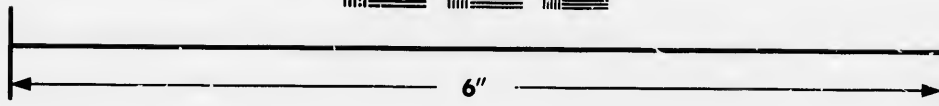
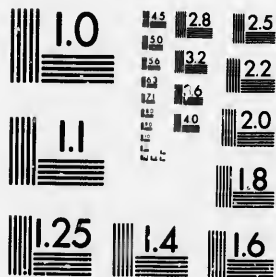


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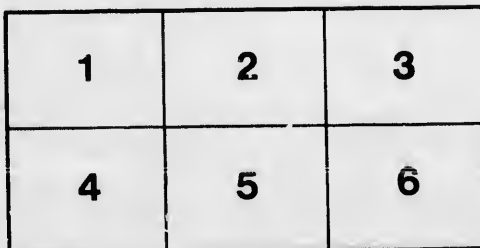
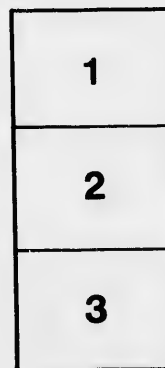
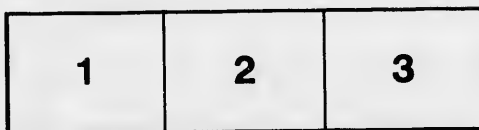
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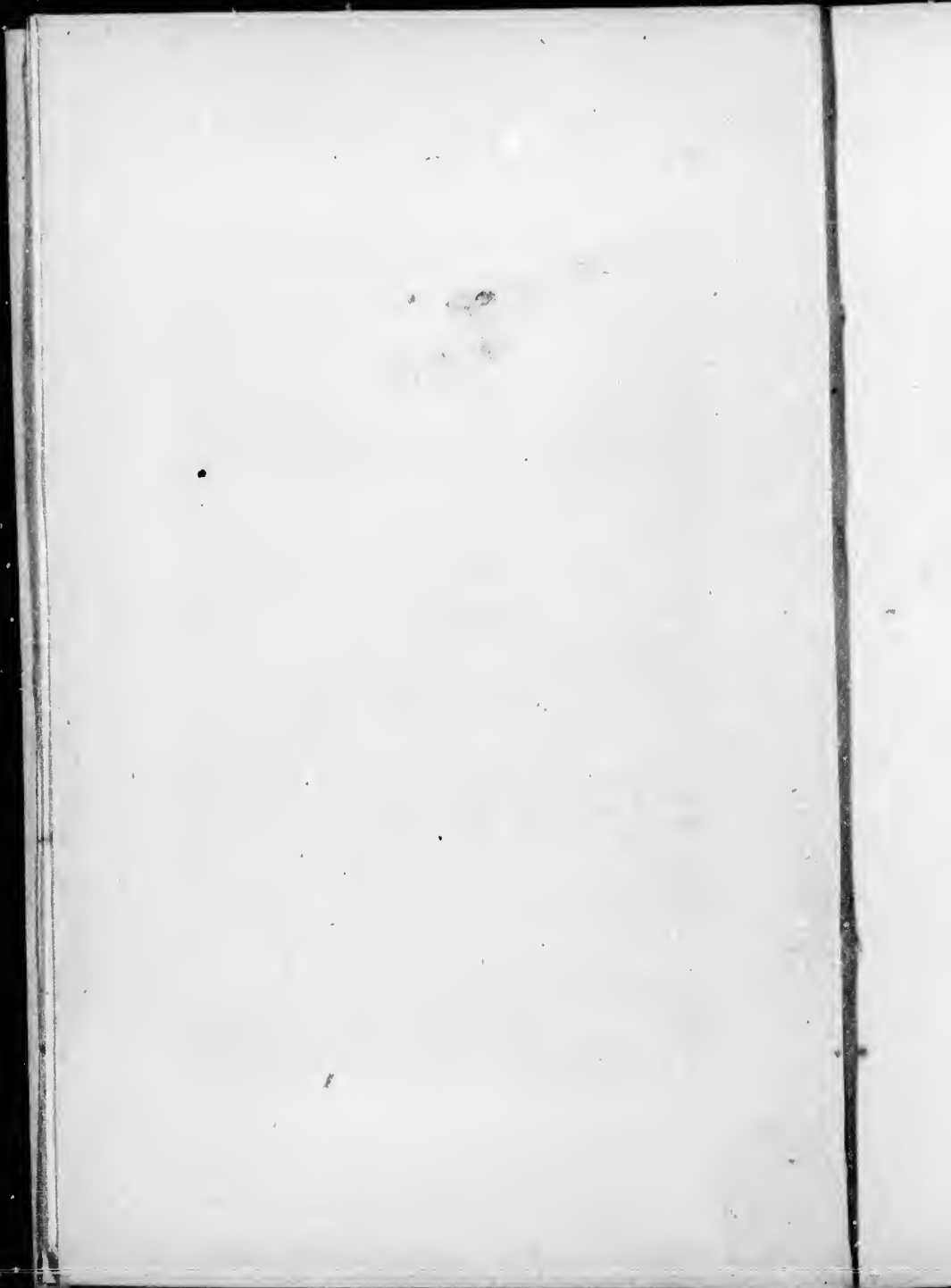
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AN
ASTRONOMICAL PHILOSOPHY;

OR,

THE STUDY OF THE HEAVENS MADE EASY.

BY

THE REV. D. F. HUTCHINSON,

AUTHOR OF THE "ESSAY ON THE LORD'S DAY," "BIBLICAL
CHART;" "DISCOURSE ON CHRISTIAN BAPTISM," IN
THREE EDITIONS; "CHRISTIAN WARFARE;" CLASS
BOOK ON RHETORIC, FIRST AND SECOND EDITION;
AND "THE GOOD OLD WAY."

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"Ipsius enim invisibilia jam inde a condito mundo et  
rebus factis, intellecta pervidentur, æterna videlicet ejus  
tum potentia tam divinitas"—[PAULUS.  
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PREFACE.

FOR many years I have been solicited by numerous friends both in the United States, and in Canada, to publish something comprehensive and at the same time interesting on the sublime science of Astronomy: not I am sure that they considered me more capable than many others residing in this Province, but because for some years past I have had more or less to do in imparting instruction on this agreeable and delightful subject. But well knowing that so many able pens have been employed for centuries in collecting information in this department of knowledge, I could hardly persuade myself that such a work was absolutely necessary, and it was only after being made thoroughly acquainted with the wants of our Country that I have at length been induced to lay aside my reluctance, and without any arrogance or pretensions on my part to present the following work to the public for their approbation.

I am at the present time fully convinced that we need a work of this description in Canada; something easily comprehended and of a practical character. By this I mean that the student of the following chapters can put them all into practice, by testing their truth in direct application, so that by a little experience and practice he will be made acquainted with the different departments of Astronomical study.

In pursuing the following pages the reader will very easily perceive that the method of communicating truth in this book is entirely new, and that though in introducing matter of an interesting character I have carefully thought for myself. I have at the same time, when proper and requisite, quoted from learned authors on some difficult points, adopting their views and ideas as my own. So far as accuracy of facts and statements is concerned, I would just observe that the subject of the following pages is for the most part founded upon my own observation and experience, and I am sure the reader will only have to examine the different facts embraced in this work to ascertain their truth and importance.

This small volume being published in our own Province it is but reasonable to expect a widely extended patronage, and that every lover of our Country will duly encourage its own publications. The instructors of youth particularly are requested carefully to examine the following pages, for the author flatters himself with the belief that it will meet with their most cordial reception. The author also believes that a vast amount of Astronomical knowledge will be found in its pages, and can be obtained by the student with but very little trouble or expense, and in a short time.

To introduce as much matter as possible I have intentionally omitted Astronomical plates, because I am satisfied the Teacher or student can supply the deficiency in the use of the black-board, or he can furnish himself with Smith's

Astronomy, in which he will find a very valuable amount of plates attached to the different lessons : so that their introduction in the present work would for present purposes seem unnecessary. In omitting them, as the reader very well understands, we can supply with much less expense, a large amount of valuable matter which could not be otherwise inserted. The work I now submit to my numerous friends in particular, and the public in general, hoping that it may be productive of good results in duly encouraging the youth of our country to appreciate the noble and interesting study of Astronomy.

Kingston, October 9th, 1854.

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AN
ASTRONOMICAL PHILOSOPHY.

PART I.

CHAPTER I.

THE subject of this small treatise is a subject unequalled by any other in the whole volume of Nature, both for its sublimity and grandeur, and for the ideas which it suggests of the Majestic Wisdom and goodness of the Eternal. It is the subject of Astronomy. Most of the ideas embraced in this Essay shall be drawn from my own observations and experience, duly respecting at the same time the opinions of the learned on every part of the science I shall here introduce. The following shall be the order pursued in this work.

I. I intend noticing the general appearance of the Heavens, as exhibited to any ordinary observer.

II. I intend giving an explanation of the general phenomena of the Heavens, as notified in the first division.

III. I intend giving a scientific arrangement of the Heavenly bodies, and

IV. I intend answering the inquiry, Are the Heavenly bodies inhabited ?

The word Astronomy is taken from two Greek words, *Asteer* or *Astron*, a Star, and *nomos*, a Law, and signifies that science which treats of the appearance, size, shape, arrangement, distances, motions, physical constitution and mutual influence of the Heavenly bodies.

The very first thing which attracts the attention of even the untutored savage is what we denominate the apparent motion of the Heavens. The Sun, the Moon, and the Stars appear to rise in a given direction, and to set some hours from thence in the opposite point of the Heavens: and though we term this revolution which they seem to make around our earth and all pertaining to it every twenty-four hours, the apparent motion of the Heavenly bodies, yet to an ordinary mind capable of reflection, it is difficult to determine the real cause of this phenonema: for, as on inspection we behold no motion in the earth, so after a similar examination we perceive no motion in the Heavens. As we gaze, all things seem perfectly still, and to our vision there appears to be no motion at all. It is only by taking an observation from some stationary object that

motion in these bodies can be sensibly perceived, but whether that motion be in the Sun, the Moon, and the Stars, or in this world in which we live, remains to be determined by scientific investigation. Of this, however, we are sure, that whether this motion in the Heavens be apparent or real, it demonstrates to us beyond the possibility of doubt the following proposition: that this world of ours is a Globe, resting upon nothing, and that it is consequently in motion. For if the Sun, the Moon, and the Stars pass over our heads and right under our feet every twenty-four hours and yet in no part touch the earth, the conclusion is that this earth rests upon nothing, and as a consequence must be in motion; for if a solitary body exists in the whole universe of God beside itself, according to the known laws of Philosophy, according to the law of Gravitating attraction, it must be in motion; there being nothing to support it upon which it could possibly rest. No body for instance heavier than its own bulk of atmosphere can possibly rest in the air any distance from the earth's surface; because the attractive power of the earth would pull it down. In like manner let a heavy ball be suspended by a cord and it will hang in a straight line, but suspend two balls within a given distance from each other, and if of the same weight, instead

of being suspended in a straight line from the place to which the cords are fastened they will mutually attract each other, the one moving to the other in a horizontal direction. Therefore if in the universe another body existed larger than the earth our globe would be moved towards that body in a straight line, but if a still larger body existed in an opposite direction, which is the case, then provided, what is the case again, the attraction of these two bodies were proportionably balanced, the earth, instead of moving in a straight line, would move in a circular or elliptical orbit: similar to the one in which our world now moves.

At the poles of the earth the apparent motion of the heavens is remarkably different. We have all heard of the continuation of perpetual day and night successively for some months at the poles. Now this is occasioned from the fact, that instead of the sun's appearing to pass over the heads of the inhabitants, as he does at the equator, and in some other places, he appears to move for a number of months together all around their sky, beginning like a new moon at the dip of the horizon until, finally, he arises to his highest attitude, at which time he commences to recede again until at length he disappears as he came to illuminate the opposite region, and to give light to the inhabitants.

This apparent motion will be readily understood, when we reflect that the earth is inhabited on all sides; all matter naturally adhering to it by attraction of gravitation: so that when the sun appears to pass over our heads, if we imagine to ourselves the position of the North-poles, we can easily perceive him to pass around their heavens while at the same time he passes over ours.

The sun, and moon, and stars are frequently darkened by either the shadow or the substance of some of the heavenly bodies passing between us and them. In the case of the sun and moon these phenomena are called eclipses, in the others they are called transits. Some of the fixed stars are also surrounded by apparently small dark bodies, never seen without the aid of a Telescope, which are evidently planets revolving around their respective luminaries as their centre, even as our own planets revolve around their common centre, the sun.

CHAPTER II.

Another peculiarity of the heavens, which deserves a place in these chapters, is, that while most of the stars appear stationary some

appear to wander from part to part and from constellation to constellation. Some of these wandering stars are visible to the naked eye, and others of them can only be discovered by means of a telescope. The one class we call fixed stars, from their fixed position with respect to each other, and the other we call planets, from the Greek planetes a wanderer, because they seem to change their position, and to wander from one cluster of stars to another. These planets when viewed through a telescope appear much larger than when seen with the naked eye, presenting to our vision their snowy poles and white capped mountains, their continents and their oceans : but the fixed stars are hardly ever increased in size, although viewed with the most powerful telescopes. Another class of these wandering stars are called comets from the Greek word Cometes which signifies *hair*, because of the resemblance its tail is supposed to bear to the hair of a woman's head. I shall direct the attention of the reader to these in another chapter.

Within the period of the last one hundred and fifty years not less than ten new stars have made their appearance in our heavens, and thirteen in different constellations seem to have totally perished ; some of these have been seen

burning in the middle of daylight, presenting all the appearances of a prodigious flame. This phenomenon will also be considered in its own proper place.

Among the natural phenomena of the heavens, the shooting or falling stars, as they are generally denominated, occupy a considerable portion in the history of Astronomy. To describe this is unnecessary, as most of my readers have witnessed more or less of this awfully grand spectacle. An explanation of this phenomenon I shall introduce in a future chapter. But what is more interestingly strange is the phenomenon of the descent to this world of ours, of what is called meteoric stones.

From some region or other in the wide range of creation these have fallen to our earth, and without a single cloud to darken the sky this wonderful phenomenon has been known to take place. Stones have fallen from the weight of a ton to the weight of a very small fragment. But as most of my readers are aware of this, and as the truth of the phenomenon is not questioned, a proper cause for this wonderful effect will be assigned in its own place.

To us a knowledge, especially of the northern portion of the heavens, for many of the necessary purposes of life, is highly important.—Navigation and many other arts render a know-

meaning of very many portions of holy Scripture. For instance when God says to Job, "Cans't thou bind the sweet influences of the Pleiades, or loose the bands of Orion?"—"Cans't thou bring forth Mazzaroth in his season?" or "Cans't thou guide Arcturus with his Sons." "Knowest thou the Ordinances of Heaven?" Job xxxviii., 31, 32, 33. It would be impossible here to understand him without a previous knowledge of these constellations. If you take the trouble to look at the northern sky on a winter's night, your attention will be directed to a cluster of stars remarkable for their brilliancy and beauty, and distinguished by the three beautiful stars known to some as the Ell and the Yard. These belong to the Constellation of Orion. The three stars just referred to, most prominent for their brightness and beauty, and nearly in a straight line, being just one astronomical degree or two breadths of the Sun apart, these are called the bands of Orion. While in a North Easterly direction you will find the Pleiades or seven stars mentioned by God, and existing in what is denominated Taurus, the Bull. In another direction in the Northern Heavens you will readily perceive the stars known as the plough, and the dipper, from their resemblance to both these instruments. These stars belong to what is called

ledge of this portion of our heavens absolutely indispensable. It also serves to give us the Ursa Major or the Greater Bear. The first two stars of the dipper are called pointers, because they point to the North polar star which is about sixty breadths of the sun or thirty degrees from them towards the horizon. The North polar star thus marked out is very important to mariners, as it points out to a positive certainty their precise distance from the Equator. For while crossing the Equinoctial line this star appears just visible at what is called the dip of the horizon, but every degree the mariner sails from the line towards the North pole, this star appears to rise two breadths of the sun or one degree in the heavens; so that for every two breadths of the sun it rises in the Zenith the mariner knows he is sixty Geographical miles distant from the equator, and by this rule he can tell his latitude in any one part of the Northern hemisphere, until he sails to the north pole itself, at which time it is visible right over his head. From its northerly position, to us it never sets, and the whole heavens appear to pass around it every twenty-four hours. This is positive proof that our earth exists in a globular form, or is round. The north polar star belongs to the constellation denominated Ursa Minor or the Lesser

Bear, so well known in the history of Astronomy.

There is another thing which may be important here to introduce, that although I mentioned certain stars as stationary or fixed, yet the whole universe seems to be in motion around a common centre; for within the last one hundred and fifty years those stars in the northern portion of the heavens have widened their relative positions while in the southern they have contracted their distances, a plain proof of the curve which they form in moving around the central luminary of creation at present invisible to us, and which at a proper time I shall also bring before the reader.

CHAPTER III.

