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THE
SOLAR SYSTEM AS IT IS,
AND
NOT AS IT IS REPRESENTED:

WHEREIN IS SHEWN, FOR THE FIRST TIME,
THE TRUE, PROPER MOTION OF THE
SUN THROUGH SPACE,
AT THE RATE OF 100,000 MILES PER HOUR.

ALSO, THAT THE EARTH AND PLANETS, AND THEIR SATELLITES MOVE
WITH THE SUN, IN

CYCLOIDAL CURVES;

AND THAT THE DOCTRINE OF ELLIPTICAL ORBITS IS FALSE; BEING AN
OPTICAL ILLUSION THAT HAS ARISEN FROM IGNORANCE OF
THE SUN'S MOTION THROUGH SPACE.

BY

R. J. MORRISON,

A LIEUTENANT IN THE ROYAL NAVY.

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PREFACE.

THE following pages must speak for themselves. They have been written without consulting any one; and their errors, as well as their merits, if they contain any, must be attributed to their Author alone. The love of truth and the interests of society have been my only motives for putting into print the ideas this work contains. I have lived too long and am too far advanced in years, to hope for any personal advantages from a work so antagonistic to the notions of the scientific world. But I ask for no favour or affection. I merely desire that Truth may have a fair hearing; which, I am aware that her own inherent powers must eventually, if not speedily, obtain. If it be thought that I have been needlessly severe on astronomical writers, from whom I differ, let it be considered how much mischief they have effected, in keeping mankind in dense ignorance of the

beauties of the Solar System, by the support they have given to the complex fallacies of the Newtonian Theories of Gravitation and Attraction, and their sister folly, the Keplerian Doctrine of Ellipses—now shewn to be utterly unfounded. I conclude by observing, that I write for the ingenuous public alone; and ask them to examine with patience the new ideas that I have herein launched upon the waters of public investigation.

The *proper* motion of the Sun is now, for the first time, put before the public in a tangible form. If the mode in which I have treated it, and the results I have drawn therefrom, both as to the *rate* of its hourly motion, and the means it offers of deducing the positions of the Planets, by a simple process, shall be considered satisfactory, and thence beneficial to the cause of human knowledge, I shall not regret having become

THE AUTHOR.

AUSTREY, WARWICKSHIRE,

June 15, 1857.

CONTENTS.

CHAPTER I.

THE THEORY OF ELLIPTICAL MOTION—ORIGINAL MOTIVE FORCE, OR “PUSH” GIVEN TO THE PLANETS—NO PUSH GIVEN TO THE SUN—EXAMINATION OF ELLIPTICAL MOTION—ITS APPARENT EXISTENCE—ITS REAL EXISTENCE DISPROVED: 1st. BY THE NATURE OF MOTION; 2nd. BY THE NECESSARY CONSEQUENCES OF THE EARTH BEING REMOVED FROM THE SUN, NOT BEING EXPERIENCED—EXPERIMENT TO PROVE THAT THERE CAN BE NO MOTION IN AN ELLIPSE, WITH A MOVING FOCUS—THE PLANETS ACTED ON BY TWO FORCES ONLY, WHICH PRODUCE CYCLOIDAL CURVES—THESE, SEEN IN A RIGHT LINE, AND NOT IN PLAN OR SECTION, TAKE THE APPEARANCE OF ELLIPSES—ANCIENT SYSTEMS—HIPPARCHUS, PTOLEMY, COPERNICUS, KEPLER, &c. Pages 31—42

CHAPTER II.

THE SUN'S PROPER MOTION ADMITTED, INVOLVES THE FACT THAT THE PLANETS MOVE THROUGH SPACE WITH HIM—THE COURSE OF THE SUN, ALTHOUGH IN A CIRCLE, MAY BE TAKEN PRACTICALLY TO BE IN A RIGHT LINE—EXTENT OF THE YEARLY MOTION OF THE SUN, NOT LESS THAN 875,696,000 OF MILES!—DISTANCE OF THE SUN FROM THE CENTRE OF HIS ORBIT, 37,300 TIMES THE DISTANCE OF THE EARTH FROM THE SUN—TRUE CAUSE OF THE PRECESSION OF THE EQUINOXES SHOWN TO BE THE SUN'S PROPER MOTION—THE SUN'S AND EARTH'S COURSES TRACED THROUGH THE SIGNS OF THE ZODIAC—THE SUN'S LONGITUDE, HOW MEASURED—THE SEASONS EXPLAINED—DIRECT AND LATERAL MOTIONS OF THE EARTH EXPLAINED, AS CAUSED BY TWO FORCES—OPTICAL EFFECTS OF THE EARTH MOVING FASTER THAN THE SUN, AND SO PASSING HIM AT THE SUMMER SOLSTICE, CONTRARY TO THE ELLIPTICAL THEORY, WHICH MAKES THE SUN MOVE SLOWEST WHEN AT THE NORTHERN TROPIC—RATE AT WHICH THE EARTH PASSES THE SUN SHOWN TO BE 1,583,333 MILES DAILY AT MIDSUMMER—IN CONSEQUENCE OF THE RAPID MOTION OF THE EARTH AND SUN COMBINED WITH THE MOTION OF LIGHT, WE NEVER DO REALLY SEE THE ENTIRE BODY OF THE SUN AT ALL Pages 43—62

CHAPTER III.

