rather err, then, if at all, by going to the opposite extreme.

Two years ago your distinguished President instructed and delighted us all by speaking of the pending problems of astronomy, what they are, and what hopes we have of solving them. To one subject in this science, a subject so subordinate that he very properly gave it only brief notice, I ask your attention. I propose to state some propositions which we may believe to be probably true about the meteorites, the meteors, and the shooting-stars.

In trying to interest you in this subject, so remote from the studies of most of you, I rely upon your sense of the unity of all

¹ Address to the American Association for the Advancement of Science, at Buffalo, August 13, 1886, by Prof. H. A. Newton, of New Haven, the retiring President of the Association.

science, and at the same time upon the strong hold which these weird bodies have ever had upon the imaginations of men. In ancient times temples were built over the meteorite images that fell down from Jupiter, and divine worship was paid them; and in these later days a meteorite stone that fell last year in India became the object of daily anointings and other ceremonial worship. In the fearful imagery of the Apocalypse, the terrors are deepened by there falling "from heaven a great star burning as a torch," and by the stars of heaven falling "unto the earth as a fig tree casteth her unripe figs when she is shaken of a great wind." The "great red dragon having seven heads and ten horns, and upon his head seven diadems," is presented in the form of a huge fire-ball. "His tail draweth the third part of the stars of heaven, and did cast them to the earth." Records of these feared visitors, under the name of flying dragons, are found all through the pages of the monkish chroniclers of the Middle Ages. The Chinese appointed officers to record the passage of meteors and comets, for they were thought to have somewhat to say to the weal or woe of rulers and people.

By gaining in these later days a sure place in science, these bodies have lost their terrors; but so much of our knowledge about them is fragmentary, and there is still so much that is mysterious, that men have loved to speculate about their origin, their functions, and their relations to other bodies in the solar system. It has been easy, and quite common too, to make these bodies the cause of all kinds of things for which other causes could not be found.

They came from the moon; they came from the earth's volcanoes; they came from the sun; they came from Jupiter and the other planets; they came from some destroyed planet; they came from comets; they came from the nebulous mass from which the solar system has grown; they came from the fixed stars; they came from the depths of space.

They supply the sun with his radiant energy; they give the moon her accelerated motion; they break in pieces heavenly bodies; they threw up the mountains on the moon; they made large gifts to our geological strata; they cause the auroras; they give regular and irregular changes to our weather.

A comparative geology has been built up from the relations of the earth's rocks to the meteorites; a large list of new animal forms have been named from their concretions; and the possible origin of life in our planet has been credited to them.

They are satellites of the earth; they travel in streams, and in groups, and in isolated orbits about the sun; they travel in groups and singly through stellar spaces; it is they that reflect the zodiacal light; they constitute the tails of comets; the solar corona is due to them; the long coronal rays are meteor streams seen edgewise.

Nearly all of these ideas have been urged by men deservedly of the highest repute for good personal work in adding to human knowledge. In presence of this host of speculations it will not, I hope, be a useless waste of your time to inquire what we may reasonably believe to be probably true. And if I shall have no new hypotheses to give you, I offer as my excuse that nearly all possible ones have been already put forth. This Association exists, it is true, for the advancement of science, but science may be advanced by rejecting bad hypotheses as well as by framing good ones.

I begin with a few propositions about which there is now practical unanimity among men of science. Such propositions need only be stated. The numbers that are to be given express quantities that are open to revision and moderate changes.

(1) The luminous meteor tracks are in the upper part of the earth's atmosphere. Few, if any, appear at a height greater than one hundred miles, and few are seen below a height of thirty miles from the earth's surface, except in rare cases where stones and irons fall to the ground. All these meteor tracks are caused by bodies which come into the air from without.

(2) The velocities of the meteors in the air are comparable with that of the earth in its orbit about the sun. It is not easy to determine the exact values of those velocities, yet they may be roughly stated as from fifty to two hundred and fifty times the velocity of sound in the air, or of a cannon-ball.

(3) It is a necessary consequence of these velocities that the meteors move about the sun and not about the earth as the controlling body.

(4) There are four comets related to four periodic star-showers that come on the dates April 20, August 10, November 14, and November 27. The meteoroids which have given us any one of these star-showers constitute a group, each individual of which