AN explanation of a few of the phenomena of the heavens to which I have just directed the attention of the reader, is the next thing to be considered: and as the apparent motion of the heavens was the first item noticed, it may be necessary to dwell upon this part of the subject for a short time. Now, that the apparent motion of the heavens is caused by the real motion of the earth, is rendered incon-

trovertible : because any other view of the subject is as unphilosophical as it is unreasonable. For a large body to move around a smaller one by the influence of its attraction, is an impossibility which cannot be accomplished without a continued miracle. We all know the earth to be a much larger body than the moon, and we just as well know that instead of the earth's moving around the moon, the moon being the smaller body, moves around the earth. Instead of the sun's moving around his planets the planets being the smaller bodies move around him, and in every known instance in the whole universe this law of philosophy is observed with the utmost precision. I shall now content myself by making a selection of the centre of our own system the sun, in order to give my reader a distinct view of this subject. Now all the ideas we can possibly form of the bulk of the whole universe are comparatively nothing in comparison to the magnitude of this luminary. The orbit of the moon is distant from the earth about two hundred and forty thousand miles. Now, were the sun placed where the earth now is he would fill the extent of that orbit all around the earth, and two hundred and forty thousand miles beyond that again ; so that could we but grasp its awful magnitude with our minds it would appear

as a universe in itself. But indeed its bulk is quite incomprehensible. The diameter of this luminary is about eight hundred and eighty-seven thousand miles ; and consequently it contains a volume of matter equal to fourteen hundred thousand globes of the size of the earth . and yet it is but a mere atom in Creation: Now, that the reader may form some just idea of the immense distance and bulk of the sun, I will here observe that the diameter of the earth is known to be about eight thousand miles, that is, four thousand miles to the East, and four thousand miles more to the West, from the spot on which any one stands. It is therefore evident that at noon when the sun is directly over our heads, or nearly so, he is just the half diameter of the earth or 4000 miles nearer to us than when he arose in the morning, and yet he appears no larger at noon than he does at the time of his rising ; a plain proof of his immense distance and great bulk. Now it would be impossible according to the known laws of gravity for this immense body to move around this small globe of ours, for then contrary to Philosophy the smaller would attract the greater with superior force. Nothing short of three miracles could accomplish this; one, to perform the awful and inconceivable, journey around the earth in an orbit 95,000,000

of miles distant from us in twenty-four hours, the other to cause the smaller to attract the larger with superior force, and the third to hold the particles of which the sun is composed from flying to pieces by the inconceivable swiftness of its motion. These three things would be naturally impossible without a constant miracle to produce the supernatural effect, but as such a miracle would be unnecessary, as all could be effected by one single revolution of the earth upon its axis, we are warranted in concluding that the infinitely wise Creator would not work such a miracle as would disprove the truth of that word which says "He hath made the earth by his power, he hath established the world by his wisdom, and hath stretched out the heavens by his understanding."—Jer. 51 : 15.

In addition to the foregoing, if the motion in the heavens was real and not apparent all the heavenly bodies would not perform the revolution in the same time, unless all were precisely the same distance from the earth. But we all know the moon is nearer to us than the sun, else the latter could not be eclipsed by the former. We all know the planets are nearer to the earth than the fixed stars, and that even among the planets, Mercury and Venus are much nearer to us than Jupiter or Saturn, while

by observing the Nocturnal sky all will acknowledge the heavenly bodies to be at unequal distances from the earth. Now, was motion in the heavens real instead of apparent the nearer ones, being attracted more powerfully than the more distant ones, would move with the greater velocity; the others being more distant from the earth would be attracted less powerfully, and consequently their motion would be slower: and for this reason, as well as on account of the greater journey they have to perform, they would be much longer in making a revolution around the earth than the nearer ones, which by attraction would be drawn more swiftly and which would have a far smaller circle to move through in order to complete their revolution. This fact is clearly made known in our own solar system, as every one read on this subject can testify. But the nearer ones and the more distant equally and alike appear to revolve around the earth every twenty-four hours, and therefore the irresistible conclusion that the motion must be in the earth and not in the heavens.

CHAPTER IV.

WITH regard to the shape of the earth and its motion upon its orbit I have already given short hints: I will now give this part of the subject a passing observation. If attraction of gravitation cause matter to adhere to a common centre, and to be formed into bodies, we might very philosophically conclude that a globular figure would be the result. If what I have already proven be true, that no body in the whole universe is connected with our world on which it could possibly rest, and, as we have ascertained, that stars and globes exist all around it, in every direction, the only conclusion we can rationally arrive at is, that our earth is a globe and that it is in motion around a superior body. In addition to the foregoing, the sinking and rising of the north polar star, the hull of a ship so long disappearing on the water before the mast is lost sight of, the eclipse of the moon, the objects seen from an elevated position which could not be seen from a lower prospect, and an examination of the other planets, these things all prove to a positive demonstration the globular figure of the earth.

First, as the reader is already informed, at the equator the north polar star appears just at

the dip of the horizon, and for every 60 Geographical miles we approach the poles from the equator this star rises just one degree in the heavens, and when we reach the north pole it appears directly over our heads; while at the same moment to the inhabitants near the equator it appears as before mentioned at the dip of the horizon. Now this is incontestable evidence that the earth, like the rest of the planets, is round and inhabited on all sides; for the rising and falling of this star can be accounted for upon no other principle. To the same effect is the evidence arising from the ship's hull disappearing in the water before the mast: for if this depended upon the organ of vision, the hull being the larger part of the vessel would naturally be seen the longest: but this is not so, and therefore as the hull of the ship disappears first, we can only account for it upon the principle of the earth's rotundity, the swell of the roundish figure of the earth rising between us and the hull of the vessel, but not between us and the mast which is elevated above it.— The true shape of the earth is determined to a positive certainty by the eclipse of the moon; for, as the reader knows, this phenomenon is caused by the earth casting her shadow upon the moon. Now the shadow is always round at the time of a lunar eclipse, and not the sha-

dow of a flat surface ; so that this is positive demonstration of the fact, that the earth exists in the form of a globe or ball. Connected with this proof drawn from the ship on the Ocean, is the fact that a vessel after disappearing upon the water may be seen again by a person rising to an elevated point, and by continuing this process one may keep the ship in view for a very long time. This is an evidence of a very positive character, and must appear satisfactory in proof of the earth's rotundity. Besides it is satisfactory to know that all the planets superior and inferior, primary and secondary, are in the same form, so that it appears the law of philosophy just mentioned holds good throughout the universe at large. It also follows from the above remarks that our globe is in motion, and by these ascertained truths we are prepared for further investigation.

CHAPTER V.

THERE is perhaps no phenomena in the heavens that more attracts the attention of mankind than the eclipses of the sun and moon ; a chapter therefore on this subject will not be out of place. All the planets, whether they

be primaries or secondaries, are opaque spherical bodies, which receive their light and heat from the sun ; that half of each which is next the sun will be therefore illuminated, and the other half will be dark : and each will project a dark shadow behind it, which, because the sun is much the largest body, must end in a point. The shadows of the planets are therefore dark cones, whose lengths will be greater or lesser, according to the planet's magnitude and distance from the sun. The length of the earth's shadow is about one hundred and seven of its diameter, and that of the moon, thirty diameters of the earth. Now, since the moon's mean distance from the earth is also thirty diameters of the earth, therefore the moon's shadow at a mean distance will just reach the earth, but because her orbit round the earth is elliptical, and as a consequence she is nearer to the earth at one time than the mean distance, and at another time more remote, therefore her shadow will sometimes extend a little beyond the earth, and sometimes fall short of it ; but the earth's shadow always extends far beyond the moon, as its length is three times and a half her distance, and its diameter at the moon is nearly equal to three of hers.

Now the eclipses of the sun and moon are produced in a similar way. An eclipse of the

moon is caused by the earth's falling in between the moon and the sun, and thereby intercepting his light, or, in other words, an eclipse of the moon is caused by the moon's falling into the earth's shadow. An eclipse of the sun is produced by the moon's passing between the earth and the sun; or, what is the same thing, by the moon's shadow striking the earth. In eclipses of the moon that luminary absolutely loses its light; but in those of the sun he does not lose his light, the moon only intercepting it from the earth for the time: and therefore solar eclipses are more properly eclipses of the earth than of the sun. There is another difference between the two; and that is, that the moon may be totally darkened for nearly two hours, but no more than a small part of the earth's surface can be totally deprived of the sun's rays, and that only for a few minutes.

The eclipse of the sun can only happen at the change of the moon; for in that case the sun and moon being in conjunction, and the dark side of the moon turned to the earth, if she fall exactly between the sun and the earth, there is necessarily an eclipse. The eclipses of the moon can only happen at full moon, when the sun being opposite to her, and her enlightened side toward the earth, if she fall exactly into the earth's shadow, she consequently

must suffer an eclipse, that is, lose the sun's light.

The obliquity of the moon's orbit on the plane of the ecliptic, is the reason why there are not eclipses at every new and full moon. The moon's orbit intersects the ecliptic at two opposite points, called her nodes. When these points are in a right line with the centre of the sun at new or full moon, the sun, moon and earth are all in a right line; and if the moon be then new, her shadow falls on the earth: if full, the earth's shadow falls upon her; and according to the moon's nearness to her nodes at new or full moon, the eclipse is more or less total. But if the sun and moon are more than seventeen degrees from either of her nodes at new moon, or the sun more than twelve degrees at full moon, no eclipse can happen: for the shadow of the moon will then pass by the earth, or the shadow of the earth pass by the moon.

The number of eclipses in any one year, cannot be more than seven, nor less than two. In the latter case they will both be of the sun, and in the former five of them will be of the sun, and two of them of the moon. The usual number however is four, two of the sun and two of the moon. The cause of this variety is thus accounted for by a celebrated writer upon

this subject : " Although the sun usually passes by both nodes only once in a year, he may pass the same node again a little before the end of the year. In consequence of the retrograde motion of the moon's nodes he will come to either of them one hundred and seventy three days after passing the other. He may therefore return to the same node in about three hundred and forty six days, having thus passed one node twice and the other once, making each time, at each, an eclipse of both the sun and the moon, or six in all. And since twelve lunations, or three hundred and fifty four days from the first eclipse, in the beginning of the year, leave room for another new moon before the close of the year, and since this new moon may fall into the ecliptic limit, it is possible for the sun to be eclipsed again. Thus there may be seven eclipses the same year."

By a *lunation*, as in the above quotation, we are to understand the time elapsing between two successive changes of the moon, which generally is about twenty-nine days and a half. Now if the lunar and solar months were exactly equal throughout the year, the moon's nodes would then always occupy the same point in the ecliptic, and all the eclipses would therefore happen in the same months of

the year, and be as regular as the rising and setting of the sun. But in twelve of the moon's months there are only about 354 days, and at this period the moon having passed through both her nodes, and having failed to accomplish her revolution around the sun, the result is that the moon's nodes fall back in the ecliptic about nineteen and a half degrees annually; so that the eclipses happen sooner every year by about 19 days. The same celebrated writer as quoted in the foregoing, says with respect to the time of eclipses: "As the moon passes from one of her nodes to the other in 173 days, there is just this period between two successive eclipses of the sun, or of the moon. At whatever time of the year, then, we have eclipses at either node, we may be sure that in 173 days afterwards, we shall have eclipses at the other node. As the moon's nodes fall back in the ecliptic, at the rate of $19\frac{1}{2}^{\circ}$ every year, they will complete a backward revolution entirely around the ecliptic to the same point again in 18 years, 225 days; in which time there would be always a regular period of eclipses, if any complete number of lunations were finished without a remainder. But this never happens; for if both the sun and moon should start from a line of conjunction with either of the nodes in any point of the ecliptic, the sun would per-

form eighteen annual revolutions and 222° of another, while the moon would perform 230 lunations and 85° of another, before the node would come around to the same point of the ecliptic again, so that the sun would then be 138° from the node, and the moon 85° from the sun.

But after 223 lunations, or 18 years, 11 days, 7 hours, 42 minutes and 31 seconds, the sun, moon and earth will return so nearly in the same position with respect to each other, that there will be a regular return of the same eclipses for many ages. This grand period was discovered by the Chaldeans, and by them called *Saros*. If, therefore, to the mean time of any eclipse, either of the sun or moon, we add the Chaldean period of 18 years and 11 days, we shall have the return of the same eclipse. This mode of predicting eclipses will hold good for a thousand years. In this period there are generally 70 eclipses, 41 of the sun and twenty-nine of the moon.

CHAPTER VI.

THE next thing which demands some explanation, or rather a passing reflection, as an explanation cannot be given, is the disappearance of some of the stars in the different constellations, which has hitherto occupied so much of the attention of Astronomers. When those stars are regarded as centres of their own respective systems, there seems to be some difficulty in understanding this wonderful phenomenon. But let this be as it may, facts are stubborn things, and the conflagration of stars that are now missing in some of the constellations is placed far beyond the bounds of a doubt or supposition. "On the 8th of November, 1572, two very notable Astronomers saw a star in the constellation of Cassiopia, which became all at once so brilliant, that it surpassed the splendor of the brightest planets, and might be seen even at noon day. Gradually this great brilliancy diminished, until the 15th of March, 1573, when, without moving from its place, it became utterly extinct. Its colour during this time exhibited all the phenomena of a prodigious flame—first it was of a dazzling white, then of a reddish yellow, and lastly of an ashy paleness, in which its light expired. It was seen for sixteen months."

"The disappearance," says a very learned Astronomer, "of some stars may be the destruction of that system at the time appointed by the Deity for the probation of its inhabitants; and the appearance of new stars may be the formation of new systems for new races of beings, then called into existence to adore the works of their Creator." "Thus" says another writer, "we may conceive the Deity to have been employed from all eternity, and thus he may continue to be employed for endless ages; forming new systems of being to adore him; and transplanting beings already formed into happier regions, who will continue to rise higher and higher in their enjoyments, and go on to contemplate system after system through the boundless universe." Another writer makes the following appropriate remark: "As to those stars which suddenly shine forth with a very vivid light, and then immediately disappear, it is extremely probable that great conflagrations, produced by extraordinary causes, take place on their surface. This conjecture is confirmed by their change of colour, which is analagous to that presented to us on the earth by those bodies which are set on fire and gradually extinguished. On the same subject another very eminent man also observes, that "Worlds and systems of worlds are not only perpetually

creating, but also perpetually disappearing. It is an extraordinary fact, that within the period of the last century, not less than thirteen stars, in different constellations, seem to have totally perished, and ten new ones to have been created. In many instances it is unquestionable that the stars themselves—the supposed habitation of other kinds or orders of intelligent beings, together with the different planets by which it is probable they were surrounded—have utterly vanished, and the spots they occupied in the heavens have become blanks! What has befallen other systems will assuredly befall our own. Of the time and the manner we know nothing; but the fact is incontrovertible: it is foretold by revelation: it is inscribed in the heavens: it is felt through the earth. Such is the awful and daily text: What then ought to be the comment?"

The disappearance, then, of so many stars, that for ages have adorned our nocturnal sky, is but an evidence that other worlds have come to an end; while the appearance of so many new stars proclaims the fact, that God is continuing to create worlds, and rational beings upon them, to love him, to adore him, and to serve him. The telescope reveals to us among the stars striking evidences of this: cloudy particles of light, of an indefinite extent, are

seen scattered through space, which undoubtedly give evidence they are yet in their chaotic state, or, as the matter of which our earth is composed originally was, "without form and void"—that is, in a chaotic state before the Laws appointed by Almighty Heaven brought it to its present form. This theory takes it for granted that the matter of which the different globes were created was made before they were formed into worlds at all, and this is in perfect accordance with the divine intimation. Thus in the whole six days' work of Earth's creation as recorded in Genesis, although the work of each day is mentioned, in no one day is it said that God created the matter; a plain proof that Moses understood that the matter of which our globe is composed had an existence previous to the creation of the earth in its present form. In accordance with this we read in Genesis 2, 3: "And God blessed the seventh day, and sanctified it: because that in it he had rested from all his work, which God *created and made.*" In the original language it is, 'which God created to make;' that is, which he created or brought into being first, and made or fashioned afterwards into all the innumerable forms and beings with which the universe is, in a sense, endlessly replenished.

CHAPTER VII.

THE next thing which demands our attention, and which shall be the subject of this chapter, is what is called the phenomenon of the Shooting Stars, which very frequently occurs in the month of November; generally between the 14th and 20th. The first thing here necessary is to give a description of the phenomenon itself. As early as A. D. 472, in the month of November, it was discovered in the heavens near Constantinople. One describing it says: "The sky appeared to be on fire," that is with the flying meteors. A United States Commissioner gives the following information: "On the 12th of November, 1799, I was called up about 3 o'clock in the morning to see the shooting stars, as they are called. The phenomenon was grand and awful. The whole heavens appeared as if illuminated with sky rockets, which disappeared only with the light of the sun, after day break. The meteors which, at one instant of time, appeared as numerous as the stars, flew in all possible directions, except from the earth, toward which they all inclined more or less, and some of them descended perpendicularly over the vessel we were in, so that I was in constant expectation of their falling on us."

Dr. Smith, of North Carolina, when writing about the phenomenon of shooting stars in Nov. 13th, 1833, gives an account of one that he saw as large as the full moon when rising. "I was startled" says he, "by the splendid light in which the surrounding scene was exhibited, rendering even small objects quite visible." Now if this body were but one mile distant from Dr. Smith it must have had a diameter of 42 feet; if 11 miles distant it must have had a diameter of 528 feet; and if 110 miles distant it must have had a diameter of one mile. We therefore know to a certainty that some, or many of the meteors were bodies of large size. It is said that at Poland, Ohio, a luminous body was distinctly visible in the North East for more than an hour. It was very brilliant, in the form of a pruning hook, and apparently 20 feet long and 18 inches broad. It gradually settled toward the horizon until it disappeared. At Niagara Falls, a large, luminous body, shaped like a square table, was seen near the zenith, remaining for some time almost stationary, emitting large streams of light. Invariable changes of weather, from warm to cold either accompanied the meteoric showers, or immediately followed them.

Now, in relation to these meteors, it is evident to me that they do not belong to earth,

but to the region of space beyond the limits of our atmosphere. We know by experience that all bodies in the atmosphere, and within the proper influence of the earth's attraction, partakes of that attraction, and are therefore moved in common with the earth's motion. But instead of following the course of the earth, their motion was from east to west; therefore they being independent of the earth's rotation, and consequently at a very great distance from it. And that these meteors exhibited the phenomena of combustion, they being converted into smoke, with intense light, it remains incontrovertible they were constituted of very light materials, else in their descent without combustion some would have felt the weight of their importance. I will close this chapter by transcribing the conclusion arrived at by Professor Olmsted, of Yale College. He says, "The meteors of November 13th, 1833, emanated from a nebulous body, which was then pursuing its way, along with the earth, around the sun; that this body continued to revolve around the sun, in an elliptical orbit, but little inclined to the plane of the ecliptic, and having its aphelion near the orbit of the earth; and, finally, that the body has a period of nearly six months, and that its perihelion is a little below the orbit of Mercury. This the-

ory at least accommodates itself to the remarkable fact, that almost all the phenomena of this description which are known to have happened have occurred in the two opposite months of April and November. A similar exhibition of meteors to that of November, 1833, was observed on the same day of the week, April 20, 1803, at Richmond, Virginia; Stockbridge, Massachusetts; and at Halifax, in British America. Another was witnessed in the autumn of 1818, in the North Sea, when, in the language of one of the observers, "all the surrounding atmosphere was enveloped in one expansive sea of fire, exhibiting the appearance of another Moscow in flames."