COMPARISON OF THE ARTIFICIAL SYSTEM OF ELLIPSES, WITH THE SIMPLE, NATURAL SYSTEM OF PROPER SOLAR MOTION AND PLANETARY CYCLOIDS—ACTION OF THE MOON ON THE EARTH, MAGNETIC AND NOT OF THE NATURE OF GRAVITATION—DESCRIPTION OF THE NEWTONIAN AND KEPLERIAN THEORY BY WOODHOUSE—COMMENTS ON THE SAME—THE PROBLEM OF THE "THREE BODIES" NEVER YET SOLVED—NEWTONIAN THEORY INCOMPLETE WITHOUT IT—WHY DOES A STONE FALL TO THE GROUND?—THIS QUESTION ANSWERED—THE ARCANA OF THE HEAVENS NOT SO INTRICATE AND MYSTERIOUS AS PHILOSOPHERS AND ASTRONOMERS HAVE IMAGINED—NO REASON WHY ASTRONOMY SHOULD BE CONFINED TO MEN OF GREAT LEARNING—THE CYCLOID SYSTEM EXTREMELY PLAIN AND SIMPLE, AND OPEN TO THE UNDERSTANDING OF THE MASS OF MANKIND .. Pages 63—74

CHAPTER IV.

MODE OF COMPUTING THE SUN'S LONGITUDE, AS GIVEN BY WOODHOUSE—MODE OF COMPUTING THE SUN'S LONGITUDE BY THE CYCLOID SYSTEM—ON THE LENGTH OF THE MEAN EQUINOCTIAL YEAR—VAGARIES OF THE NAUTICAL ALMANAC ON THIS SUBJECT—ORTHODOX ASTRONOMY OF 1834, NOT ORTHODOX IN 1857—SUN'S LONGITUDE COMPUTED ON THE CYCLOID SYSTEM, WITH REFERENCE TO THE CHANGES IN THE OBLIQUITY OF THE ECLIPTIC—EXPLANATION OF THE PRINCIPLES OF THE ABOVE MODE OF COMPUTING THE SUN'S LONGITUDE AT ANY TIME—FORMULÆ FOR THE SAME—EXAMINATION OF THE SUPPOSED POWER OF MARS TO ATTRACT THE EARTH—MARS AT FAULT—THE ATTRACTIVE POWERS OF VENUS TESTED, AND FOUND WANTING.

Pages 75—95

CHAPTER V.

OF THE MOTIONS OF MARS AND VENUS—OBLIQUITY OF THE ORBIT OF VENUS, HOW DISCOVERED—OF THE HELIOCENTRIC DECLINATION OF VENUS AND MODE OF DETERMINING HER HELIOCENTRIC LONGITUDE—OF THE INFERIOR AND SUPERIOR CONJUNCTIONS OF VENUS WITH THE SUN—OF HER GREATEST ELONGATION, STATIONARY POSITION, &c.—OF THE THREE CYCLOIDS FORMED BY VENUS, WHILE THE EARTH FORMS TWO SUCH, IN TWO YEARS—VENUS'S COURSE TRACED THROUGH THE THREE CYCLOIDS—DIFFICULTIES OF THE DOCTRINE OF PLANETARY ATTRACTION, WHEN CLOSELY EXAMINED—INVESTIGATION OF THE SUPPOSED ATTRACTION OF THE EARTH ON VENUS—ATTRACTION AT FAULT—ATTRACTION OF JUPITER ON VENUS EXAMINED—ATTRACTION, EVEN IF PROVED TO EXIST, DOES NOT MILITATE AGAINST THE CYCLOIDS—ON THE MODE OF COMPUTING THE PLACE OF MARS—OBLIQUITY OF THE ORBIT OF MARS, HOW DETERMINED—HELIOCENTRIC DECLINATION AND LONGITUDE OF MARS CALCULATED ON THE CYCLOID SYSTEM, AND MOTION OF THE SUN THROUGH SPACE—DIAGRAM OF THE MOTIONS OF THE SUN, MARS, EARTH, AND VENUS EXPLAINED Pages 96—118

CHAPTER VI.

PROBLEM OF FINDING THE GEOCENTRIC LONGITUDE OF A PLANET FROM THE HELIOCENTRIC PLACES OF THE SAME—EXEMPLIFICATION IN THE CASE OF VENUS, WHEN EAST OF THE SUN—DITTO, WHEN VENUS IS WEST OF THE SUN—THE SAME PROBLEM IN THE CASE OF A SUPERIOR PLANET—THE GEOCENTRIC LONGITUDE OF MARS COMPUTED—THE SOLUTION OF THESE PROBLEMS BY PLANE TRIGONOMETRY SHOWN TO BE A CONFIRMATION OF THE TRUTH OF THE SYSTEM OF CYCLOIDS. Pages 119—123

CHAPTER VII.

ON THE MOTION OF THE FIRST SATELLITE OF JUPITER—THE CORRECT PREDICTION OF THE ECLIPSES OF JUPITER'S SATELLITES, NO DECISIVE PROOF THAT THEY MOVE IN ELLIPSES—THE ASTRONOMERS PLAYING THE PART OF THE BOTTLE CONJUROR—DIAGRAM OF THE TRUE AND REAL MOTIONS THROUGH SPACE OF JUPITER AND HIS FIRST SATELLITE ACCORDING TO THE NEWTONIAN THEORY—THE MOTION OF THE SATELLITE THEREBY PROVED TO BE A CYCLOID—DIAGRAM OF THE SAME MOTIONS ACCORDING TO THE THEORY OF THE PROPER MOTION OF THE SUN—THE MOTION OF THE SATELLITE THEREBY SHOWN TO BE A MORE BEAUTIFUL CYCLOID—FALLACIOUS APPEARANCE OF THE PHENOMENA AS SEEN FROM THE EARTH .. Pages 134—147

CHAPTER VIII.