The Professor proceeds in another communication and says: "Innumerable small bodies, thus consisting of extremely light, thin combustible matter, existing together in space far beyond the limits of the atmosphere, are believed to compose a body of immense extent, which has been called the nebulous body. Only the skirts or extreme portions of this are brought down to the earth, while the entire extent occupies many thousands, and perhaps several millions of miles. This nebulous body is inferred to have a revolution around the sun, as well as the earth, and to come very near to the latter about the 13th of November each year.

This annual meeting every year, for several years in succession, could not take place unless the periodic time of the nebulous body is either nearly a year, or half a year. Various reasons have induced the belief that half a year is the true period; but this point is considered as somewhat doubtful. The zodiacal light, a faint light that appears at different seasons of the year, either immediately preceding the morning or following the evening twilight, ascending from the sun in a triangular form, is, with some degree of probability, though thought to be the nebulous body itself, although the existence of such a body, revolving in the solar system, was inferred to be the cause of the meteoric showers, before any connection of it with the zodiacal light was even thought of."

CHAPTER VIII.

HAVING thus far given my own opinion and those of the learned upon that awfully grand spectacle, the meteoric shower of stars, I now proceed to a subject equally as interesting: the descent of meteoric stones. Meteoric stones, says a very respectable Astronomer, or what are generally termed *ærolites*, are stones which

sometimes fall from the upper region of the atmosphere upon the earth. The substance of which they are composed, is for the most part metallic; but the ore of which it consists is not to be found in the same constituent proportions in any known substance upon the earth. Their fall is generally preceded by a luminous appearance, a hissing noise, and a loud explosion; and when found immediately after their descent, they are always hot, and usually covered with a black crust, indicating a state of exterior fusion. Their size varies from that of small fragments of inconsiderable weight, to that of the most ponderous masses. They have been found to weigh from 300 lbs. to several tons; and they have descended to the earth with a force sufficient to bury them many feet under the surface. In some instances these showers have penetrated through the roofs of houses, and proved destructive to the inhabitants.

There are but three views, I believe, entertained by Astronomers upon this subject; the first is that they have fallen from the atmosphere; hence the name *ærolites* which has been given to them; the second is that they have been projected from Volcanoes in the moon; the third attributes them to the smaller fragments of an exploded planet which once existed between the orbit of Mars and Jupiter. Now

in relation to the above views on this great subject it requires but little philosophical knowledge to know that the first is untenable ; for how could large volumes of rock, the weight of whole tons, so many thousand times heavier than its own weight of air, be generated in our atmosphere ? Reason will at once decide, for whatever may be thought of the descent of meteoric stones in other respects, we are sure of this : that these stones have been generated beyond the limits of our own atmosphere, yea farther, that they have had an existence in some part of space where the earth's attraction was far less powerful than the body to which they had originally been attached. The second theory is that they have been projected from some volcano in the moon. To allow this theory as just and reasonable is to take it for granted that such a volcano exists in this world, belonging to our next neighbors. But this is very far from being proved ; and until this is satisfactorily done we should seek for a rational explanation of this strange phenomenon from some other quarter. At least this explanation does not settle all doubts and enquiries respecting this wonderful phenomenon. The third view seems to be the most rational and reasonable of the whole ; viz : that they are the smaller fragments of an exploded planet

which once existed between the orbits of Mars and Jupiter.

Upon this subject a celebrated writer very conclusively makes the following remarks: "The scientific Bode entertains the opinion that the planetary distances above Mercury formed a Geometrical series, each exterior orbit being double the distance of its next interior one from the sun : a fact which obtains with remarkable exactness between Jupiter, Saturn and Herschel. But this law seemed to be interrupted between Mars and Jupiter. Hence he inferred that there was a planet wanting in that interval; which is now happily supplied by the discovery of the ten *star form* planets, occupying the very space where the unexplained vacancy presented a strong objection to his theory.

From these and other circumstances, many eminent Astronomers are of opinion that these ten planets are the fragments of a large celestial body which once revolved between Mars and Jupiter, and which burst asunder by some tremendous convulsion, or some external violence. Now granting the truth of this, (and I think it cannot very well be denied,) we have a clear explanation of the descent of Meteoric stones, which are to be regarded as the fragments of that planet which once existed between the orbits of Mars and Jupiter but which has long

since been exploded. These stones are parts of still smaller fragments which continue to move around our sun, and perhaps some of them around our earth, and which by the influence of Earth's attraction when nearest our planet are brought down to its surface. This supposition is in perfect accordance with the account given of this wonderful phenomenon, at the commencement of the present chapter, and which seems to be the only rational explanation which can possibly be given.

CHAPTER IX.

A SCIENTIFIC ARRANGEMENT OF THE HEAVENLY BODIES.

OF the worlds which roll above, below and around us in the universe of God there are, as has already been observed, Satellites, Planets, Comets and Central Luminaries denominated Suns and fixed Stars. Our own moon is a satellite attending the earth: the earth is its centre of motion. The earth is a planet revolving in an orbit around the sun: the sun is its centre of motion. The sun and fixed stars are luminaries revolving in orbits around the Throne of God: heaven is their centre of motion. I shall first treat of this central lu-

mina of the whole creation, which in the holy scriptures is denominated the *Heaven of Heavens* from its very great influence over universal creation. The sun in our own system is its emblem. For as the superior attraction of the earth draws our moon along with it in its orbit around the sun, so the sun draws the earth and all the planets and their satellite around the Heaven of Heavens, the common centre of all: so that our own planetary system is the universe in a miniature scale. When the central sun was created we know not and are only informed that in the beginning God created the heavens and the earth, and that Christ our blessed Lord created all things, visible and invisible; but this we do know that such a sun is necessary to the well being of the whole. For if our earth were blown out of existence the moon would not pursue its present course; but having lost its centre of motion it would either be destroyed, or it would revolve in an orbit around some other superior body; in like manner, without a central sun, the universe would become a scene of bankruptcy and confusion: for it is this centre which keeps the whole creation from being dashed to pieces. Now in proof that the moon, the earth, the planets and their moons, and the fixed stars and their planets are all in rapid motion around this central

luminary, I will here introduce the following, taken from a work which is improperly styled Geography of the Heavens, by E. H. Burritt : " We have hitherto described the stars as being immovable and at rest ; but from a series of observations on double stars, Dr. Herschel found that a great many of them have changed their situations with regard to each other, that some perform revolutions about others, at known and regular periods, and that the motion of some is direct, while that of others is retrograde ; and that many of them have dark spots upon their surface, and turn on their axis like the sun. A remarkable change appears to be gradually taking place in the relative distances of the stars from each other in the constellation Hercules. The stars in this region appear to be spreading farther and farther apart, while those in the opposite point of the heavens seem to close nearer and nearer together, in the same manner as when walking through a forest, the trees towards which we advance appear to be constantly separating, while the distance between those which we leave behind is gradually contracting. From this it is concluded that the sun, with all its retinue of planetary worlds, is moving through the regions of the universe toward some distant centre, or around some wide circumference at the rate of sixty or

seventy thousand miles an hour ; and that it is therefore highly probable, if not absolutely certain, that we shall never occupy that portion of absolute space through which we are at this moment passing, during all the succeeding ages of eternity. This central luminary, being equally attracted on all sides, is the only one we may regard as stationary or fixed, and it is the centre of universal motion."

Upon this subject a modern writer gives us the following interesting information : "At the close of the meeting of the Royal Irish Academy on the 14th of December, 1846, Sir William Hamilton announced that he had just received from Professor Madler, of Dorpat, the extraordinary and exciting intelligence of the presumed discovery of a central sun !

By an extensive and laborious comparison of the quantities and directions of the proper motions of the stars in various parts of the heavens, combined with indications afforded by the parallaxes hitherto determined, and with the theory of universal gravitation, Professor Madler has arrived at the conclusion that the Pleiades form the central group of our whole astral or sidereal system ; including the Milky Way and all the brighter stars, but exclusive of the more distant nebulae, and of the stars of which those nebulae may be composed. And

within this central group itself he has been led to fix on the star Alcyone, otherwise known by the name of Tauri, as occupying exactly, or nearly the position of the centre of gravity, and as entitled to be called the central sun.

Assuming Bessel's parallax of the star 61 Cygni, long since remarkable for its large proper motion, to be correctly determined, Madler proceeds to form a first approximate estimate of the distance of this central body from the planetary or solar system, and arrives at the provisional conclusion that Alcyone is about thirty-four million times as far removed from us, or from our own sun, as the latter luminary is from us. It would therefore, according to his estimation, be at least a million times as distant as the new planet, of which the theoretical or deductive discovery has been so great and beautiful a triumph of modern Astronomy, and so striking a confirmation of the law of Newton. The same approximate determination of distance conducts to the result that the light of the central sun occupies more than five centuries in travelling thence to us.

The enormous orbit which our own sun, with the earth and the other planets, is thus inferred to be describing about that distant centre—not indeed under its influence alone, but by the combined attractions of all the stars which are

nearer to it than we are, and which are estimated to amount to more than one hundred and seventeen millions of masses, each equal to the mass of our own solar system—is supposed to require upwards of eighteen millions of years for its complete description, at the rate of about eight geographical miles in every second of time.

The plane of this vast orbit of the sun is judged to have an inclination of about eighty-four degrees to the ecliptic, or to the plane of the annual orbit of the earth; and the longitude of the ascending node of the former orbit on the latter, is concluded to be nearly two hundred and thirty-seven degrees.

CHAPTER X.

THE CENTRAL LUMINARY RECOGNIZED IN THE HOLY SCRIPTURES.

WHEN incorrect notions on Astronomy prevailed even among the learned, the Greek and the Latin fathers attempted to improve the Bible on scientific subjects; but modern discoveries most incontestibly prove the inspiration of that Bible which ages ago, before they were even thought of, contained the very truths

which modern philosophers claim to be the result of recent investigation.

When the inspired writers speak of the heavens, they employ the most philosophic and the most elegant expressions to designate and to define them. The *heavens* in the Bible means the expanse, or the vacant space, or ether, or immensity. When they describe the heavens they are careful to distinguish them; first, as the heaven of the birds, of the tempests, and of evil spirits; then the heaven of the stars; and lastly, the third heaven, which they designate the heaven of heavens. St. Paul mentions this part of the universe when he says: "He knew a man that was caught up to the third heavens, that is the central luminary of creation." This heaven is represented by the inspired writers as being above the most distant stars and planets that twinkle in our evening sky. Thus while the Angels inform the men of Galilee that Jesus had ascended up into heaven, St. Paul informs us that he had ascended far above all heavens; that is above everything visible. This heaven then into which Jesus our Lord ascended at his ascension is far above all heavens, whether atmospherical or starry, and is therefore in the centre of all, is the cause of universal motion, and is the great fountain of light, and conse-

quently is of the very greatest importance to the whole of them. To the very same effect is Solomon's expression at the dedication of the temple: "The heaven of heavens cannot contain thee." Again it is said: "He hath set his glory above the heavens." It is also said that "God hath established his throne in the heavens." Now all these expressions imply the very same thing, the heaven of heavens having reference to this central luminary as being the cause of universal motion, universal light and universal attraction; in a word it has reference to its influence over all the other heavens in creation.

God's glory being *above* the heavens, and his throne being *in* the heavens imply the same thing, viz: that there is a centre to creation, where God in the effulgence of his glory more immediately dwells, and that this centre is above the heavens, or as St. Paul expresses it "far above all heavens;" that is *above* all things visible, while at the same time it is *in* the heavens, that is in the centre of the heavens, visible and invisible; or in other words the centre of the universe. This place is undoubtedly the heaven of the good either after death, or the resurrection: for it is the place into which Christ our Lord has gone, where Enoch and Elijah are, and where all the saints shall be, when they shall see Christ as he is.

CHAPTER XI.

THE SUN.

THE Sun, in our system, is the representative of this central luminary: indeed the solar system is the universe in a miniature scale; and the sun, to his whole system, is what heaven is to the whole universe of God's creation. For as the planets have moons that revolve around them as their centre, so the fixed stars and sun have planets revolving around them, and yet they all revolve around the heaven of heavens as their common centre of motion. It has been remarked by a celebrated astronomer, that our Sun, from his immense bulk, is a universe in himself: for all the ideas we can possibly entertain of immensity is comparatively nothing at all to the bulk of this luminary. This bulk is about five hundred times larger than all his planets and satellites taken together; and were he placed where the earth is now, he would not only fill the orbit of the moon (240,000 miles distant from us), but over 240,000 miles beyond that again; so that although his bulk can be given in figures, it is very far beyond the grasp of the largest imagination to comprehend it, or form an idea of it, even in the mind; and yet the sun to crea-

tion is far smaller than one drop of water to the ocean, or a grain of sand to all the grains in the composition of the earth.

The Sun is an opaque, or dark, solid body ; and not a ball of fire, as he was formerly supposed to be. Its surface is seldom visible to us, for that which we behold is but his glorious and luminous atmosphere. This atmosphere is kept in continual agitation, and thousands of miles of it are constantly opening and closing alternately, through which openings are seen dark spots, which are evidently the surface of the body itself. Of this surface but little is known, as the glory of its atmosphere prevents it being examined with an ordinary telescope. The sun gives us light and heat—is the grand agent in every kind of attraction—gives all colors to nature—causes vegetation, trees and plants of all kinds, to grow—produces wonderful changes in the earth's atmosphere, which are productive of health and happiness—is the cause of all vapors, of mist, dew and rain—together with the moon, is the cause of the ebbing and flowing tides, which are in very many ways serviceable to man. It is not only an emblem of heaven—the great centre luminary of all—but, in the holy Scriptures, is recorded as an emblem of Deity himself.

CHAPTER VII.

OF THE PLANETS.

THE planets are known by their moving from constellation to constellation among the fixed stars, and have therefore received their name, which signifies wanderers. In point of relationship, the planets may be said to be our nearest neighbors. Beginning at the sun, the first or nearest planet is called Mercury. It is always in the neighborhood of the sun, as seen by astronomers, and, being therefore continually immersed in the sun's rays, but very little can possibly be known about it. With the exception of the asteroids, Mercury is the smallest of any of the planets yet known, and is about sixteen times smaller than the earth. It revolves about its axis, from west to east, in 24 hours 5 minutes 28 seconds, which makes its day about ten minutes longer than ours. It is about 37,000,000 of miles from the sun, and its year is a few minutes less than 88 of our days. Mercury is known to shine by borrowed light from the sun, from the fact, that, when viewed through a proper telescope, it exhibits all the phases of the moon—except that it never appears quite full, because its enlightened hemisphere is never turned directly to-

wards us, only when it is behind the sun, or so near to it as to be lost in its beams. The side next the sun's being enlightened, and the opposite sides being dark, proves the planet to be an opaque body, shining only by the light of the sun. Like Venus, the Moon, and the Earth, Mercury has several high mountains in the southern hemisphere. One of these mountains is found nearly eleven miles high. Mercury is very seldom seen with the naked eye. It can only be seen for a few minutes in the morning or evening twilight, during a few days in March, April, August, and September. Its greatest distance ever seen from the sun is from 16 deg. 12 min., to 28 deg. 48 min., alternately. Its day is determined by certain marks or spots upon its surface appearing in the same direction every day, and then disappearing. Being situated so near the sun it receives about six times more light and heat than the earth does, and as a consequence the colors on the planet are more showy and splendid. The mountains apparently are tinged with gold, while the forests and surrounding scenery appear as teeming with beauty and grandeur.

CHAPTER XIII.

VENUS.

VENUS is the second planet from the sun. From its brilliancy and beauty most persons are more or less acquainted with it : to thousands it is known as the morning and evening star : and it is never visible six hours after the sun sets. Venus is never seen 96 breadths of the sun, or 48 degrees distant from him. In its orbit it seems to recede from the sun three-fifths of a degree every day, and it is sometimes seen east and sometimes west of him. The year of Venus, or the time it takes to move on its orbit around the sun, is 224 two-thirds days, and it is about 68,000,000 miles distant from him, and moves in its orbit at the rate of 80,000 miles an hour. Its day is 23 h. 21 m. 7 sec. long, or about 25 minutes shorter than ours ; while its year is only equal to 32 of our weeks.

To Venus the sun appears about as large again as he does to the earth, and consequently colors upon the planet are doubly more resplendent than with us. Venus was never seen rising in the east while the sun was setting in the west, nor was it ever seen on the meridian when the sun was either rising or

setting : by this it is known that its orbit is within the orbit of the earth.

The atmosphere of this planet is exceedingly dense and seems at all times to be heavily loaded with clouds. The consequence is, it is viewed in its physical constitution with considerable difficulty. Venus, like Mercury, presents to us all the phases of the moon. When nearest to us it would appear 25 times larger than when most distant, were it not that at that time its darkened hemisphere is turned to us, having but a very small part of its surface illuminated. Very generally when at the full it is lost in the solar ray ; and as a consequence is invisible to the earth.

When viewed with a good telescope the surface of Venus presents a variety of inequalities : elevated mountains, dark spots, hills and valleys present themselves to our vision. Dr. Herschel estimates the diameter of Venus 8649 miles, making its bulk about 6 times larger than that of the earth.

CHAPTER XIV.

THE EARTH AND THE MOON.