ON THE NATURE OF GRAVITY—SIR JOHN HERSCHELL'S ARGUMENTS IN FAVOUR OF GRAVITY REFUTED—A STONE FALLS TO THE GROUND, NOT BY THE POWER OF GRAVITY, BUT BY MAGNETIC ATTRACTION, WHICH DRAWS ALL BODIES TO THE EARTH—THE MOON ACTING AS A MAGNET, MAY DISTURB THE PARALLELISM OF THE EARTH'S POLES, AND SO PRODUCE "NUTATION"—FOUR DISTINCT ARGUMENTS FOUNDED ON KNOWN FACTS, TO PROVE THAT THE MOON DOES NOT AND CANNOT MOVE IN AN ELLIPSE—SIR JOHN HERSCHELL'S EXPERIMENT OF THE "STICK" AND "STRING," SHOWN TO BE DELUSIVE AND FALLACIOUS—NEWTON'S DEMONSTRATION THAT GRAVITATING BODIES, MOVING IN EACH OTHER'S NEIGHBOURHOOD, MUST MOVE IN ONE OR OTHER OF THE CURVES KNOWN AS CONIC SECTIONS, SHOWN NOT TO APPLY TO THE PLANETS OR THEIR SATELLITES, AND THEREFORE NOT TO THE EARTH AND MOON—THE LAW OF GRAVITATION THUS PROVED NOT TO EXTEND TO THE SOLAR SYSTEM—DEMONSTRATION THAT THE MOON MOVES IN A CYCLOIDAL CURVE Pages 148—173

CHAPTER IX.

THE DIRECT FORCE WHICH IMPELS THE SUN AND PLANETS THROUGH SPACE—WHY THE SUN DOES NOT MOVE IN A RIGHT LINE—ANCIENT INDIAN ASTRONOMY IN PROOF OF THE PRECESSION OF THE EQUINOXES—SIR JOHN HERSCHELL ON THE PRECESSION SHEWN TO BE ERRONEOUS—CAUSES OF THE LATERAL MOTION OF THE EARTH AND PLANETS—EXPLANATION OF THE LATERAL MOTION BY REFERENCE TO THE ACTION OF ELECTRICITY AND MAGNETISM, AS EMANATING FROM THE SUN—MODIFIED HYPOTHESIS OF THE CAUSE OF LATERAL MOTION APPLIED TO THE ACTION OF THE SATELLITES AND THE MOON—DIMINISHED MOTION OF THE MOON AT NEW MOON—ACCELERATED DITTO AT THE FULL MOON—ATMOSPHERE OF THE MOON, THOUGH EXTREMELY SMALL, SUFFICIENT TO BE ACTED ON BY ELECTRICITY Pages 179—194

CHAPTER X.

OBLIQUITY OF THE ECLIPTIC NOT CAUSED BY THE "ACTIONS OF THE PLANETS," AS STATED BY SIR JOHN HERSCHELL—THE THEOREM OF LA GRANGE, TO DEMONSTRATE THE STABILITY OF THE SYSTEM, UNFOUNDED—THE OBLIQUITY NOT "OSCILLATING," BUT PERPETUAL—ECLIPTIC AND EQUATOR WILL COINCIDE IN 168,898 YEARS—RESULTS OF THEIR DIFFERENCE IN 4,000 YEARS—GREATER RISE OF THE NILE—GEOLOGICAL CONSEQUENCES OF THE TROPICS HAVING PASSED OVER EUROPE—THE SUN VERTICAL TO LONDON 202,146 YEARS SINCE—THE CONSEQUENCES—VERTICAL POSITION OF THE SUN, THE CAUSE OF GEOLOGICAL PHENOMENA—FORMATION OF LAKES AND INLAND SEAS—INCREASED DISTANCE FORMERLY OF THE EARTH FROM THE SUN—THE EARTH APPROACHES THE SUN—TIME WHEN THE EARTH MUST FALL INTO THE SUN AND BE DESTROYED—ORIGIN OF THE EARTH AND PLANETS—PERIOD WHEN THE EARTH FIRST EXISTED—THE SUN ONCE AT THE POLE—DITTO VERTICAL TO NOVA ZEMBLA—CAUSE OF TROPICAL PLANTS AND ANIMALS IN THAT ISLAND AND IN BRITAIN—CONCLUSION Pages 195—214

INTRODUCTION.

It was at the meeting of the British Association, in 1837, that I offered to display a diagram of the true motion of the Moon; when I was coolly informed by Dr. Whewell, that they (the Association) did not wish to disturb existing systems; so an inspection of my diagram, and a hearing for my arguments, were quietly refused. In the following year, having obtained an introduction to Sir W. Hamilton, the ablest astronomer of the age, I waited on him to request his attention to my ideas. He was a gentleman; and, the person from whom I brought a note being a man of distinction, I was politely received. Sir William, however, informed me that he had an observation to make in a quarter of an hour, and that he could not give me more than ten minutes. I replied that ten minutes would

be sufficient, and was permitted to unroll my diagram, about nine yards long, in the passage of the Observatory at Dublin. Sir William Hamilton stooped down to inspect it, and after a few minutes he got upon his knees, and did not rise from thence for nearly half an hour. He forgot the observation—became intensely interested in the diagram, and asked me several pointed questions on the subject; at length he got up, shook me by the hand, and complimented me by saying, that I was the first man who had ever placed the Moon's motion correctly on paper.

The diagram above alluded to, I displayed at Cheltenham and other places publicly, but found few persons willing to examine the question of the Moon's true motion, most people being, like Dr. W., of opinion that it is not wise to disturb existing systems. This conservative notion I found extended to the Royal Astronomical Society; for when my friend, Dr. Lee, one of their council, presented to them my large diagram of the Moon's motion, he informed me that they accepted it, but it was not their custom to thank anybody for a present; and so my diagram, no doubt, rots in some corner of the Society's apartments, and has rarely, if ever,

been honoured by an inspection of the contents by any of the great men who are to be found among its members.