For a description of this world in which we live the reader must be referred to works published on this subject particularly. It is only necessary to say that the earth is the third planet from the sun, and is the place from which Astronomers make all their observations. This earth is to its moon what the sun is to the earth, its centre of motion, by whose superior attraction the moon is kept in nearly a circular orbit. The moon makes one revolution upon its orbit around the earth in 29 d. 12 h. 44 m. 3 s., being the time from one new moon to another. This is called her *synodic* revolution: but her revolution from any fixed star to the same star again is called her *periodic* or *sideral* revolution. This is accomplished in 27d. 7 h. 43m. 11 and one-half seconds. The moon revolves but once upon its axis during the time it makes one revolution around the earth: it follows therefore that it has but one day and night in its year, containing both together 29 d. 12 h. 44 m. 3 seconds: for this reason we never see but one side of the moon.

As the moon enlightens the earth by reflecting the light of the sun upon it so the earth enlightens that part of the moon presented to it, and as but one side of the moon is ever presented to the inhabitants of the earth it, therefore follows that the inhabitants of the opposite side of the moon are deprived of the sight of our earth in their heavens, and that no doubt many travel from one side to the other on the moon's surface to behold an orb in their sky appearing to them thirteen times as large as our full moon does to us.

As the earth revolves upon its axis, its continents and Islands appear to the inhabitants of the moon like so many dark spots upon its surface, by which spots they can determine not only the period of the earth's rotation, just as we do that of the sun, but they can also find the longitude of their places, as we find the latitude of ours.

“When viewed with a good telescope”—says a celebrated astronomer—“the moon presents a most wonderful and interesting aspect. Besides the large dark spots, which are visible to the naked eye, we perceive extensive valleys, shelving rocks, and long ridges of elevated mountains, projecting their shadows on the plains below. Single mountains occasionally rise to a great height, while circular hollows

more than three miles deep, seem excavated in the plains.

Her mountain scenery bears a striking resemblance to the towering sublimity and terrific ruggedness of the Alpine regions, or of the Apennines, after which some of her mountains have been named, and of the Cordilleras of our own continent. Huge masses of rock rising precipitously from the plains, lift their peaked summits to an immense height in the air, while shapeless crags hang over their projecting sides and seem on the eve of being precipitated into the tremendous chasm below.

Around the base of these frightful eminences are strewn numerous loose and unconnected fragments, which time seems to have detached from their parent mass; and when we examine the rents and ravines which accompany the overhanging cliffs, the beholder expects every moment that they are to be torn from their base, and that the process of destructive separation, which he had only contemplated in its effects, is about to be exhibited before him in all its reality.

The range of mountains called the Apennines which traverse a portion of the Moon's disc from north-east to south-west, and of which some parts are visible to the naked eye, rise with precipitous and craggy front from the level of

the *Mare Imbrium* or sea of showers—a name which is given to a lunar spot.

In this extensive range are several ridges, whose summits have a perpendicular elevation of four miles and more ; and though they often descend to a much lower level, they present an inaccessible barrier on the north-east—while on the south-west they sink in gentle declivity to the plains.

There is one remarkable feature in the moon's surface which bears no analogy to anything observable on the earth. This is the circular cavities which appear on every part of her disc. Some of these immense caverns are nearly four miles deep and forty miles in diameter. They are most numerous in the south-western part. As they reflect the Sun's rays more copiously, they render this part of her surface more brilliant than any other. They present to us nearly the same appearance that our earth might be supposed to present to the moon if all our great lakes and seas were dried up.

The number of remarkable spots on the moon, whose latitude and longitude have been accurately determined, exceeds 200. The number of seas and lakes, as they were formerly considered, whose length and breadth are known, is between 20 and 30 ; while the number of peaks and mountains whose perpendicular eleva-

tion varies from a fourth of a mile to five miles in height, and whose basis, are from one to seventy miles in length, is not less than 150.

An idea of some of these scenes may be formed by conceiving a plain of about 100 miles in circumference, encircled by a range of mountains of various forms, three miles in perpendicular height, and having a mountain near the centre, whose top reaches a mile-and-a-half above the level of the plain. From the top of this central mountain, the whole plain with all its scenery would be distinctly visible, and the view would be bounded only by a lofty amphitheatre of mountains rearing their summits to the sky. The bright spots of the moon are the mountainous regions, while the dark spots are the plains or more level parts of her surface.— There may be rivers or small lakes on this planet; but it is generally thought by astronomers of the present day, that there are no seas or large collections of waters, as was formerly supposed. Some of these mountains and deep vallies are visible to the naked eye, and many more are visible through a telescope of but moderate powers. A telescope which magnifies only 100 times will show a spot on the moon's surface, whose diameter is 1233 yards; and one which magnifies 1000 times will enable us to perceive any enlightened object on her sur-

face whose dimensions are only 122 yards, which does not much exceed the dimensions of some of our public edifices ; as, for instance, the Capitol at Washington or St. Paul's Cathedral. Professor Frawenhofer, of Munich, recently announced that he had discovered a lunar edifice, resembling a fortification, together with several lines of road. The celebrated Astronomer Schroeter conjectured the existence of a great city on the east side of the moon, a little north of her equator, an extensive canal in another place, and fields or vegetation in another.

CHAPTER XV.

OF MARS.

MARS is the fourth planet from the Sun, and is the first of the superior planets, its orbit being beyond that of the earth, and resembles our own world more than any other of the planets yet known. At its nearest approach to the earth, Mars is about 50,000,000 miles distant, and its greatest distance is about 240 millions of miles. Mars appears to the naked eye of a reddish color, occasioned no doubt by the density of its atmosphere, by which the other rays are dissolved and the red only reflected. Mars

is sometimes seen in conjunction with the Sun, and sometimes in opposition to him. Sometimes it is gibbous, but never horned; and it is never seen to pass over the Sun's disc, from which we learn that its orbit is exterior to the earth's, and that it shines by the borrowed light of the Sun and consequently is an opaque body. Mars performs its revolution around the sun in one year, ten-and-a-half months, and is distant from that luminary 145,000,000 miles—its diurnal rotation on its axis is performed 24 h. 39 m. 21½s., making its day 44 minutes longer than ours, and it moves in its orbit at the rate of 55,000 miles an hour. Mars is viewed with very great interest by Astronomers. Its seasons have a very striking resemblance to those of the earth, and its surface seems diversified with zones of peculiar brightness, some of which appear more brilliant than others—and the whole bearing striking evidences of wisdom and intelligence. Very dazzling zones appear and disappear alternately in the northern and southern polar regions, which when exposed to about eight months of summer, become considerably reduced, and in some cases for a time disappear. From this it is reasonably concluded that these luminous zones are the accumulation of ice and snow which always appear after the planet emerges from a long night of a polar winter.

CHAPTER XVI.

THE ASTEROIDS.

"THE scientific Bode," says a celebrated astronomer, "entertains the opinion that the planetary distances above Mercury, formed a geometrical series, each exterior orbit being double the distance of its next interior one from the Sun—a fact which obtains with remarkable exactness between Jupiter, Saturn and Herschel. But this law seemed to be interrupted between Mars and Jupiter. Hence he inferred that there was a planet wanting in that interval, which is now happily supplied by the discovery of the ten star-formed planets, occupying the very space where the unexplained vacancy presented a strong objection to his theory."

From a long series of observations it is most scientifically and justly concluded that these ten planets are the remains of a large body which once moved in an orbit between that of Mars and Jupiter; and that through some internal convulsion this large body was caused to burst assunder, by means of which the several masses of the different fragments were driven with such force as caused each of them to move in an orbit of its own, according to the known

laws of gravitation. This, as I have explained before, will account for the descent of what is termed Meteoric stones to our earth : for it is evident that smaller masses in motion around the Sun, or some other body when in that part of their orbit nearest the earth, might be so powerfully attracted by our planet as to cause fragments to descend to its surface.

CHAPTER XVII.

JUPITER.

Jupiter is the largest of the planets yet known. His diameter is 86,255 miles, being about 1300 miles larger than the earth's. His year is as long as 12 of ours, and he moves on his orbit at the rate of 30,000 miles an hour, and at the distance from the Sun of 490,000,000 of miles. He makes one revolution on his axis in 9h., 55m., 50s., which is the length of his day. Being at the distance of 490 millions of miles from the Sun, the light and heat received on Jupiter is about 27 times less than that received on the earth. When viewed through a telescope, he is perceived to have large belts appearing across his surface, which are observed frequently to change their position and appear-

ance. But very little is known concerning these belts, but it is altogether likely that they are caused by the rapid motion of the planet upon its axis, thereby causing the atmospherical phenomena just referred to. He is attended by four moons, some of which always appear visible to the planet. As might be expected, being at so great a distance from the sun, he is less powerfully attracted by that luminary, and as a consequence attraction of cohesion in this planet is not so powerful as in those planets which are nearer to their common centre—the Sun; and the result is found to be that Jupiter is less dense than those planets referred to, being about as light as our common cork, while some of them are found to be as dense as lead.

CHAPTER XVIII.

SATURN.

The orbit of Saturn is between the orbit of Jupiter and Herschel. It is distinctly visible to the naked eye, and is distinguished by its uniform and steady light. It is not difficult to trace its course in the heavens, as it is just two years and a half in passing a distinct constellation. Saturn is 909 millions of miles distant

from the sun, being nearly twice the distance of Jupiter. It contains about 1100 times as much matter as the earth, and moves upon its orbit 22,000 miles an hour. Its year is about $29\frac{1}{2}$ of ours, but its day is only $10\frac{1}{2}$ hours long, the one being nearly thirty times longer than ours, and the other shorter than ours by more than one-half. Dr Herschell perceived five belts upon its surface, three of them dark and two bright. The dark belts have a yellowish tinge and cover a broader zone of the planet than those of Jupiter. To the inhabitants of Saturn the sun appears 90 times less than he does to us, and consequently the planet receives about nineteen times less light and heat than our earth does; but even this is said to be equal to the light of three thousand full moons, so that the inhabitants have a sufficiency of light for every necessary purpose.

Saturn is surrounded by two large rings of uncommon beauty and grandeur. They appear more brilliant than the planet itself, and are divided by a dark band which is nearly 3000 miles in breadth. The distance of Saturn from his inner ring is 21,000 miles, which places the ring about ten times nearer to the planet than our moon is to the earth, and it is about 20,000 miles broad. It is very evident that these rings were created for the benefit of intelligent

beings upon the surface of this planet : for their obvious use is to reflect the light of the sun to a people that, owing to their great distance from this luminary, would comparatively be in darkness. The rings appear to the inhabitants of Saturn in a circle all across their heavens covering a zone equal in breadth to about one hundred of our moons.

Besides these two great rings, Saturn enjoys the benefit of eight Satellites or moons, all of which revolve about him at different periods and distances. I will close this chapter with the remarks of a celebrated author :—"The various aspects of the seven moons, * one rising above the horizon, while another is setting, and a third approaching to the Meridian ; one entering into an eclipse, and another emerging from one ; one appearing as a crescent, and another with a gibbous phase ; and sometimes the whole of them shining in the same hemisphere, in one bright assemblage. The majestic motion of the rings—at one time illuminating the sky with their splendor and eclipsing the stars, at another casting a deep shade over certain regions of the planet, and unveiling to view the wonders of the starry firmament— are scenes worthy of the majesty of the Divine Be-

* The eighth satellite has been but recently discovered.

ing to unfold, and of rational creatures to contemplate.

Such displays of wisdom and omnipotence lead us to conclude that the numerous splendid objects connected with this planet, were not created merely to shed their lustre on naked rocks and barren sands ; but that an immense population of intelligent beings is placed in those regions, to enjoy the bounty and adore the goodness of their Creator."

CHAPTER XIX.

HERSCHEL OR URANUS.

HERSCHEL is the next planet in order from the Sun, and received its name from Dr Herschel who first discovered it to be a planet. It was observed however as far back as 1690. It was seen eleven times by Lemonier, three times by Flamstead, once by Bradley, and once by Mayer ; but so far from suspecting it to be a planet that they all registered it among the stars.— This oversight can be accounted for from the fact that this planet being at such an immense distance from the Sun, and having such a wide circle to travel, is scarcely perceivable to be in motion, it taking seven years to pass over one

single sign or constellation. When first seen by the Doctor in 1781, it was in the foot of Gemini ; so that it has not completed one revolution on its orbit since it was first discovered to be a planet. "The inequalities, says a learned writer, in the motions of Jupiter and Saturn, which could not be accounted for from the mutual attractions of these planets, led astronomers to suppose that there existed another planet beyond the orbit of Saturn, by whose action these irregularities were produced. This conjecture was confirmed March 13, 1781, when Dr Herschel discovered the motions of this body, and thus proved it to be a planet.—Herschel is attended by six Satellites or moons, which revolve about him in different periods and at various distances. Four of them were discovered by Dr Herschel, and two by his sister, Miss Caroline Herschel. It is possible that others remain yet to be discovered.

Herschel's mean distance from the Sun is 1828 millions of miles—more than twice the mean distance of Saturn. His sidereal revolution is performed in 84 of our years and one month, and his motion in his orbit is 15,000 miles an hour. He is supposed to have a rotation on his axis, in common with the other planets ; but astronomers have not yet been able to obtain any ocular proof of such a mo-

tion. His diameter is estimated at 34,000 miles, which would make his volume more than eighty times larger than the earth's. To his inhabitants the sun appears only the 1-368th part as large as he does to us ; and of course they receive from him only that small proportion of light and heat. It may be shown, however, that the 1-368th part of the sun's light exceeds the illuminating power of 800 full moons. This added to the light they must receive from their six Satellites, will render their days and nights far from cheerless."

CHAPTER XX.

LEVERRIER OR NEPTUNE.

Leverrier is the most distant of all the planets from the Sun. It is distant from this central luminary, the sun, about 2,850,000,000 miles, and performs its revolution around him in 164 of our years. Its diameter is about 40,000 miles.

"The circumstances of the discovery of this planet, says Burret, are at once interesting and remarkable. Such is the regularity of the planetary motions, that astronomers are ena-

bled to predict with great accuracy, their future places in the heavens, and to construct tables, exhibiting their position for ages to come.

Soon after the discovery of Herschel in 1781, his orbit was computed, and a table constructed for determining his future position in the heavens. But instead of following the prescribed path, or occupying his estimated positions, he was found to be yielding to some mysterious and unaccountable influence, under which he was gradually leaving his computed orbit, and failing to meet the conditions of the tables.

At first this discrepancy between the observed and the estimated places of Herschel was charged upon the tables, and a new orbit and new tables were computed, which it was thought could not fail to represent the future places of the planet. But these also seemed to be erroneous, as it was soon discovered that the computed and observed places did not agree, and the difference was becoming greater and greater every year. This was an anomaly in the movements of a planetary body. It was not strange that it should be subject to perturbations, from the attractive influence of the large planets Jupiter and Saturn, as these were known to act upon him, as well as upon each other, and the smaller planets producing perturbations in their orbits, but all this had

been taken into the account in constructing the tables, and still the planet deviated from its prescribed path. To charge the discrepancy to the tables was no longer reasonable, though it was thought perhaps sufficient allowance had not been made in their computation for the disturbing influence of Jupiter and Saturn. To determine, M. Leverrier, of Paris, undertook a thorough discussion of the subject, and soon ascertained that the disturbing influence upon Herschel of all the known planets was not sufficient to account for the anomalous perturbations already described, and that they were probably caused by some unknown planet, revolving beyond the orbit of Herschel. From the amount and effect of this disturbing influence from an unknown source, the distance, magnitude, and position of the imaginary planet were computed. At this stage of the investigation, Leverrier wrote to his friend Dr. Galle, of Berlin, requesting him to direct his telescope to that part of the heavens in which his calculations had located the new planet; when lo! there he lay a thousand millions of miles beyond the orbit of Herschel, and yet within less than one degree of the place pointed out by Leverrier! This was on the first of September, 1846.

When M. Leverrier was engaged in his cal-

culations at Paris, Mr. Adams, a young mathematician of Cambridge, England, was discussing the same great problem, and had arrived at similar results even before M. Leverrier, though entirely ignorant of each other's labors and conclusions. This seems to establish the fact that the new planet was discovered by calculation, though the failure of Mr. Adams to publish his conclusions cut off his right to the honor of the discovery.

Since the discovery of this planet, it has been ascertained that it was seen as far back as 1795, though supposed to be a fixed star, and catalogued as such, and that all the irregularities of Herschel, with which astronomers were so much perplexed, are perfectly accounted for by the influence of the new planet.

On the 12th of October, 1846, Mr. Lassell, of Starfield, near Liverpool, discovered a satellite attendant upon Leverrier, and also, as he supposes, one or more rings similar to those of Saturn; but though the secondary has often been seen by others since, and has been made the basis of elaborate calculations respecting the mass of the primary, no further discovery of the rings has been made by any other observer.

CHAPTER XXI.

COMETS.

OF all the heavenly bodies the comets are the most interestingly peculiar. Their orbits are very eccentric. At one time, when nearest the sun, according to Newton, they are 22,000 times hotter than red hot iron; at another, when most distant from him, they are immersed in total darkness where the rays of the sun cannot reach them. That part of the comet which is more opaque and luminous than the rest is called the *nucleus*. This is frequently surrounded by something of a cloudy or hairy appearance, and in many instances these constitute the whole of the comet.

Very frequently, however, they are attended by a long train called the tail; but some of them are without this appendage, and are not easily distinguished from the planets. Others again appear to be nothing more than globular masses of vapor. Very little is known with certainty of the composition of these bodies; one thing is certain their composition generally appears to be nothing more than vapor, the tail being nothing but the vapor becoming more luminous and transparent when approach-

ing the sun. As the comets pass between us and the fixed stars, their envelopes and tails are so thin that stars of very small magnitude may be seen through them. While part of some appear to be solid, others again throughout every part, throughout their whole extent are perfectly transparent. Astronomers divide the comets into three classes :—1st, those which have no nucleus, being transparent throughout their whole extent ; 2nd, those which have a transparent nucleus ; and 3rd, those having a nucleus which is solid and opaque.