Twenty years of farther consideration of the Solar System have brought me to the confident assurance that the Copernican, Keplerian, and Newtonian system of motion, viz., that which is thought to depend on centripetal and centrifugal forces, resulting in *apparent* elliptical curves, is very far from what really exists in nature. I am willing to admit that these ellipses *do really appear* to exist; and that, if their *foci* did not move, either in the plane of the ellipse, or out of the plane, then, indeed, would the evidence be complete, and the elliptical philosophy would triumph. But no one can doubt for a moment that had Sir Isaac Newton been aware that the *focus* of the ellipse that he conceived the Earth to form yearly, viz., the Sun, is in constant and rapid motion, he would have taken *that fact* into consideration, when determining the nature of elliptical motion.

But neither Copernicus, Kepler, or Newton, ever expressed the least idea of a knowledge of the great

fact, that THE SUN DOES REALLY MOVE THROUGH SPACE. This important element in astronomical science was first announced by that most excellent man and able astronomer, Sir William Herschel: and his son, Sir John Herschel, mentions this distinctly at page 397 of his "Treatise on Astronomy," published in 1833, where he observes, in allusion to a supposed general tendency of the stars to move to some point in the heavens, that this general tendency was referred by Sir William Herschel "TO A MOTION OF THE SUN and Solar System in the opposite direction." Sir John Herschel goes on to say, that, "no one, who reflects with due attention on the subject, will be inclined to deny the high probability, NAY CERTAINTY, that the Sun *has* a proper motion in *some* direction." Fortified by such opinions, from such undeniable authority, and considering a recent attempt by a German astronomer to prove that our Sun and Solar System do really move round a common centre, supposed to be near the star Alcyone, one of the Pleiades, which was well received by astronomers generally, I am not disposed to offer any excuse for asserting my belief that the Sun really does move forward in space; or for attempting to prove the *rate* at which such motion, which I believe to be equable at all

times, takes place. I feel the greater confidence in this attempt, because there results from my theory, if really true, most important consequences; which will tend to render the whole subject of astronomical science, when consistent with the facts that really exist in nature, and no longer dependent on *imaginary* forces of gravitation and attraction, and their assumed progeny, elliptical courses, more simple, more beautiful, and far more easy of acquirement.

I am encouraged in this effort by the discoveries that I have already made, which prove that the system I am induced to offer is that which really and truly exists; and that it is not a mere optical illusion, like the *supposed* rising and setting of the heavenly bodies, or their *apparent* approach to the meridian and recess therefrom, or the *apparent course* of the Earth and Planets round the Sun, in ellipses, or of the Moon or other satellites round their primaries in the same manner. Those discoveries are such that we may account for all the phenomena of the seasons and of conjunctions, oppositions, eclipses, elongations, and compute the longitudes of the Sun and Planets, &c., by most simple means, and quite

independent of the abstruse and laborious system of computation adopted by modern astronomers. This system of calculation does in fact avowedly exclude all but the fortunate few, who are educated in the higher branches of mathematics, from any thing approaching to a personal, or individual knowledge of the sublime truths of astronomical research. The discovery that we may determine the Sun's longitude at any period, with great exactness, in a few minutes, and without reference first to an assumed motion in a supposed circle, which is then to be reduced to motion in an apparent ellipse, as the Newtonian theory demands; and which ellipse is uncertain and irregular, being affected by sundry and constant attractions of numerous bodies thousands of millions of miles distant—this discovery, I submit, alone entitles my theory to the considerate attention of all lovers of truth and nature, which are ever clothed in the garb of simplicity.

But my methods of determining the *heliocentric* and *geocentric* longitude of a Planet, may be pointed to as triumphant proofs of the correctness of my theory; for, independent of the value they have from their being dependent only on the solution of

two plane triangles, the *fact* of the *rate* at which the Sun moves and the other *great fact* that the Earth and Planets move, as I declare, *in cycloidal curves*, and not, therefore, in ellipses, as hitherto taught, remain indisputable. Because both the rate of motion of the Sun, and the nature and description of the courses formed by the Earth and Planets, as referred to the Sun, are involved in these problems of the heliocentric and geocentric longitudes of any Planet; which being determined correctly by the theory I advance, undoubtedly demonstrate the reality of that theory.

And here let me prevent the objection that the same argument may be applied to prove the reality of the elliptical theory; because by it the geocentric place of a heavenly body may be determined from the heliocentric place. I say that this assertion is not strictly true. For it is *not* by the *elliptical* theory *alone* that such problems are solved. And whether the bodies move heliocentrically in ellipses or not, when their heliocentric positions are known, their geocentric places may be found, on the supposition that the Sun, the focus, is stationary; as is done daily. But if the Sun be admitted *not* to be

stationary (as is the case), then the heliocentric and consequently geocentric place of any planet could not be determined by my method, unless the Earth and Planet did both really move in the *cycloidal curves*, for which I contend.

I do not for a moment imagine that, in bringing forward a theory to demonstrate the nature of "the Solar System as it is, and not as it is represented," I shall be exempt from the fate that attends the authors of all important discoveries. I am quite prepared to believe that with me it will be as it ever has been, is now, and ever shall be. "What," the empty scribblers, who live by their pens, will exclaim, "Attempt to shake the throne of astronomy! attempt to show the world that we men of the nineteenth century can be in the wrong in our notion of the motions of the heavenly bodies!" Treason to the Queen of the Sciences! "Away with him, and away with his book, and point the finger of scorn to his name!" These will be the cries I may expect to hear, and were it the right time, and were it the right place, the "away with him," would take the form of "imprison him," "hang him," "burn him," or "crucify him!" The

spirit of *hatred to truth* still exists, in spite of our boasted nineteenth centuryism. That same spirit it was which thrust Gallileo into a dungeon; kept Copernicus thirty years in silence; let Kepler linger in poverty; and which compelled Newton to conceal for many a year the MS. of his "Principia," lest offence should be taken by the jealous *savans* of his day. Very rarely do we see any justice done to the men who attempt to inform or instruct their fellows. How, then, can a man so humble and unknown as the writer of these lines expect to be forgiven for thus venturing to exhibit the errors that exist in that astronomy, which so many are proud to point to as the greatest monument of human skill, and the brightest jewel in the crown of human intellect?

But I fear not the shafts of those critics who condemn without examination; and I can quietly "bide my time," and take shelter under the *Ægis* of never-failing truth; to the votaries of whom I appeal for a final verdict.

Let it not be imagined that I pretend to bring forward in this mere tract, written to call the atten-

tion of abler geometers than myself to the subject, anything like a perfect treatise on the Solar System.

It must not be expected that in this primary essay, I can launch forth, like Minerva full grown from the head of Jove, a work containing all that this vast and extensive topic may embrace. It rather pretends only to exhibit the foundations of a system, such as nature presents to our view; and which the more it is examined, the more we find to admire and to respect, as the handy-work of the Great Architect, whose works and whose ways are past finding out.

Let not my critics exclaim that the *name* of Newton alone shall suffice to smother the little fire that may appear in these pages. Let them remember rather that no name, however great, can ever entirely smother the flame that is lighted at the torch of sacred truth. And let it also be remembered, that Newton, in his efforts to uphold and demonstrate the discoveries of Kepler,* did not possess all the

* "The laws of elliptic motion about the Sun as a focus, and of the equable description of areas by a line joining the Sun and planets, were originally established by Kepler."—*Sir J. Herschel.*

data necessary for resolving the problem of the laws of elliptic motion. He knew nothing of the grand fact, that the *focus* of the ellipse—the Sun itself—is in constant and enormously rapid motion—nearly 100,000 miles in an hour! and then let us remember that Newton, with all his wondrous powers as a mathematician, was no more than human. And let us not forget that *humanum est errare*. Even Newton fell into grievous errors, and wrote much that was *unfit to meet the public eye*. Let me not be condemned for this remark until the following statement, published in 1822, by Mr. Prescot,* and never, I believe, contradicted, shall be overthrown.

On looking over a catalogue of Sir Isaac Newton's manuscripts and papers, as annexed to a bond, given by Mr. Conduit to the administrators of Sir Isaac; by which he bound himself to account for any profit he might make by publishing any of the papers; I find that Newton treated on the following important subjects, viz. :—*Church History; Prophetic Style; Temple of Solomon; The Sanctuary; Corruptions of Scripture; Paradoxical Questions concerning*

* Inverted Scheme of Copernicus, p. xli.

Athanasius; Working of the Mystery of Iniquity; Theology of the Heathens; Account of the Contest between the Host of Heaven and the Transgressors of the Covenant; History of the Prophecies.

Dr. Pellett, it appears, by agreement of the executors, entered into Acts of the Prerogative Court, and was appointed to peruse all the papers, and judge which were proper for the press. He accordingly did peruse them, and judged those, enumerated above, *not fit to be published.*

One cannot help inquiring *why* they were not fit to be published? We have been told over and over again, that he was sent by Heaven to remove the veil that covered Nature, and to enlighten mankind; and yet, notwithstanding that assurance, we have evidence laid before us, that he, with incalculable pains, wrote perhaps eight or ten folio volumes, upon the most important matters, which were "*not fit to be published!*" "It is astonishing," says his biographer, "what care and industry Sir Isaac had employed about the papers relating to Church History, Chronology, &c., as on examining the papers themselves, which are in the possession

of the family of the Earl of Portsmouth ; it appears that many of them are copies over and over again, often with little or no variation ; *the whole number being upwards of 4,000 sheets in folio (16,000 pages), or 8 reams of folio paper, beside the bound books, &c.* in this catalogue, of which the number of sheets is not mentioned. Of these 4,000 sheets, exclusive of the bound books, there have been published *only* the Chronology, and Observations on the Prophecies of Daniel, and the Apocalypse of St. John." There must be some great mystery in the condemnation and suppression of this mass of the *pious labours* of this "Pride of the Seventeenth Century," as the Monthly Reviewers term him—this "name which far surpasses that of Princes." *

I beg to observe here that I do not join in the sneer against Sir Isaac ; but have quoted this passage to shew that he was not infallible ; and

* It does seem an incongruity, I must confess, that Newton should have brought similar arguments to prove that the Moon goes in an ellipse round the Earth (or centre of gravity), as its *focus*, which said focus is in rapid motion, as he brought to prove that the Earth goes also in an ellipse round the Sun, as its *focus* ; which said focus is said to be perfectly stationary. However, this matter I shall enter more at large upon in the chapter on the Moon's motion.

that, therefore, I am justified in observing that his *name*, or any other *great name* alone, should not deter us from following the advice given in another great man's work—"to *consult sense* about those things that fall under the cognizance of it, *and to examine by experience whether men have not been mistaken in their Hypotheses and Reasonings.*"*

Of all the weaknesses of the human mind, perhaps there is none more ridiculous, more pitiable, than that of vaunting. Yet it seems to be the besetting sin of men, calling themselves philosophers in our days. The vanity of the "Nineteenth Century Men," who have for ever in their mouth—"the Steam Engine," "the Spinning Jenny," "the Electric Telegraph," &c. &c. &c., is the worst feature of our age. But it nowhere shows its serpent's trail more distinctly than in books treating on the modern system of physics; or, on what is called, "physical astronomy." And, whenever a breath is heard against the goddess these men have set up, we are instantly met by a bawling crew, who exclaim, "What, would ye assail the principles of

* Hon. Robt. Boyle's Works, 2nd vol., p. 742, Ed. 1772.

mathematics?" "Would ye attack geometry itself?" "Would ye overthrow the demonstrations of Euclid?" And then a shout of derision follows; shewing the shouters, blunderingly, or purposely, confound the eternal and unassailable principles of mathematical truth, with the erroneous results arising from the ignorant, or mistaken, *application* of those principles.