. In passing near or among the planets the comets are so powerfully attracted as to be drawn aside from their course, and in some instances through this means their orbits seem to have been entirely changed. This has been the case especially with regard to Jupiter which seems to be a perpetual stumbling block to them. It is very certain that the comets contain but very little matter : for when passing near to any of the planets they produce no perceivable effect on their motion. It is said that a comet in 1454 eclipsed the moon : so that it must have been very near the earth ; yet no sensible effect was observed to be produced either upon the earth or the moon.

Dr. Herschel says—“The remarkable comet of 1770, which was found to revolve in a mo-

derate elipse, in a period of about five years, actually got entangled among the satellites of Jupiter, and thrown out of its orbit by the attractions of that planet, and has not been heard of since." (Herschel p. 310) But in this extraordinary rencontre the satellites of Jupiter suffered not the least perceivable derangement. "A sufficient proof," says an author, "of the aeriform nature of the comet's mass."

"That the luminous part of a comet," says Sir John Herschel, "is something in the nature of a smoke, fog or cloud, suspended in a transparent atmosphere, is evident from a fact which has been often noticed, viz., that the portion of the tail where it comes up to, and surrounds the head, is yet separated from it by an interval less luminous; as we often see one layer of clouds laid over another with a considerable clear space between them. It follows that these can only be regarded as great masses of thin vapor, susceptible of being penetrated through their whole substance by the sunbeams.

"We have before observed", says Burrit, "that comets unlike the planets, observe no one direction in their orbits, but approach to and recede from their great centre of attraction in every possible direction. Nothing can be more sublime or better calculated to fill the mind with profound astonishment, than to contemplate the

revolution of comets, while in that part of their orbits which comes within the sphere of the telescope, some seem to come up from the immeasurable depths below the ecliptic ; and having doubled the heavens' mighty cape, again plunge downward with their fiery trains,

On the long travel of a thousand years.

Others appear to come down from the zenith of the universe to double their perihelion about the Sun, and then reascend far above all human vision. Others are dashing through the solar system in all possible directions, and apparently without any undisturbed or undisturbing path prescribed by him who guides and sustains them all."

In 1805, a comet known as Biela's comet, from M. Biela of Josephstadt, who determined the elements of its orbit, came very near the orbit of the earth ; "so near," says an author, "that at the moment the centre of the comet is at the point nearest to the earth's path, the matter of the comet extends beyond that path and includes a portion within it. Thus, if the earth were at that point of its orbit which is nearest to the path of the comet, at the same moment that the comet should be in that point of its orbit which is nearest to the path of the earth,

the earth would be enveloped in the nebulous atmosphere of the comet.

With respect to the effect which might be produced upon our atmosphere by such a circumstance, it is impossible to offer anything but the most vague conjecture. Sir John Herschel was able to distinguish stars as minute as the 16th or 17th magnitude through the body of the comet! Hence it seems reasonable to infer, that the nebulous matter of which it is composed, must be infinitely more attenuated than our atmosphere; so that for every particle of cometary matter which we should inhale, we should inspire millions of particles of atmospheric air.

This is the comet which was to come in collision with the earth, and to blot it from the solar system. In returning to its perihelion, Nov. 26, 1832, it was computed that it would cross the earth's orbit at a distance only of 18,500 miles. It is evident that if the earth had been in that part of her orbit at the *same time* with the comet, our atmosphere would have mingled with the atmosphere of the comet, and the two bodies perhaps have come in contact. But the comet passed the earth's orbit on the 26th October, in the 8th degree of Sagittarius, and the earth did not arrive at that point until the 30th of November" which was 32 days afterwards.

If we multiply the number of hours in 32 days by 68,000 (the velocity of the earth per hour) we shall find that the earth was more than 52,000,000 miles behind the comet, when it crossed her orbit. Its nearest approach to the earth at any time was about 51 millions of miles; its nearest approach to the Sun was about 83 millions of miles. Its mean distance from the sun, or half the longest axis of its orbit, is 337 millions of miles. Its eccentricity is 253 millions of miles, consequently it is 507 millions of miles nearer the sun in its perihelion than in its aphelion. The period of its sidereal revolution is 2460 days or about $6\frac{2}{3}$ years."

CHAPTER XXII.

THE FIXED STARS.

FROM what has already been shown, it is evident that all the stars are subject to great physical revolutions. Several of them once distinguished for their brilliancy have totally disappeared in the heavens, others are now very conspicuous which were unknown to the ancient astronomers. "The periodical variations of brilliancy," says Burrit, "to which some of the fixed stars are subject, may be reckoned

among the most remarkable of their phenomena. Several stars, formerly distinguished by their splendor, have entirely disappeared ; others are now conspicuous which do not seem to have been visible to the ancient observers ; and there are some which alternately appear and disappear, or at least, of which the light undergoes great periodic changes. Some appear to become gradually more obscure, as *Delta* in the Great Bear ; others like *Beta* in the whale, to be increasing in brilliancy. Some stars have all at once blazed forth with great splendor, and after a gradual diminution of their light again become extinct. It is very evident that all this is caused by the revolution of all the stars about an axis. Upon this subject the elder Herschel very properly remarks—"Such a motion may be as evidently proved as the diurnal motion of the earth. Dark spots or large portions of the surface, less luminous than the rest, turned alternately in certain directions, either toward or from us, will account for all the phenomena of periodical changes in the lustre of the stars, so satisfactorily, that we certainly need not look for any other cause."

In minutely examining the heavens with a good telescope, there are two things of some importance noticed by the observer. One is, there are dark spots seen upon the apparent

surface of certain fixed stars not of a stationary character but of a planetary nature. They appear and disappear just as some of our planetary satellites appear and disappear on the apparent surface of their respective planets. The other is the existence of certain patches of light scattered here and there throughout the wide expanse of the heavens and assuming no particular figure or without any special form and bearing evident marks of being in a chaotic state, very similar no doubt to the original state of the earth as represented in the Holy Scriptures—"without form, and void." The first of these can be very easily accounted for by understanding that every fixed star is a sun equal no doubt in magnitude to our own, and like our own great centre attended with planets and their satellites. This great truth presents to our minds a magnificent view of the subject. We think our own system—the Sun, his planets and their satellites, with the comets—to be a magnificent proof of Divine power; but every fixed star, however small to our vision, is a sun, and probably attended by as many planets as our own luminary; and thus as we gaze upon the heavens at night we have system after system, world after world and centre after centre presented for our contemplation.—Now, that each one of the fixed stars shines by

its own light, and not by the light of the sun, is evident from their position and distance. Sirius, the nearest fixed star in the heavens is inconceivably more distant from the Sun than any of the planets, and yet it shines with as much brilliancy as Venus. Now we know that in proportion as the planets are distant from the sun, their brilliancy diminishes, but here are stars inconceivably more distant from him than Saturn, Jupiter or Herschel, and who yet shine with as much splendor as Venus or Mars. This could not be if they shone by the borrowed light of the Sun, and therefore it is evident they shine by their own native light, or else receive their light with the Sun from the central luminary of creation. Regarding them in the same light as we do our Sun, we are prepared to view them as so many centres of respective systems, governing the motions of so many revolving planets, but being so very distant it is not possible to perceive them with the naked eye.— But what may we lawfully conclude those dark spots to be? They are evidently the solid matter of the planets belonging to the system of the particular star referred to, and presenting interesting evidence that infinite space is adorned with system after system to declare the glory, wisdom and majesty of the universal Lord.

The cloudy patches of light scattered throughout space can be no other than matter created to be moulded or fashioned into worlds, and are just now what the matter of our earth was before what is termed creation, agreeable to that truth communicated to us in the sacred volume of Inspiration.

CHAPTER XXIII.

HEAVENLY BODIES BEING INHABITED.

THE subject of the present chapter shall be an answer to the inquiry,—Are the heavenly bodies inhabited? and shall embrace the scientific and scriptural evidence or testimony afforded to further us in our investigation. In the great volume of nature at large we are furnished with a sober answer to the question; as all the skill, wisdom and evident contrivance contained in this volume, proclaim in lasting accents that they have had more than naked rocks and barren sands for their object, viz : rational, accountable and intelligent beings. The heavens and the earth both “declare the glory of God,” and present evidence of his existence, proclaiming that existence as plainly as the truth is evident that there can be no effect

without a cause equal to that effect produced. It would therefore be quite as reasonable to conclude that the crystal palace in London sprung into existence without any intelligence to bring it there ; as to suppose that our earth, or in fact any one of the heavenly bodies, could bring itself forth into being without the aid of a great original intelligence ; and if the existence of our own world incontestibly proves the existence of a Creator, the circumstances associated with Earth's creation give evidence that the great Original had rational beings in contemplation when he created it, for whom he adapted it both as a place of habitation and enjoyment.

Now, at the time of creation, had the earth been so placed that the sun's rays might pass either above or beneath it, and not upon it, or was it so placed as to move around a dark body instead of a luminous one, these facts would present evidence that the Creator had no reference to contemplated creatures when he created it ; but when we find this world of ours to be so situated as to receive fully the light and heat of the sun, that it is literally teeming with blessings and comforts, with beauty and grandeur, we may very philosophically conclude that God contemplated beings to live upon it, capable of enjoyment when he created it.

Should an inquiry arise as to the design of the Creator in placing the moon in the firmament of heaven, the inspired historian furnishes us with a sufficient answer. "to give light upon the earth," so that through this medium the light of the sun is reflected upon us, and by which means our winter months are far from being cheerless and dreary. Now it must appear evident to all that this well-directed apparatus was not created to dazzle the senseless mass of this world, but evidently for the benefit of beings which we find to be upon it, and which appear to be contemplated at the time of creation.

In addition to the foregoing, the peculiarities of the seasons demand a passing reflection.—All will acknowledge the importance of the kindly fruits of the earth. Fruits, herbs, vegetables, and plants in a richly assorted variety are heaped upon us by our beneficent creator; but to what purpose would be such manifestations of goodness and benevolence, if for the enjoyment of which there existed no rational and accountable beings?

By what is termed evaporation the inhabitants of this world are benefitted in a variety of ways. Evaporation is caused by the influence of the Sun upon the small globes of water in a given volume, causing a spark of caloric to

penetrate the little globe, thereby making it lighter than its own bulk of atmosphere, and causing it to ascend to an atmosphere of its own gravity. Now it will be recollected that this matter constantly arising from the Oceans is scattered over the whole earth by the blowing of the winds, and the result is, the waters, from warm climates being mixed with the waters from the cold, and the waters from cold being mixed up with the waters from warm climates by what is called the *Tides*, are made temperate, and are blown over our whole Earth, thus comparatively cooling and refreshing us in summer and warming and invigorating us in winter. A knowledge of this interesting process teaches us to conclude that our Creator had rational beings in contemplation when he placed this wonderful apparatus in connection with our globe, or in other words when God, said "Let the waters under the heaven be gathered together into one place, and it was so."

Next to the above, the air or atmosphere by which the earth is surrounded, is replete with wonderful displays of the power and wisdom of God. In the three regions which surround us the lowest is that in which we move, which we inhale, and is the vehicle by which thought is communicated by the sound of words. It is

dense enough to contain heat and subtle enough to be inhaled, in fact it is the only region in which we could live in the enjoyment of God's bounties. All men know that living depends upon respiration and that the medium of respiration is air. Now although the air is a compound substance, made up of very different materials—one of them noxious, and another perfectly unproductive of life—yet these are so blended with a third, in which alone the power of maintaining life resides, that in their combination they are better fitted to continue life than even the life-giving principal would be, if it existed pure and unmixed. Added to this, the fact should not be forgotten that amidst the innumerable revolutions, of which the air is the subject and its perpetual fluctuations, the proportional quantities are at all times substantially, if not exactly, the same. It seems scarcely less than a miracle that this equability so necessary for the continuance of life, should be always and everywhere preserved. Nothing less than the wisdom of God could accomplish all this ; but all this wisdom and forethought would be evidently in vain, if it had been determined that this world should be a blank in creation with respect to population. In a word, our atmosphere is the medium of heat and cold, through which are conveyed to

us rain, dew, hail, and snow. It is eminently the source of health, the medium of human conversation, the seat of magnificent displays of God's power, as in storms, thunder, lightning, combustion, volcanoes, earthquakes, the magnificent rainbow and the delightful breeze, while it is in many respects an important aid to vision.

Having thus far pointed out the reasonableness of concluding from nature that the Creator intended this earth to be what it is—a place of habitation for intelligent beings ; I now purpose to show that what are called the heavenly bodies present to us similar evidence that they were created to be the residence of their respective inhabitants.

The planets like our own earth are all of them so situated as to receive fully the light and heat of the sun, not one of them has a dark body around which to roll ; but all of them are adorned and illuminated by the light of the Sun. This is my first evidence that they are inhabited, as so much beauty from the light, and comfort from the heat of the Sun would never have been imparted for the senseless matter of their own position.

Like to our earth, many of them have not only one moon to reflect to them the light of the Sun, but some of them have seven and

others eight, just in proportion as they are needed. Now a well-furnished house for comfort and convenience evidently teaches us that living and thinking beings inhabit it, although we may not see one of them, and surely this apparatus just referred to will lead us to the same conclusion, as we cannot imagine how the moons of Saturn and Jupiter could be designed to benefit the senseless matter of the planets. This is my second reason for believing the planets to be inhabited.

The different planets are ascertained to have a variety of seasons as well as the earth. Like it they have their annual and diurnal motion, while as in the case of Mars, our next planetary neighbor, the snow is not only seen at its poles, but it is noticed literally by degrees to disappear as the planet emerges from a long night of a polar winter. We may therefore lawfully conclude that as we know day and night, summer and winter, to exist there, that the planets have also spring and harvest; and all for the benefit, not of inert matter, but of intelligent beings. This is my third reason for believing the planets to be inhabited.

The planets like our earth have each of them an atmosphere, have oceans and waters which arise by evaporation and form clouds; their surface presents as great a variety of

scenery as our earth, and many of them much more so. The oceans are plainly discernable on Mars, so are the clouds on Venus. The mountains of Venus and the Moon, the rings of Saturn and the belts of Jupiter, with the different moons of these last-mentioned planets lead us to conclude that the Creator had the happiness of living beings in contemplation when he created them. This is my fourth reason for believing the planetary bodies to be inhabited. At least it would be very unreasonable to conclude that while every inch of atmosphere and drop of water is occupied by living animals which the microscope at any moment can reveal, that these great masses in the heavens are so many blanks with respect to life, mind and intelligence.

CHAPTER XXIV.

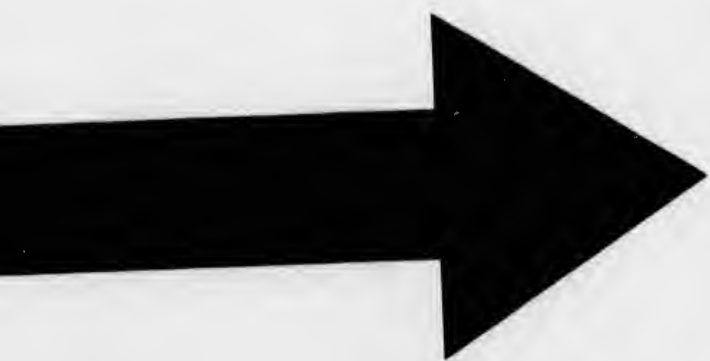
THE LIGHT OF SACRED SCRIPTURE ON THIS SUBJECT.

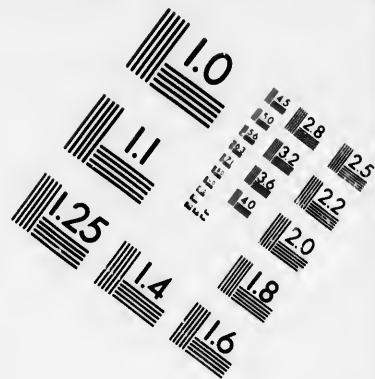
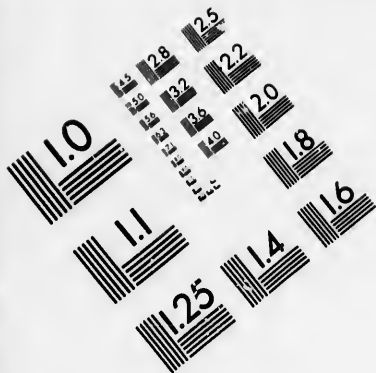
THE great volume of nature, thus teaching us with regard to heavenly intelligence as we may here, for convenience sake, call the inhabitants of other worlds, we are now prepared for the loftier disclosures of sacred revelation upon the same subject. The Bible teaches us pos-

itively that the inhabitants of this little planet are not the only intelligences in existence, but that other orders of beings have been created by the same hand that created us. There are such persons as angels or messengers mentioned in the Bible, whose immediate residence is Heaven. Our Lord tells us there is joy in their presence over a sinner that repenteth, which implies that they are beings capable of joy, and that they are not sinners like ourselves. To prove their existence is unnecessary, as every reader of the Bible is more or less acquainted with these lofty personages.