Let us turn for evidence of this assertion, to the work of our greatest astronomer, Sir John Herschel. At page 206 of his "Treatise on Astronomy," we find the following passage:—"In investigating the solar motions,* the first notion we obtain is that of an orbit, generally speaking round, and not far from a circle, which, on more careful and exact examination, proves to be an ellipse, of small eccentricity, and described in conformity with certain laws, as above stated. Still minuter inquiry, however, detects yet smaller deviations again from this form and from these laws." Farther on he says, "of these deviations, and their causes, we shall speak hereafter at length. *It is the triumph of physical astronomy to*

* Meaning thereby, the *apparent* motions of the Sun, but in *reality* the motions of the Earth.

have rendered a complete account of them all, and TO HAVE LEFT NOTHING UNEXPLAINED, either in the motions of the Sun, or in those of any other of the bodies of our system."

How very idle and unworthy of the man who wrote it, is the vaunt contained in the few latter lines, of *nothing being unexplained*, will be apparent, when we turn to page 397 of the same work, where Sir John is obliged to admit, when speaking of the consequences of the proper motion of the Sun, that "it seems to be the general opinion of astronomers, at present, that their science is *not yet matured enough* to afford data for any secure conclusions of this kind, one way or another." The vaunt at page 206 had better have been omitted. Sir John tells the world at page 397 again, that, "a very ingenious idea has been suggested by the present astronomer Royal (Mr. Pond), viz., that a solar motion, if it exist, and have a velocity at all comparable to that of light, must necessarily produce a *solar aberration*, in consequence of which we do not see the Stars disposed as they really are, but too much crowded in the region the Sun is leaving—too open in that he is approaching."

Now this "idea" will prove to be anything but "ingenious," when the reader comes to see that I have proved that the motion of the Sun (which there is no reason to believe is other than regular and equable) is just about 100,000 miles per hour; instead of, according to this "ingenious idea," being 691,200,000 miles per hour; which it must be, if it move equally swift with light, as this is known to move 192,000 miles in a second, which, as there are 3,600 seconds in an hour, gives a product of just 691,200,000 miles! In fact, such astoundingly rapid motions as these, are not likely to exist as regards solid bodies *anywhere*, least of all as refers to a huge body like the Sun, which is about 355,000 times as ponderous as the earth. One exception I must make to this statement—they do certainly exist in the imaginations of our modern astronomers.

I must now make a few observations to meet the reasoning, if such it may be called, of those persons, the calibre of whose intellect is confined to about the measure of that of the men who write astronomical critiques in general. The limit of their ideas rarely exceeds the notion that, "modern astronomy must be true, because astronomers can calculate and foretell

eclipses correctly." To such persons I would recommend the recollection of the fact, that eclipses were foretold by the Chinese many thousand years ago; but on what principle of calculation we know not, though certainly not that of the modern European astronomers. Also, that the system of "concentric spheres," when the Sun, Moon, and heavenly bodies, were believed to climb up from the eastern horizon along the convex side of the heavens, and descend again into the western ocean; and so, also, the more artificial system of eccentric spheres and epicycles, invented by Apollonius, perfected by Hipparchus, and taught by Ptolemy; again, the yet more complex systems of Purbach, and his disciple Regiomontanus, all these equally well enabled those who adopted them, to foretell eclipses of the Sun and Moon, and conjunctions of the Planets. Let not the question, therefore, of the truth or falsehood of the modern Keplerian and Newtonian system of *ellipses*, be encumbered with that with which it has nothing to do. For if the mere fact of the lunar eclipses were to be considered alone, as evidence of the truth of the elliptical motions, it would fail entirely to prove them, since it will be seen that I demonstrate most clearly that, if the Moon really moved round the

earth, either in an ellipse or a circle, there never could possibly be any eclipse of the Moon at all. Indeed, so long as the SUN, the centre, and as it were, the very soul of the system, was thought to have either a *false* motion, concentric, or eccentric, and in epicycles; or was thought to have no proper motion at all, as the modern elliptic system supposes, the real truths of nature were necessarily obscured. It will only be when the real motion of the Sun through space, in a right line, or if in a curve, in one so large that we cannot distinguish the portion with which we have to do from a right line, is received and adopted, that we shall possess an unassailable system of astronomy, such as nature presents, and such as man has *not* invented.

One word in conclusion, as to the present system of ellipses. I am ready to admit its great utility, although I believe that astronomy will become far more simple, and therefore, more extensively understood, and far more generally practised, when it shall have given place to that which alone is *true*; the system now offered to public notice, and which I denominate the *system of cycloidal curves*; because I find that the Earth and other Planets, as also the

Moon and other satellites, do indisputably move for ever in such curves. And it will be found that, although means are at present wanting to calculate the places of some of the heavenly bodies on this system, there is evidence that the Earth's true place, or the apparent place (longitude) of the Sun, and heliocentric longitudes of the Planets, may be most readily determined thereby. And it is fair to conclude, that modes will be discovered of determining, at any time, all the heliocentric and geocentric places of the other bodies of the Solar System by the same, or similar means. All that I have attempted to do, is to throw out a few hints of how the motions take place, and to prove that they are confined to two distinct motions, arising from *two only forces*; one of them I term the *direct force*, which carries the Sun and all the system *forward in space*; and the other, the *lateral force*, which carries the Planets from side to side of the Sun, and acts in a line at right angles to the line of *direct force*. The direct force acts, of course, on the satellites, as well as the Primary planets, and these, the satellites, obey the *lateral force* also, while at the same time they obey a *secondary lateral force*, causing them also to pass from side to side of their several primaries.

The result is, that the Moon, for instance, forms twelve *small cycloidal curves* upon the Earth's course, from New Moon to New Moon, while she and the Earth together form one *large cycloidal curve* in the course of a year, upon the Sun's course through space.