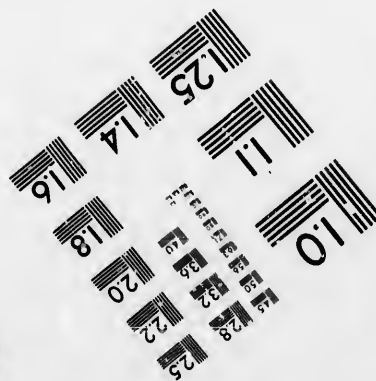
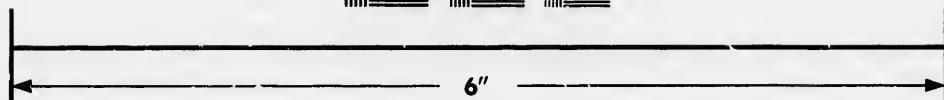
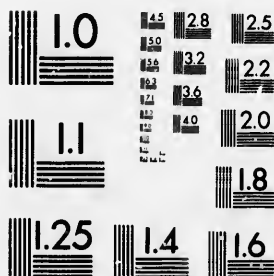
In the eighth Psalm, as David, the Royal Psalmist, contemplated the magnificent extent of God's creation, he breaks out into the following exclamation—"When I consider thy heavens the work of thy fingers, the moon and the stars which thou hast ordained, what is man that thou art mindful of him? and the son of man that thou visitest him?" In this passage, David, evidently moved by Divine inspiration, took a scientific view of creation, and regarding the heavenly bodies as peopled with lofty intelligences, and then viewing man as a depraved and sinful being, he exclaims in wonder—"What is man that thou art mindful of him? or the son of man that thou visitest him?" This would be what is termed a bom-







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bast, if the moon and the stars were not inhabited : for if living beings did not exist there, and our earth, the only globe inhabited, there would be no wonder at all that God would be mindful of man when he had no other beings to occupy his attention. We are also taught that God has established his throne in the *Heavens* and his kingdom ruleth over *all*." Now the very same fact is made known in this declaration : for the idea cannot be that God has established his throne amidst the silence of a nonpopulated region, where no beings exist to admire his glory and adore his majesty. But in the assertion "His kingdom ruleth over *all*," the great truth is communicated, for there can be no kingdom without subjects, and no ruling without persons to rule. But his throne is established in the *Heavens* and his kingdom ruleth over all, which certainly implies that the *all*, over whom God rules, is not blind, unconscious matter, but living, and thinking, and accountable beings.

PART II.

LESSONS OF SHORT SENTENCES TO BE COMMIT- TED TO MEMORY.

1. Astronomy is that science which treats of the appearance, size, shape, arrangement, distances, motions, physical constitution, and mutual influence of the heavenly bodies.

2. By the heavenly bodies are meant the Sun, the Moon, the Planets, the Comets, and the fixed Stars.

3. These are divided into two classes—luminous and opaque.

4. A luminous body is a body that shines by its own light, but an opaque body shines only by reflecting the light of a luminous one.

5. The sun and the fixed stars in our heavens are luminous bodies, but the Moon, Planets, and Comets are opaque.

6. These opaque bodies appear luminous to us only by reflecting the light of the sun.

7. The Sun, Moon, Planets and Comets constitute what is called the solar system.

8. The sun is placed in the centre of this system, the planets and comets revolve around it at unequal distances.

9. There are thirty-seven known as belonging to this system.

10. These are divided into four classes—primary, secondary, inferior and superior.

11. A primary planet is a planet which revolves around the Sun directly.

12. A secondary planet is a planet which revolves around its primary and with it around the Sun.

13. The secondary planets are usually called satellites or moons.

14. There are eighteen primary planets, ten of which are called Asteroids or small planets.

15. The following are the names of the planets, beginning with the Sun, viz :—Mercury, Venus, the Earth, Mars, Vesta, Astrea, Juno, Ceres, Pallas, Hebe, Iris, Flora, Metis, Hygias, Jupiter, Saturn, Herschel and Neptune.

16. The Earth has one Moon ; Jupiter has four ; Saturn seven ; Herschel six ; and Neptune one.

17. The inferior planets are those whose orbits are included within the circle of the earth's orbit.

18. The superior planets are those whose orbits encircle the earth's orbit.

19. The inferior planets are Mercury and Venus—the rest are superior planets.

ON ATTRACTION AND MOTION.

1. Attraction is that power with which the universe is kept in motion.
2. All bodies are attracted in proportion to the quantity of matter they contain.
3. The primary planets have two motions, called revolutions—one on their axis and another around the Sun.
4. The axis of a planet is an imaginary straight line around which it turns.
5. The orbit of a planet is that course in which it revolves around the Sun.
6. The Earth's orbit is called the ecliptic—because eclipses take place when the Moon is in its plane.
7. A secondary planet has three revolutions: one on its axis, another around its primary, and the third with its primary around the Sun.
8. The attractive force of a planet is that power by which it is kept in motion.
9. There are two forces—the centripetal and centrifugal.
10. The centripetal is that force which draws a body towards the centre, around which it revolves.
11. The centrifugal is that force which moves a body in a straight line.
12. The Sun exerts by its attraction a cen-

tripetal force upon its primary planets and comets; and the primary planets exert a centripetal force upon their secondaries or moons.

13. These two forces cause the planets to move in circular or elliptical orbits.

14. A circle is a plain figure bounded by a curve line, all parts of which are equally distant from the centre.

15. An eclipse is an oblique view of a circle.

THE SUN.

1. The Sun is a large, luminous body which gives light and heat to the whole solar system.

2. The diameter of the Sun is 886,952 miles. It is 1,384,472 times larger than the earth.

3. The Sun is 500 times the bulk of all the planets taken together, and is supposed to be about 750 times their weight.

4. The Sun is about ninety-five millions of miles from the earth.

5. Ancient astronomers supposed it to be a large globe of fire, but at present it is proved to be an opaque body like the earth, surrounded by a luminous atmosphere.

6. The Sun has three motions—one on its axis, another around the centre of gravity of the solar system, and the third around the centre of the universe.

7. The sun revolves on its axis in about twenty-five days and a half.

8. The revolution of the Sun on its axis is determined by spots on its surface, appearing first on the east side, then passing over and appearing on the west side.

9. These spots are supposed to be openings in the luminous atmosphere, which enable us to see the dark body of the sun.

10. The atmosphere of the sun appears to be in a continual and violent state of agitation, especially within about thirty degrees of the equator.

11. Astronomers attribute this to a rarified atmosphere at the equator, producing violent storms and continual agitation.

12. The spots seen through the openings in the sun's atmosphere are constantly changing ; some appear and others disappear very suddenly.

13. The brightness of the sun is greater than the most vivid flame—a fact which proves the atmosphere of the Sun to be intensely hot.

TRANSITS OF CERTAIN BODIES.

1. The transit of a heavenly body is its passage across the meridian.

2. The passage of Mercury and Venus across the sun's disc is called their transit.

3. By the disc of the sun or a planet is meant

that circular illuminated surface visible to us.

4. Mercury and Venus appear like black spots when moving across the Sun.

5. A transit always begins on the east side of the sun, and terminates on the west side.

THE ZODIAC.

1. The Zodiac is a circular belt in the Heavens, sixteen degrees wide—eight degrees on each side of the ecliptic.

2. The zodiac is divided into twelve equal parts, called signs or constellations of the zodiac.

3. Each sign is divided into thirty degrees; each degree into sixty minutes; each minute into sixty seconds.

4. The ecliptic is the great circle in the middle of the zodiac.

5. The signs of the ecliptic and names of the constellations of the zodiac are—Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces.

6. These constellations and signs do not always occupy the same place in the heavens: for the signs in the ecliptic have fallen back of the constellations about thirty-one degrees.

7. These constellations and signs corresponded to each other about twenty-two centuries ago.

8. The falling back of the signs of the ecliptic among the constellations is caused by the retrograde motion of the equinoxes.

9. The seasons depend upon the revolution of the earth from one equinox to the same again.

10. The sun has an apparent motion in the ecliptic, in an eastern direction around the Heavens, during the year.

11. This is caused by the earth's moving around the Sun.

12. When for instance the earth is in the sign Aries, the same appears in the opposite sign Libra.

13. As the earth moves round in the ecliptic, the sun appears to move in the opposite part of the heavens, and in the opposite direction from the motion of the earth.

14. The Sun enters the sign Cancer when the north pole leans towards the Sun. This happens the 21st June.

15. At this time the earth enters the sign Capricornus.

16. The Sun enters the signs Aries and Libra when the north pole leans sideways to the sun.

17. The Sun enters the sign Capricornus when the north pole leans exactly from the sun. This happens Dec. 22nd.

18. The equinoctial signs are Aries 21st of March, Libra 23rd of September.

19. The Solstitial signs are, Cancer 21st June, Capricornus 22nd of December.

LONGITUDE, ETC.

1. The signs of the ecliptic are divided into four divisions, according to the seasons.

2. The Spring signs are Aries, Taurus, Gemini; the summer signs, Cancer, Leo, Virgo; the autumnal signs, Libra, Scorpio, Sagittarius; and the winter signs, Capricornus, Aquarius, Pisces.

3. Longitude in the Heavens is the distance from the first degree of the sign Aries, reckoned eastward on the ecliptic, and embracing the whole circumference of the heavens.

4. When the Sun enters Aries, it has no longitude, but at that time the longitude of the earth is 180 degrees.

5. When the Sun enters Cancer, its longitude is 90 degrees, and the earth's at the same time is 270.

6. When the Sun enters Libra, its longitude is 180 degrees, and the earth at the same time has no longitude.

THE PLANETS.

MERCURY.

1. Mercury is the nearest planet to the sun; it is twenty times less than the earth, and revolves around the Sun in two months and twenty-eight days.

2. Very little is known of the planet Mercury, it being mostly lost to vision in the solar ray.

VENUS.

1. Venus the second planet in the system is about as large as the earth, and revolves around the sun in seven months and fifteen days.

2. Mercury and Venus are called inferior planets, because the earth's orbit includes theirs.

3. The inferior planets will sometimes appear east of the Sun and sometimes west, according to the part of their orbits they are in; when east they are evening stars, and when west they are morning stars.

4. Venus, at most, can set but four hours and a quarter after the Sun, and rise four hours and a quarters before him—and Mercury but two hours.

5. When they rise and set with the sun, if they be in the remote part of their orbit, we call this the superior conjunction ; but if in the nearest part we call it the inferior conjunction, at which time if they fall exactly between the earth and the sun, such a phenomena is called a transit, and the planet will appear on the sun's disc like a black spot.

THE EARTH.

1. The Earth is the third planet from the sun—it moves round it in three hundred and sixty-five days and six hours, nearly.

2. The wise Author of nature has caused a secondary planet, called the moon, to move round the earth in twenty-seven days and a half. The moon receives its light and heat from the sun and reflects the former of these upon the earth.

3. The earth is round like a globe or ball, a little flattened at the poles.

We clearly demonstrate the earth to be round,
 Since such a form fittest for motion is found ;
 The higher the eye is, the prospect's more vast,
 And a ship's hull appears not so soon as its mast.
 Round the earth the bold mariner often has been,
 And the rest of the planets are circular seen ;
 This, too, in all lunar eclipses is shown :
 For the shadow is round on the face of the moon.
 The polar star sinks as we sail to the line,
 And canals from a level must gently decline.

4. A description of the Earth belongs to the department of Geography.

MARS.

1. The fourth planet from the Sun is called Mars. It is about one-fifth as large as the earth, and moves round the Sun in something less than two years.

2. The diameter of Mars is 4189 miles, and its distance from the Sun 142 millions of miles.

3. Mars revolves on its axis in 24h., 39m., 22s., and it revolves around the Sun in one year and 321 days, moving in its orbit at the rate of 55,000 miles an hour.

4. The seasons of Mars are similar to those of the earth, but nearly twice as long—because this planet is nearly two of our years in revolving around the Sun.

5. Mars is surrounded with a very dense atmosphere, causing it to appear of a redish and fiery color.

6. When viewed with a telescope, the outlines of apparent continents and seas are distinctly visible in Mars.

7. The seas of Mars appear of a greenish color, caused by contrast with the red colour of the continents.

8. Mars frequently appears gibbous but never horned like the moon.

9. A planet appears gibbous when we can see more than half, but not the whole, of the illuminated surface.

10. Mars does not appear horned like the Moon, because it does not pass between us and the Sun.

11. Bright spots, supposed to be snow, are seen alternately at the poles of Mars.

12. These spots appear only in the winter of Mars, which proves them to be an accumulation of snow and ice which soon passes away when the planet emerges from a long night of a polar winter.

13. Mars has about half as much light and heat as the Earth.

14. The seasons of Mars are very similar to those of the earth, and the analogy between Mars and the earth is greater than the analogy between the Earth and any other planet of the solar system.

15. Their diurnal motion, and of course the length of their days and nights, are nearly the same; the obliquity of their ecliptics, on which the seasons depend, is not very different; and of all the superior planets, the distance of Mars from the Sun is by far the nearest to that of the Earth.

16. To a spectator on this planet, the earth will appear, alternately, as a morning and evening star, and through a telescope would exhibit all the phases of the Moon, just as Mercury and Venus do to us.

17. Viewed through a telescope, the disc of Mars is diversified with numerous irregular and variable spots, and ornamented with zones and belts of varying brilliancy, that form and disappear by turns.

18. Zones of intense brightness are to be seen in its polar regions, subject, however, to gradual changes. That of the southern pole is by far the most brilliant.

19. Dr Herschel supposes that they are produced by the reflection of the Sun's light from the frozen regions, and that the melting of these masses of polar ice is the cause of the variation in their magnitude and appearance.

20. He was confirmed in this opinion by observing, that after the exposure of the luminous zone about the north pole to a summer of eight months, it was considerably decreased, while that on the south pole, which had been in total darkness during eight months, had considerably increased.

21. The atmosphere of Mars is of an extraordinary height and density. This accounts for the redness of this planet.

THE ASTEROIDS.

1. In the solar system, between the orbits of Mars and Jupiter, we find a cluster of small planets, peculiarly distinguished from all the other planets of the system.

2. The dates of their discovery, and the names of their discoverers are the following :—
Ceres, Jan. 1, 1801, by M. Piazzi, of Palermo.
Pallas, March 28, 1802, by M. Olbers, of Bremen.
Juno, S. p. 11, 1804, by M. Harding, Bremen.
Vesta, March 29, 1809, by M. Olbers, Bremen.
Astrea, Dec. 8, 1845, by Hencke of Dresden.
Hebe, July 5, 1847, by Hencke of Dresden.
Iris, August 13, 1847, by Hind, of London.
Flora, October 18, 1847, by Hind of London.
Metis, April 25, 1848, by Graham of Sligo.
Hygiea, April 12, 1849, by Gasporis, Naples.

3. The scientific Bode entertained the opinion, that the planetary distances above Mercury, formed a geometrical series, each exterior orbit being double the distance of its next interior one from the sun.

4. This is precisely the case with Jupiter, Saturn and Herschel ; but the law seemed to be interrupted between Mars and Jupiter.

5. He therefore inferred that there was a planet wanting in that interval, which is now happily supplied by the discovery of the ten

star-form planets, occupying the very space where the unexplained vacancy presented a strong objection to his theory.

6. These planets are much smaller in size than the older ones, they all revolve in nearly the same distances from the Sun, and perform their revolutions in nearly the same periods.

7. Their orbits are much more eccentric, and have a greater inclination to the ecliptic, and all cross each other—so that there is a possibility that two of these bodies in the course of their revolutions may come in collision.

9. From these and other circumstances, it is evident that these ten planets are the fragments of a large celestial body which once revolved between Mars and Jupiter, and which burst asunder by some tremendous convulsion, or some external violence.

10. Dr Brewster attributes the fall of meteoric stones to the smaller fragments of these bodies happening to come within the sphere of the earth's attraction.— [*Burritt's Glass Book of Astronomy*, page 233.]

11. Vesta appears like a star of the fifth or sixth magnitude, shining with a pure, steady light, and is the only one of the asteroids which can be discerned with the naked eye.

12. Juno revolves around the Sun in 4 years and $4\frac{1}{2}$ months, at the mean distance of 254

millions of miles, moving in her orbit at the rate of 41,000 miles an hour.

13 Its diameter being estimated at 1393 miles, would make its magnitude 183 times less than the earth's.

14. Its light and heat are seven times less than that received upon our globe.

15. The eccentricity of its orbit is so great that its greatest distance from the Sun is nearly double its least distance—so that when it is in its *perihelion* it is nearer the sun by 130 millions of miles than when it is in its *aphelion*.

16. This great eccentricity has a corresponding effect upon its rate of motion, for being so much nearer, and therefore being so much more powerfully attracted by the Sun at one time than at another, it moves through that half of its orbit which is nearest the Sun, in one half of the time that it occupies in completing the other half.

17. Juno is surrounded by an atmosphere more dense than that of any of the other asteroids—a proof that it is capable of being inhabited.

18. Ceres revolves about the Sun in 4 years and 7 1-3 months, at the mean distance of 263½ millions of miles, moving in its orbit at the rate of 41,000 miles an hour.

19. Its diameter is estimated at 1582 miles, which makes its magnitude 125 times less than the earth's.

20. The intensity of the light and heat of this planet is about 71-2 times less than that received upon this earth.

21. Ceres shines with a ruddy color, and appears to be only the size of a star of the eighth magnitude; it is therefore never seen with the naked eye.

22. It is surrounded by a species of cloudy or nebulous light, which gives it somewhat the appearance of a comet, forming an atmosphere 675 miles in height.

23. Ceres was the first discovered of the Asteroids. At its discovery astronomers congratulated themselves upon the harmony of the system's being restored. They had long wanted a planet to fill up the space between Mars and Jupiter, in order in their eyes to make the system complete.

24. But the successive discoveries of Pallas and Juno again introduced confusion, and presented a difficulty which they were unable to solve, till Dr. Olbers suggested the idea that these small anomalous bodies were merely the fragments of a larger planet which had been exploded by some mighty convulsion.

25. Pallas performs its revolution around

the Sun in 4 years and 73 months, at the mean distance of 284 millions of miles an hour.

26. Its diameter is estimated at 2025 miles, which is but little less than that of our Moon.

27. Ceres and Pallas are nearly of equal size, and they are situated at equal distances from the Sun.

JUPITER.

1. Jupiter is the next planet in order from the Sun, and is the largest one which has been discovered, being about a thousand times larger than the earth, and five times more remote from the Sun.

2. Jupiter may be readily distinguished from the fixed stars, by its peculiar splendor and magnitude, appearing to the naked eye almost as resplendent as Venus, although it is more than seven times more distant from the Sun.

3. When its right ascension is less than that of the Sun, it is our morning star, and appears in the eastern hemisphere before the Sun rises; when greater, it is our evening star, and lingers in the western hemisphere after the Sun sets.

4. It is very easy to trace Jupiter among the constellations of the Zodiac, for in whatever

constellation it is seen to-day, one year hence it will be seen equally advanced in the next constellation—two years hence in the next and so on, being just a year in passing over one constellation.