I have only to add my earnest hope that these truths may prevail speedily, as prevail they must at length, to the glory of God and benefit of mankind.

THE
SOLAR SYSTEM AS IT IS:
AND
NOT AS IT IS REPRESENTED.

CHAPTER I.

THE THEORY OF ELLIPTICAL MOTION—ORIGINAL MOTIVE FORCE, OR “PUSH” GIVEN TO THE PLANETS—NO PUSH GIVEN TO THE SUN—EXAMINATION OF ELLIPTICAL MOTION—ITS APPARENT EXISTENCE—ITS REAL EXISTENCE DISPROVED: 1st. BY THE NATURE OF MOTION; 2nd. BY THE NECESSARY CONSEQUENCES OF THE EARTH BEING REMOVED FROM THE SUN, NOT BEING EXPERIENCED—EXPERIMENT TO PROVE THAT THERE CAN BE NO MOTION IN AN ELLIPSE, WITH A MOVING FOCUS—THE PLANETS ACTED ON BY TWO FORCES ONLY, WHICH PRODUCE CYCLOIDAL CURVES—THESE, SEEN IN A RIGHT LINE, AND NOT IN PLAN OR SECTION, TAKE THE APPEARANCE OF ELLIPSES—ANCIENT SYSTEMS—HIPPARCHUS, PTOLEMY, GOPERNICUS, KEPLER, &c.

It is well known that the Sun has hitherto been considered to “stand still” in the heart of the System of which the Earth on which we exist forms a portion. No motion has been attributed to this immense body, except that of rotation upon its axis, once in about 25 days. It has been deemed necessary for the satisfaction of the curious, however, to shew how it is that the Planets do not *fall into the Sun*, to which they are said to be *attracted*; and this

has been done by supposing a *tendency* on the part of the attracted body to fly off at a tangent, and so escape from the body to which it is said to be attracted. This tendency is declared to exist, in consequence of the laws of motion. These laws comprise, as it is declared, one which compels bodies, if *once put in motion*, to continue to move for ever in the direction *given them*, if not turned aside or arrested by any other motive force. And it is farther declared that the Planets, having had this original *push*, have ever since obeyed the same, and would still obey it if they could, and that it is only because they are *attracted towards the Sun*, by a force just equivalent to that which disposes them to *leave him*, that they jog on together in mutual agreement. Strange, that they should all have had this original "*push*" in the *same* direction, or nearly so, and that, therefore, they should all move nearly in the *same* plane. True, they are occasionally wheedled away, it is said, being *attracted* again by their fellow Planets, and pulled sometimes this way and sometimes that; yet they obstinately strive and contrive to keep in the same plane. The Earth, for instance, we are told, obeys the coaxing of Jupiter and Saturn, the former about 500,000,000 of miles away, and the latter over 900,000,000, which is nearly ten times as far as the Sun is distant. Stranger still it is that the SUN should have never received this original "*push*," but have been passed by when the Planets were bowled into space, and so remained to this

day, nobody being able to explain why *he* did not "FALL" somewhere. Surely, if there required some guiding hand to poise the Earth at its first formation, there should have been some attention paid to that much larger body, the Sun, which is more ponderous than the Earth in the proportion of 354,936 to 1! It is not reasonable, I submit, to think that if any original "push" were really given to the Earth and other Planets, this enormous body that supplies light and heat to all the others, should have been forgotten, and left to roll round upon its axis, for no sensible reason that we can discover.

We will now examine this said *elliptical motion*, and endeavour to determine whether, notwithstanding great names, it really ever did or could exist, while the *focus* of the ellipse were in motion.

No doubt the elliptical motions of the Earth and Planets do *appear* to exist; and there can be as little doubt that, if the *foci* were at rest, they might and would really exist. But the moment the Sun, the *focus* of each of the planetary ellipses, begins to move forward in space, the bodies forming the ellipses FOLLOW him (or otherwise they would be left behind), and so they cease to form elliptical figures. Let us conceive the Sun to be at S, the focus, in Fig. 1, Plate VI. Let the Earth be supposed to course round the ellipse from A to B C and D. Then let us try to imagine the Sun at S, carried forward in the direction of *D and M to N, while the Earth moved from A to B, during one quarter of a

year. Who does not see that when the Earth had reached half way to B, viz. to x , the Sun would have reached half way to N, viz. to the place of M, and that the Sun and Earth would be separated and far beyond the usual distance they are found at in any part of the ellipse? But as the Earth is to go on forming the ellipse, it will at length reach B, about the time the Sun will reach N, and clearly, the distance between them will be that contained between B and N, which is something over *seven* times the distance from B to S, that which would have been between them if S had remained stationary in the focus of the ellipse.

Let us now conceive that while the Sun, at S, is carried forward in the manner described towards M, N, that the Earth were really carried in the *opposite* direction to B, should we not find the Sun appear greatly diminished in size? Would not the Earth, in fact, be left behind and part company from the Sun? Would not a drear winter ensue, and entire destruction to the animal and vegetable world, assuredly follow? But as none of these evils ever occur, as light and heat, summer and winter, "seed time and harvest," for ever continue without sensible alteration, may we not rest assured that such is *not* the relative condition of the Sun and Earth? Will the astronomers please to assure us that we never *shall* part company from our noble Sun, the source of light and heat and life to all below?