5. In 1854, it passed through Sagittarius; in 1855 it passes through Capricornus; 1856, Aquarius; 1857, Pisces; 1858, Aries; 1859, Taurus; 1860, Gemini; 1861, Cancer.

6. Jupiter revolves round the Sun in twelve years nearly, and has four satellites or moons moving around; they receive their light and heat from the Sun, and reflect the same upon Jupiter, as our moon does upon the earth. It is also surrounded by dark circular spaces or zones, called its belts.

7. Jupiter is 485 millions of miles from the Sun, and its diameter is 87,000 miles. It moves on its orbit 30,000 miles an hour.

8. Jupiter has no change of seasons, because its axis is nearly perpendicular to the plane of its orbit, which causes the Sun to be always vertical at the equator.

9. The light belts which appear to surround Jupiter are supposed to be clouds which are thrown into parallel lines by the quick rotation of the planet upon its axis—while the dark belts which are seen are supposed to be the body of the planet seen between the clouds.

10. These belts change frequently, and sometimes the clouds break to pieces.

11. Jupiter has twenty-seven times less light and heat than we have upon our earth.

12. When Jupiter is in conjunction, he rises, sets, and comes to the meridian with the Sun; but is never observed to make a transit, or pass over the Sun's disc; when in opposition, he rises when the Sun sets, sets when the Sun rises, and comes to the meridian at midnight, which never happens in the case of an inferior planet. This proves that Jupiter revolves in an orbit which is exterior to that of the earth.

13. About the equatorial regions of Jupiter there reigns perpetual summer, and at its poles everlasting winter; but yet equal day and equal night at each.

14. This arrangement evidently shows the kind design of the Great Creator—for had its axis been inclined to its orbit, like that of the earth, his polar winters would have been alternately a dreadful night of six years' darkness.

15. Some of Jupiter's moons are always visible to the inhabitants, exhibiting in a small scale most of the phenomena of the solar system.

16. When viewed through a telescope these moons present an interesting and beautiful appearance.

17. The first moon, or that nearest the planet, is 259,000 miles distant from its centre, and revolves around it in 42½ hours, and appears at the surface of Jupiter four times larger than our moon does to us. The second moon, being both smaller and farther distant, appears about the size of ours; the third somewhat less; and the fourth, which is more than a million of miles from him, and takes 16½ days to revolve around him, appears only about one-third the diameter of our Moon.

18. These satellites suffer frequent eclipses from passing through Jupiter's shadow, in the same manner as our moon is eclipsed in passing through the Earth's shadow.

19. The three nearest moons fall into Jupiter's shadow, and are eclipsed in every revolution; but the orbit of the fourth is so much inclined that it passes by its opposition two years in six without falling into the planet's shadow.

20. By means of these eclipses Astronomers have discovered that light is 8 min., 13 secs. in coming to us from the Sun; and they are also enabled to determine the longitude of places on the Earth with greater facility and exactness than by any other methods yet known.

21. By a careful observation it was found that when the Earth is in that part of its orbit which is nearest to Jupiter, the eclipses appear

to happen 8 min. and 13 sec. sooner than the tables of eclipses predict; and when in that part of its orbit which is farther from Jupiter, 8 min. 13 sec. later than the tables predict.

22. When these eclipses happen sooner than the tables predict, Jupiter is at its nearest approach to the earth--when later, at its greatest distance: so that its difference in its distances from the earth, in the two cases, is the whole diameter of the Earth's orbit or about 190,000,000 of miles. Hence it is concluded that light is not instantaneous, but that it occupies 16 min., 26 sec., in passing across the Earth's orbit--or the half of that 8 min., 13 sec., in coming from the Sun to the Earth, being nearly 12,000,000 of miles a minute.

23. The revolutions of the satellites about Jupiter are precisely similar to the revolutions of the planets about the sun.

24. Jupiter when seen from its nearest satellite, appears a thousand times larger than our moon does to us, exhibiting on a scale of inconceivable magnificence, the varying forms of a crescent, a half-moon, a gibbous phase, and a full appearance every 42 hours.

25. In passing across the disc of Jupiter, one of its satellites has been known to lose all its light, as if undergoing an eclipse, until finally it became a *black spot* on the disc of the planet;

after passing off the disc it resumed its light.

SATURN.

1. Saturn is situated between the orbits of Jupiter and Herschel, and is distinctly visible to the naked eye.

2. It may be easily distinguished from the fixed stars by its pale, feeble and steady light.

3. From its slowness of motion it is two years and a half in passing over a single constellation.

4. The mean distance of Saturn from the sun is 909 millions of miles.

5. Its diameter is about 82,000 miles, and it requires $29\frac{1}{2}$ of our years to complete its circle round the sun, but its diurnal rotation on its axis is accomplished in 10 hours and a half.

6. Its year therefore is nearly thirty times as long as ours, but its day is shorter by more than one half.

7. Its year contains 10,759 of our days and about 25,150 of its own.

8. The surface of Saturn like that of Jupiter is diversified with belts and dark spots.

9. Dr. Herschel perceived at some time five belts on its surface ; three of which were dark, and two bright.

10. The dark belts have a yellowish tinge, and generally cover a broader zone of the planet than those of Jupiter.

11. The sun appears 90 times less to the inhabitants of Saturn than he does to the inhabitants of the Earth, and therefore they receive 90 times less light and heat than we do.

12. Saturn moves on its orbit at the rate of 22,000 miles an hour.

13. Its night alternately at the poles is about 15 of our years, and its axis leans towards its orbit about 30 degrees.

Its Rings.

1. Saturn is surrounded by two large concentric rings, which are separated from each other, and also from the planet.

2. The matter of these rings is as solid as the planet itself, and they are observed to cast a strong shadow upon the planet.

3. The light of these rings is more brilliant than the planet itself.

4. The rings turn around their centre of motion in the same time that Saturn turns on its axis.

5. The distance between Saturn and its inner ring is about 21,000 miles; being less than a tenth part of the distance of our moon from the Earth.

6. The interval between the rings is 3000 miles, and the breadth of the inner ring is 20,000 miles.

7. This ring will present to the inhabitants of Saturn a luminous zone, arching the whole concave vault from one hemisphere to the other with a broad girdle of light.

8. The obvious use of this double ring is to reflect light upon the planet in the absence of the sun.

9. The sun illuminates one side of it during 15 years, or one half of the period of the planet's revolution; and during the next 15 years, the other side is enlightened in its turn.

10. When viewed from the middle zone of the planet, in the absence of the sun, the rings will appear like vast luminous arches, extending along the canopy of heaven, from the eastern to the western horizon; exceeding in breadth one hundred times the apparent diameter of our Moon.

Its Moons.

1. Besides the rings, Saturn is attended with seven Satellites or Moons; which revolve around this planet at different periods and distances, and reciprocally reflect the Sun's rays on each other and on the planet.

2. The rings and moons illuminate the nights of Saturn ; the Moons and Saturn enlighten the rings, and the planet and rings reflect the Sun's beams on the Satellites.

3. The sixth and seventh are the smallest of these Satellites, the first and second are the next smallest, the third is greater than the first and second, the fourth is the largest of them all, and the fifth surpasses the rest in brightness.

4. There is no planet in the solar system whose firmament presents such a variety of splendid and magnificent objects as that of Saturn.

5. The various aspects of the seven moons, one rising above the horizon, while another is setting, and a third approaching to the meridian—one entering into an eclipse and another emerging from one, one appearing as a crescent and another with a gibbous phase ; and sometimes the whole of them shining in the same hemisphere in one bright assemblage.

6. The majestic motion of the rings, at one time illuminating the sky with their splendour and eclipsing the stars, at another casting a deep shade over certain regions of the planet and unveiling to the inhabitants the wonders of the starry firmament—these are scenes worthy of the majesty of the Divine Being to unfold, and of rational creatures to contemplate.

7. Such grand displays of Divine Wisdom and Omnipotence, lead us to conclude that the numerous splendid objects connected with this planet, were not created merely to shed their lustre on naked rocks and barren sands; but that an immense population of intelligent beings is placed in those regions, to enjoy the bounty and adore the goodness of their great Creator.—*Burrit.*

HERSCHEL.

1. Herschel is the next planet in order from the sun, beyond or above Saturn.

2. To the naked eye it appears like a star of only the sixth or seventh magnitude, and of a pale, bluish white: but it can seldom be seen, except in a very fine, clear night, and in the absence of the Moon.

3. It requires just seven years to pass over one sign or constellation.

4. It was first seen by Dr. Herschel, in 1781, it was then in the foot of Gemini—so that it has not yet completed one revolution since it was first discovered to be a planet.

5. It was, however, observed as far back as 1690. It was seen three times by Flamstead, once by Bradley, once by Mayer, and eleven times by Lemounier, who registered it among

the stars—but not one of them suspected it to be a planet.

6. The irregularities in the motion of Jupiter and Saturn, which could not be accounted for from the mutual attractions of these planets, led Astronomers to suppose that there existed another planet beyond the orbit of Saturn, by whose action these irregularities were produced.

7. This conjecture was confirmed March 13th, 1781, when Dr. Herschel discovered the motions of this body, and thus proved it to be a planet.

8. Herschel is attended by six moons or satellites, which revolve around it in different periods and at various distances.

9. Four of them were discovered by Dr. Herschel, and two more by his sister, Miss Caroline Herschel.

10. Herschel's mean distance from the sun is 1828 millions of miles—more than twice the mean distance of Saturn.

11. Its motion in its orbit is 16,600 miles an hour.

12. It is supposed like other planets to have a rotation on its axis; but astronomers have not been able to obtain any ocular proof of such a motion.

13. Its diameter is estimated at 34,000

miles, which would make its volume more than 80 times larger than the Earth.

14. To its inhabitants the Sun appears only the 1-368 part as large as it does to us; and of course they only receive that small proportion of light and heat.

15. This light, however, added to the light they receive from their six satellites, will render their days and nights far from cheerless.

LEVERRIER OR NEPTUNE.

1. The planet Leverrier or Neptune is the most distant of the primary planets, and in some respects one of the most interesting.

2. It is about 40,000 miles in diameter, is situated at the mean distance of 2,850,000,000 of miles from the Sun, and revolves around this luminary in 164 of our years.

3. This planet is so remote that it would take a body moving at the rate of 30 miles an hour, over 20,000 years to reach it.

4. Such is the regularity of the planetary motions, that astronomers are enabled to predict, with great accuracy, their future places in the heavens, and to construct tables exhibiting their positions for ages to come.

5. Soon after the discovery of Herschel in 1781, its orbit was computed, and a table con-

structed for determining its future position in the heavens, but instead of following the prescribed path or occupying its estimated positions, it was found to be yielding to some unaccountable and mysterious influence, under which it was gradually leaving its computed orbit, and failing to meet the conditions of the tables.

6. To determine the cause of this, M. Leverrier, of Paris, undertook a thorough discussion of the subject, and soon ascertained that the disturbing influence upon Herschel of all the known planets, was not sufficient to account for the anomalous perturbations already described, and that they were probably caused by some unknown planet, revolving beyond the orbit of Herschel.

7. From the amount and effect of this disturbing influence from an unknown source, the distance, magnitude, and position of the imaginary planet were computed.

8. At this stage of investigation, Leverrier wrote to his friend Dr. Galle of Berlin, requesting him to direct his telescope to that part of the heavens in which his calculations had located the new planet, when lo! there it lay, one thousand millions of miles beyond the orbit of Herschel, and yet within less than one degree of the place pointed out by Leverrier.

This was on the 1st of September, 1846.

9. At the very same time Mr Adams, a young Mathematician of Cambridge, England, was discussing the same great problem and had arrived at similar results, even before M. Leverrier, although entirely ignorant of each other's labors or conclusions.

10. Mr Adams' neglecting to publish his conclusions, cut off his right to the honor of the discovery.

11. Since the discovery of this planet, it has been ascertained that it was seen as far back as 1795, though supposed to be a fixed star, and catalogued as such, and that all the irregularities of Herschel, with which astronomers were so much perplexed, are perfectly accounted for by the influence of the new planet.

12. On the 12th of October, 1846, Mr Lassell of Starfield, near Liverpool, discovered a satellite attendant upon Neptune. He supposed he also saw one or more rings around this planet similar to those belonging to Saturn—but this is very uncertain.

SOLAR SYSTEM.

1. From what is known it appears philosophically certain that every member of the solar system being necessary to the whole, they were therefore all created at the same time—all maintain their present stations and motions and distances, by their mutual action on each other.

2. The solar system could not be where it is nor move as it does, nor appear as we see it unless every member of which it is composed were all coexistent.

3. The presence of each appears essential to the system, the Sun to them, they to the Sun, and all to each other. This fact is a strong indication that their formation was simultaneous.

THE MOON.

1. The Moon is a satellite or secondary planet, revolving around the earth.
2. The moon is 49 times less than the earth.
3. Its diameter is about 2180 miles.
4. Its mean distance from the earth is about 240,000 miles.

5. It revolves around the earth in 27 days, 7 hours, 43 min., 11sec., 5 deg., and it revolves upon its axis in the same time.

6. In consequence of the moon's revolving upon its axis and around the earth in the same time, the same side of the moon is always presented to us. We have therefore never seen the opposite side of the moon.

7. The moon is supposed to be more dense in one side than the other—therefore the centre of gravity not being in the centre of the Moon, she always presents the same side to the earth.

8. A lunation or lunar month is the time from one new month to another.

9. The length of a lunation is 29 days, 12h., 44m.

10. A lunation is longer than it takes the Moon to revolve around the earth, because the earth is revolving round the Sun at the same time.

11. As the Moon revolves on its axis only once in its revolution around the earth, it continually presents the same side to the earth, and there is, consequently, only one day and night in each revolution of the moon around the earth, or the day and night would each be nearly 15 days long.

12. The Moon revolves around the earth from West to East.

13. It is caused to rise in the east by the Earth's revolving on its axis the same way.

14. The Moon rises about 50 minutes later every day.

15. This is caused by the Moon's revolving around the earth from west to east.

16. The phases of the Moon, from new moon to new moon again, is caused by the moon's revolving around the earth.

17. When the Moon is between the Earth and the Sun, and the dark side is presented to us we have what is called new moon.

18. When the Moon is on the opposite side of the earth from the Sun, and the illuminated side is presented to us, we have what is called full Moon.

19. The light of the moon is just 300,000 less than that of the Sun.

20. When the Sun and Moon are 90 degrees distant from each other, they are in what is called quadrature.

21. One-half of the Moon's illuminated side is visible to us when it is quadrature.

22. The moon is about 70,000,000 of times smaller than the Sun.

23. The Moon appears to us as large as the Sun, because it is 400 times nearer to us than the Sun.

24. By the phases of the Moon is meant

the various appearances which the moon presents from new to full moon, and from full moon to new moon again.

ECLIPSES.

1. An eclipse is the interception of the Sun's rays by some opake body.
2. Eclipses are divided, with respect to the body eclipsed, into two kinds: solar and lunar.
3. A solar eclipse is an eclipse of the sun, and a lunar eclipse is an eclipse of the moon.
4. A solar eclipse is caused by the moon's passing between the Earth and Sun, and casting its shadow upon the earth.
5. A solar eclipse of the Sun can therefore only happen at the time of new moon.
6. An eclipse of the moon is caused by the moon's passing through the earth's shadow.
7. An eclipse of the moon can only happen at full moon.
8. Eclipses are divided, with respect to the amount eclipsed, into total and partial.
9. A total eclipse is an eclipse of the whole Sun, or Moon.
10. A partial eclipse is an eclipse of only a part of the Sun or Moon.
11. An annular eclipse is an eclipse of the central part of the Sun, when the moon is so

far from the earth, that the Sun can be seen like a bright ring around it.

12. We do not have an eclipse of the Sun at every new moon, because at new moon, the moon is generally too high or too low for its shadow to fall upon the earth.

13. In like manner the moon's passing, above or below the earth's shadow, prevents us having an eclipse of the moon at every full moon.

14. The length of the earth's shadow is about 600,000 miles. This is the mean or average length:

15. The average length of the moon's shadow is about 234,000 miles.

16. A digit is the twelfth part of the apparent diameter of the Sun or Moon's disc.

17. The greatest number of eclipses that can take place in a year is seven: five of the sun and two of the moon.

18. The least number of eclipses that can take place in a year is two; and both must be of the sun.

ECLIPSES—*Continued.*

1. All opake bodies cast a shadow when the rays from any luminous body fall upon them.

2. If the sun were smaller than the earth, the earth's shadow would increase in diameter as the distance increases from the earth; but if the sun and earth were of the same size, the shadow would be of the same size, no matter how great the distance from the earth.

3. But as the sun is immensely larger than the earth, the earth's shadow terminates in a point at about 600,000 miles from the earth.

4. The moon revolves around the earth from one new moon to another in about $29\frac{1}{2}$ days.— If the moon passed at every new moon exactly between the centres of the sun and the earth, we should have a great eclipse of the sun at every new moon, and a total eclipse of the moon at every full moon; but the moon's orbit makes an angle with the plane of the ecliptic of about $5\frac{1}{2}$ degrees, consequently one-half of the moon's orbit is above the ecliptic, and the other half below it.

5. The plane of the ecliptic is described by a line drawn from the centre of the Sun, passing through the centre of the earth, and extended to the heavens.

6. The two opposite points where the moon's orbit cuts the plane of the ecliptic, are called the moon's nodes.

7. The nodes do not keep in the same position with respect to the earth and the Sun,

but have a retrograde motion of about nineteen degrees in a year.

8. This causes the Moon, at New Moon, to be too high or too low, so that the Moon's shadow passes above the north pole or below the south pole, and there is therefore no eclipse, and at full moon the moon passes either above or below the earth's shadow.

9. A total eclipse of the moon occurs when the whole of the moon is immersed in the earth's shadow, but we occasionally have a partial eclipse of the moon, which is caused by the moon's being so high or so low as only to be partially immersed in the earth's shadow.

10. The number of eclipses in any one year cannot be less than two, nor more than seven. There are sometimes six, but the usual number is four—two of the Sun and two of the Moon.

11. The following is a list of all the solar eclipses which will be visible in Europe and America during the present century :

1854	at 26 min. past 4 P.M.	on 26th May,
1858	" 14 " 6 A.M.	15th March,
1859	" 32 " 5 P.M.	29th July,
1860	" 23 " 7 A.M.	18th July,
1861	" 30 " 7 A.M.	31st Dec.,
1863	" " 1 P.M.	17th May,
1865	" 10 " 9 A.M.	19th October,

1866	at 12 min. past	11 A.M.	5th October,
1876		3 A.M.	6th March,
1868		10 A.M.	23rd Feb.,
1869	" 21	" 5 A.M.	7th August,
1870		6 A.M.	22nd Dec.,
1873		3 A.M.	26th May,
1874		4 A.M.	10th October,
1875	" 56	" 5 A.M.	29th Sep.,
1876	" 11	" 4 P.M.	25th March,
1878	" 56	" 4 P.M.	29th July,
1879		2 A.M.	19th July,
1880	" 30	" 7 A.M.	31st Dec.,
1882		1 A.M.	17th May,
1885	" 35	" 12 A.M.	16th March,
1886	" 30	" 6 A.M.	29th August,
1887		10 P.M.	18th August,
1890		3 A.M.	17th June,
1691		12 Mer.,	6th June,
1892	" 19	" 12 P.M.	20th October,
1895		4 A.M.	26th March,
1896		12 Mer.	9th August,
1897	" 8	" 9 A.M.	29th July,
1899		12 Mer.	8th June,
1900	" 9	" 8 A.M.	28th May.

12. The diameter of the Sun and Moon's discs is divided into twelve equal parts called digits.

CONJUNCTION.

1. A planet is in what is called inferior conjunction when it is between the earth and the Sun.

2. Mercury, Venus and the Moon, can be in inferior conjunction.

3. A planet is in superior conjunction when it is on the opposite side of the Sun.

4. All the planets except the Earth and the Moon can be in superior conjunction.

COMETS.

1. Comets are another sort of planets, moving in all directions round the Sun, in orbits so very eccentric, that some of them in their perihelions are more than a thousand times nearer the Sun than in their aphelions.

2. The motion of comets in returning from their aphelions is continually accelerated by the attraction of the Sun—so that by the time they reach their perihelions their velocity is immensely increased.

3. When having passed their perihelions their velocity is continually diminished by the Sun's attraction until they reach their aphelions, when it is the least, and in the opposite

points of their ascent and descent their velocity is the same.

4. Some comets have passed so near the Sun as to be only the distance of one of his diameters from him.

5. They are so much heated in their perihelions that they project tails or luminous appearances like flowing hair, to a prodigious length.

6. That part of a comet which is usually brighter or more opaque than the other portions is called the *nucleus*.

7. Nothing is known with certainty of the composition of these bodies.

8. The envelope by which they are surrounded appears to be nothing more than vapor, becoming more luminous and transparent when approaching the Sun.

9. As the comets frequently pass between us and the fixed stars, their envelopes and tails are so thin that stars of very small magnitudes may be seen through them.

10. Some comets having no nucleus are transparent throughout their whole extent.

11. The nucleus of a comet sometimes appears opaque, and it then resembles a planet.

A FEW GENERAL OBSERVATIONS ON ASTROLOGY.

Ancient Astrology, from its connection with the history of the past, deserves a passing reflection; and simply to inform the reader of some of the curiosities of this professed science, and without giving any opinion of my own as to its correctness, I will, in this closing Chapter, show how the ancient *Magis*, as they were called, prognosticated in relation to human nativities.

Of the Birth of Children with respect to the age of the Moon.

To be born *on the first day of the New Moon* was reckoned very fortunate—for to such in astrology was promised prosperity in business, sweetness of sleep, pleasantness of dreams, and a long life.

A child born *on the second day of the New Moon* shall grow apace. On this day it is proper to go on messages, to trade by land or to sail on the sea, as also to put seed into the ground that it may thrive. It is also good to open a vein upon this day if there be occasion. A

child born *on the third day of the moon* shall die quickly, or at least be short-lived. On this day to begin any work of importance is very unfortunate—for it seldom comes to a good conclusion, and if any fall sick upon this day he will hardly recover. *On the fourth day of the moon*, the child that is born shall prosper in the world and be of good repute. It is good to begin any enterprise upon this day—provided it be done with good advice and with dependence on the divine blessing. A person that falls sick upon this day will either recover or die in a short time. They that will may also on this day use phlebotomy. *The fifth day of the moon* is unfortunate and the child born therein is likely to die in infancy. On this day let no man do anything of great importance, for he will have no success—he that is in danger and thinks to escape shall certainly be taken; he had better, therefore, be still as he is. If good council be given you to day, take it, but execute it to-morrow. You may, however, be bled on this day with good success. The child that is born on the *sixth day of the moon*, will be of long life, but very sickly unless prompt means and strict attention prevent it. To send children to school this day is very fortunate, and denotes they shall increase in learning. *On the seventh day* the child that is born may

live many years. To take sick upon this day is dangerous, but if he have been long sick, by taking medicine upon this day, he will be likely to recover. A child born *on the eighth day* shall be in danger of dying young, but if he outlive his sickness he shall live long and arrive at a great estate. Whatever business a man undertakes on this day shall prosper ; but it is especially good to buy cattle and to begin build-ings. He that falls sick upon this day shall recover, and a thing that's lost shall be found. On the *ninth day* a child that shall be born is very fortunate, enjoying long life and arriving at great riches. What you undertake this day will come to good issue. It is very dangerous to let blood upon this day. On the *tenth day* the child that is born shall be a great traveller, pass through many kingdoms and countries, and at last die at home in his old age. Do nothing upon this day but what you want all men to know, for the secrets of this day are generally made known. Blood letting may be used this day with good success. A child that is born on the *eleventh day of the moon* shall be of good constitution, and very religious, shall be long-lived and of a lovely countenance. If a female she shall be much addicted to wisdom and learning. It is good to begin a journey upon this day, for it shall be prosperous, and also to marry for the

married couple shall live happy all their lives, and be blest with many children. *The twelfth day of the moon's age* in allusion to the 12th sign or house of the zodiac, betokens nothing but sorrow and woe. The child born upon this day shall be given to wrathfulness, and subject to many afflictions. If there be occasion to let blood this day, let it be towards the evening, and then it may do no harm. *On the thirteenth day* the child that is born shall be of short life, and subject to much misery while it lives by reason of peevish crossness so that it cannot be pleased. To wed a wife upon this day is good, for she shall be both loving and obedient to her husband. The child that is born on the *fourteenth day of the moon's age* shall be an enemy to his country, which shall bring upon him his deserved end. On this day if you ask a kindness of either a friend or an enemy, it shall be granted you. Give proper medicine to a sick person and it shall restore him to his former health. The child that is born on the *fifteenth day* shall shortly die. Begin no work upon this day, for it is very unfortunate. That which was lost yesterday will be found to-day. On the *sixteenth day of the moon*, the child that is born shall be of ill manners and very unfortunate. Yet this is a good day for buying, selling or merchandizing. If a man

be sick, and on this day change his habitation, he may recover and do well again. The child born on the *seventeenth day of the moon* will be foolish. To go on messages upon this day is unfortunate. Yet to contract matrimony, to compound physical preparations, and to take medicine are very good; but by no means let blood upon this day. The child that shall be born on the *eighteenth day* (if a male) will be courageous, valiant and eloquent; but if a female, chaste and industrious, and shall come to honor in her old age. It is good to begin buildings upon this day, and to send children to school; but it is very dangerous to let blood. The child that is born on the *nineteenth* (if a male) will be renowned for wisdom and virtue, and thereby arrive to great honors; but if a female she will be of a weak and sickly constitution. This day they that have occasion may bleed. The child that shall be born on the *twentieth day of the moon* shall be stubborn, quarrelsome and a great fighter, yet he shall arrive to riches. This is a good day for any manner of business. On the *twenty-first day of the moon's age*, the child that is born shall be witty and ingenious, yet he shall be addicted to stealing, which may be remedied by early training and cultivation, else he may be brought to the gallows. Abstain from bleeding on this

day at your peril. On the *twenty-second day* the child born shall be fortunate, and purchase a good estate—he shall also be of a cheerful countenance, comely and religious, and shall be well-beloved. Avoid going on a message upon this day ; neither remove from one place to another. Blood letting on this day may be profitable. The child born on the *twenty-third day* shall be of an ungovernable spirit and shall give up himself to wandering abroad in the world. This day is generally prosperous for all kinds of business. On the *twenty-fourth day of the moon* a child then born shall be a prodigy in the world, and make all men admire at his surprising and wonderful actions, which shall exceed those of ordinary persons. On the *twenty-fifth day of the moon*, the child then born shall be wicked, he shall encounter with many dangers. A very unfortunate day for all kinds of business. On the *twenty-sixth day of the moon's age* the child born shall be very beautiful and amiable, but yet of an indifferent station in the world ; if it be a female a rich man marries her for her beauty. Let those who travel on this day beware of meeting those they don't care for. The child that shall be born on the *twenty-seventh day of the moon* shall be of an affable temper and disposition that it will attract the love of every one with whom it

shall converse ; and yet if a man he shall never rise to any very great height in the world ; but if a woman, the sweetness of her disposition may advance her. On the *twenty-eighth day of the moon's age*, the child born shall be very fortunate. It is a very good day for business.

How Persons may know under which of the Twelve Signs they are born.

He that is born under Aries is of a nature hot and dry, of a loud voice, inclined to cholera ; and if a woman she will at least have but few children. Overbearing, with black eye-brows, thick shoulders, middle stature, and of swarthy complexion. Those under Taurus are of a cold and dry constitution—very chaste, honest and religious—melancholy and yet love pleasure—seldom angry, but if once aroused and provoked seldom reconciled—of short stature, well-set short legs, bull's neck, wide mouth and black hair. Those under Gemini are hot and moist—of fair and sanguine complexion—affable and courteous in their behaviour—wise and accomplished, with elegance of speech and good delivery—having brown hair, brisk and quick eyes, a large breast, long arms, hands and legs, and a tall, straight and well-set body. Those under Cancer are cold and moist, and of a phlegmatic constitution—of a low stature,

blackish hair ; if it be a woman, it shows she will have children. Those under Leo are very choleric, of a shrill voice, and viciously inclined, much addicted to anger, and very subtle ; if a woman, unfruitful—of a generous and free temper, very courageous, of yellowish hair, broad shoulders, great head and eyes, of middle stature, but a lusty body. Those under Virgo are cold and dry, of a melancholic constitution, fair countenance, courteous and yet selfish, the body spare, but of good proportion—of a brown complexion, but black hair and large eyes. Those under Libra are hot and moist, sanguine complexion, fair and of good proportion, of comely visage, well-favored, light brown hair, courteous, rosy cheeks, very slender. Those under Scorpio are cold and moist, and phlegmatic, a sickly constitution, yet very fruitful, very vicious and sometimes crooked in their bodies. Those under Sagittary are hot and dry, choleric, fair, with brown hair and tall of stature. Those under Capricorn, cold and dry, melancholy, of a savage and cruel nature, face lean and thin, and pale color. Those under Aquarius are of a sanguine complexion, countenance very amiable and lovely, and of a chaste, honest and religious nature. Those under Pisces are cold, moist and phlegmatic, of a short stature, often crooked and deformed, and ill-composed both in

body and mind, pale and wan complexion, thick shouldered, short-necked and stooping.

By comparing themselves to what is here written, persons may come to know under what sign they were born.

A Table of the Planetary Hours for every day in the week.

SUN.		MON.		TUES.		WED.		THURS.		FRI.		SATUR.	
Pl.	H.	Pl.	H.	Pl.	H.	Pl.	H.	Pl.	H.	Pl.	H.	Pl.	H.
Sol	1	Lu	1	Mars	1	Mer	1	Jup	1	Ven	1	Sat	1
Ven	2	Sat	2	Sol	2	Lu	2	Mars	2	Mer	2	Jup	2
Mer	3	Jup	3	Ven	3	Sat	3	Sol	3	Lu	3	Mars	3
Juno	4	Mars	4	Mer	4	Jup	4	Ven	4	Sat	4	Sol	4
Sat	5	Sol	5	Lu	5	Mars	5	Mer	5	Jup	5	Ven	5
Jup	6	Ven	6	Sat	6	Sol	6	Lu	6	Mars	6	Mer	6
Mer	7	Mer	7	Jup	7	Ven	7	Sat	7	Sol	7	Lu	7
Sol	8	Lu	8	Mars	8	Mer	8	Jup	8	Ven	8	Sat	8
Ven	9	Sat	9	Sol	9	Lu	9	Mars	9	Mer	9	Jup	9
Mer	10	Jup	10	Ven	10	Sat	10	Sol	10	Lu	10	Mars	10
Lu	11	Mars	11	Mer	11	Jup	11	Ven	11	Sat	11	Sol	11
Sat	12	Sol	12	Lu	12	Mars	12	Mer	12	Jup	12	Ven	12
Jup	13	Ven	13	Sat	13	Sol	13	Lu	13	Mars	13	Mer	13
Mars	14	Mer	14	Jup	14	Ven	14	Sat	14	Sol	14	Lu	14
Sol	15	Lu	15	Mars	15	Mer	15	Jup	15	Ven	15	Sat	15
Ven	16	Sat	16	Sol	16	Lu	16	Mars	16	Mer	16	Jup	16
Mer	17	Jup	17	Ven	17	Sat	17	S 1	17	Lu	17	Mars	17
Lu	18	Mars	18	Mer	18	Jup	18	Ven	18	Sat	18	Sol	18
Sat	19	Sol	19	Lu	19	Mars	19	Mer	19	Jup	19	Ven	19
Jup	20	Ven	20	Sat	20	Sol	20	Lu	20	Mars	20	Mer	20
Mars	21	Mer	21	Jup	21	Ven	21	Sat	21	Sol	21	Lu	21
Sol	22	Lu	22	Mars	22	Mer	22	Jup	22	Ven	22	Sat	22
Ven	23	Sat	23	Sol	23	Lu	23	Mars	23	Mer	23	Jup	23
Mer	24	Jup	24	Ven	24	Sat	24	Sol	24	Lu	24	Mars	24

This table is so easy, it needs little explanation. Its use is, to find out what planet rules any hour of the day, and every day of the week. As for example, I desire to know what planet rules on Wednesday at 8 o'clock at night—under the title of Wed. I look for 20 which answers to 8 o'clock, by commencing the 13th hour on the list with 1 o'clock, 14, 2 o'clock &c., for the natural day consists of 24 hours, and begins after midnight; 20 therefore answers to 8 o'clock at night, over against which you will find Sol, which shows that to be the hour of the Sun. And if you would know what planet rules at 7 in the morning, that day you will find against Venus 7, which shows that Venus rules that hour, and so of any other hour in the day.

I shall now record the significations of the planetary hours of each planet, and what it portends to those that are born in them.

The hour of Saturn is strong, and is good to all things that require strength—such as fighting and bearing burdens or the like, but for other things it is very evil. He that is born in the hour of Saturn is slow, dull and melancholy, of a dogged temper and disposition, black and swarthy of complexion, being quarrelsome, wrathful and very malicious.

The hour of Jupiter is in all things good, and denotes peace, love and concord. He that is

tion,
here
that

very

SATUR.

	H.
at	1
up	2
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ars	10
ol	11
en	12
er	13
u	14
at	15
up	16
ars	17
ol	18
en	19
er	20
u	21
at	22
up	23
ars	24

born in the hour of Jupiter is of a ruddy and sandy complexion, fair hair, well-proportioned body, and of a lovely countenance, his face rather broad than long, well-spoken and courteous, sober, just and religious. The hour of Mars is evil, and denotes the person born in it to be of a hot, choleric constitution, and of a robust, strong body, soon angry and hard to be reconciled; his face red, his eyes sparkling and fiery, much addicted to fighting and always ready for a quarrel which without much watching and prayer and faith will certainly bring him to a bad end. The hour of the Sun signifies great strength, and is very fortunate for Kings, Princes, and Governors. He that is born in this hour hath sharp eyes, brown hair, and a round face, and denotes one that is a great projector, aims at high things, but is often disappointed, and seldom brings his designs to pass.

The hour of Venus is very propitious and fortunate, but it is better by night than day, especially mid-day, for then the Sun covers it. He that is born in this hour hath fair hair, soft eyes, a little forehead, and round beard, very complaisant in his carriage, mighty amorous, and a great admirer of the opposite sex, much addicted to spending money. The hour of Mercury is very good, but chiefly from the be-

ginning to the middle. He that is born in this hour has a stature inclining to tallness, a sharp long face, long eyes and a long nose, his forehead narrow, long beard, and thin hair, long arms and long fingers—of a good disposition and obliging temper—much given to reading and very desirous of knowledge, delighting to be among books—but falsehood is his besetment and his great temptation is to be light-fingered. In all cases by thoughtful, watchful prayer, the evil may be avoided. The hour of the Moon is both good and evil, according to the day—for from the 4th to the 17th it is good to those who are born under it ; but from the 17th to the 20th it is counted unfortunate to be born under it ; and from the 20th to the 27th very unhappy. He that is born in the hour of the moon, (especially upon her own day,) shall be pale faced, of a thin meagre visage, with hollow eyes, and of a middle stature : he appears very obliging, but is crafty and deceitful ; he is very inconstant, what he cries up one hour he cries down the next : he is very malicious, and will never forget an affront once offered him. His constitution phlegmatic.

Thus have I given the reader the judgment of the ancients, upon the planetary hours, and what they portend to those that are born under them, by which a person comparing himself

with what is here set down, may easily know under what planet he was born.

NOTE TO THE READER.

At the suggestion of several friends I insert these thoughts on Astrology, if for nothing more than to gratify the curiosity of some. I simply give them for information, feeling they can do no harm, without passing an opinion of my own, as to their merits.

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