May not the Earth be *carried on*, however, *with*

the Sun and still form the ellipse round him as his focus? To this question I distinctly answer, No; for it is an *utter and physical impossibility*. The evidence of this is clear and indisputable. For let it be observed that the Earth, when at A, and moving towards B, is leaving the line A C, and going to the *left hand* towards B, while the Sun, S, is also leaving the line A C, and going to the *right hand*, towards D. And as it is *impossible* for a body to move absolutely at the same time *in opposite directions*, through space, so it is quite impossible for the Earth at A, to move towards B, and also *at the same time* to follow the Sun from S towards D. If, therefore, the Sun have a motion towards D M N, then, so long as the Earth remains at the *same distance from him*, it is impossible that the Earth can move in the ellipse A B C D. We will now examine what would be the result if the Earth were moving *up* the ellipse, from D to A, and the Sun at the same time were moving from S towards D M N. If the Sun moved from S to D, one-seventh part of its course towards N, while the earth at D moved one-seventh part of its course towards A, viz., to *y*, then would the Sun reach D when the Earth reached *y*, and although there might not be an absolute collision between the Earth and Sun, they would be most uncomfortably near together. The result would be that intense heat, light, and drought would in this case do as much mischief as extreme cold and darkness in the other. We should be all destroyed by the fiery beams of Sol, and the very

seas licked dry from their slimy beds. Such fearful consequences, happily, never do occur; and therefore either the Sun "stands still," or the Earth moves not in an ellipse around him. Finally, let us enquire what would result if the Earth were at C, and moving in the ellipse towards D, while the Sun moved onwards from S towards D M N. Let it be conceived even that, by some means the Earth *did* keep its relative position with the Sun and same distance from him, until the latter arrived at M. The Earth, we will say, shall have reached the same relative position to the Sun, as if the latter had remained at S, when it (the Earth) would have reached D. The Sun would go straight on from S to M, and at the same time the Earth would have moved from C to *z*. And, then, who does not perceive that the Earth must have left its former course in the ellipse from C to D, and actually traversed through the *dotted line* from C to *z*? And if so, what becomes of the *elliptical* motion? From C to *z* may be a right line, or it may be a curve; but assuredly it is no part of the ellipse, A B C D.

Now we may be met by the exclamation that, "the Sun need not move in the line S M N; for he may move in any other direction and so *carry the Earth with him* in the ellipse." To this the reply is that, move the Sun in what direction you please in the same plane, the results will be similar, and equally fatal to the doctrine of the elliptical motion of the Earth around the Sun.

“But,” it may be rejoined, “the Sun may move *out of the plane of the ellipse*, and how *then* will you show that the Earth does not move with him forward in space and yet maintain the elliptical course?” I reply that—1st. If the Sun move *out* of the plane, the Earth must also move out of the plane of its course, or it would be left behind the Sun. Yet we know that it does not ever move out of the plane of the ecliptic, or the Sun would have *latitude* to an extent it has not. 2nd. If the Sun were to move out of the plane the Earth moves in, then the course the Earth would needs follow, must be that of a helix, or *corkscrew* form: which would compel a *constant variation* of the plane of the Earth’s motion; a fact that certainly does *not* obtain.

Here I would advise the reader, who may desire to form a more lucid idea of the effect produced on an ellipse, when the *focus* begins to move, to make the following simple and easy experiment. Let two persons, A and B, each take a ball in one hand, then stand facing each other and extend the hands holding the balls. Next let A, representing the Earth by the ball in his hand, move the ball around the other ball, held by B, representing the Sun. So long as B, the Sun, remains stationary, A may form an *ellipse* around the ball held by B, but let B begin to move backwards, away from A, and let A follow him and still move the ball as far as he is able around the other ball; then will it be seen that the ball held by A does *no longer form an ellipse*, but

forms a helix-like or corkscrew figure, more and more collapsed, as the motion of B is rendered more rapid.

Let both parties now resume their original position, and let A again form the *ellipse* round the ball held out by B. Then let B move laterally, on either side, keeping his ball in the plane in which the ellipse is formed:—and let A follow him, sideways, and endeavour to form the *ellipse*, as before. It will be seen that *no ellipse can be so formed*, but that the ball held by A will form a series of curves, which are what I term *cycloidal curves*.

These cycloidal curves are what I submit are produced by the *two forces* that act upon the Planets, as they accompany the Sun in its motion through space; and are also the same curves as are formed by the Satellites as they accompany their respective Planets. And one reason why they have been *mistaken for ellipses* is that, if, when bodies are moving in cycloidal curves about a central line, they be viewed from one end of their line of motion or nearly so, they will necessarily *appear* to form ellipses or circles. For, as the *forward* motion of the bodies cannot be perceived, where the spectator is himself carried forward with them (as is the case with all spectators on the Earth when viewing the Solar system), and only the *lateral* motion is detected by the observer, who sees the moving body, first on one side of the *direct* line of motion, and then on the other side, it seems to him that nothing but a

circle or an ellipse is produced, when in reality each body is forming a *serpentine* course, which results in a *cycloidal curve*. This *optical illusion* it is that has hitherto misled astronomers, who have relied too much on mere *appearances*, and not penetrated far enough into the arcana of nature to detect the *reality* and distinguish it from the *appearance*. This has, indeed, ever been the destiny of astronomical science. For, during many ages, very able philosophers both in Chaldea and Egypt, believed that the heavens consisted of a series of *concentric* spheres; and upon this false hypothesis they contrived to trace the course of the Planets pretty correctly and to make several important discoveries, as to the relative periods of those bodies and of the Sun and Moon, which they nevertheless believed to move all round the Earth once in every twenty-four hours. Then came the system devised by Apollonius, maintained by Hipparchus and taught by Ptolemy, in which *eccentric* spheres and *epicycles* figured. These enabled Hipparchus to point out first, and Ptolemy to demonstrate afterwards, the *recession* of the equinoctial points, commonly called the *precession* of the equinoxes. Numerous other discoveries were made also by this system.

“ From the time of Hipparchus, this system seems to have been pretty generally received by all those who attended particularly to the study of the heavens. That astronomer first made a catalogue of the fixed stars; calculated for 600 years the revolutions of the Sun, Moon, and five Planets; marked the places in the heavens in which, during all that period, each of these bodies should appear;

and ascertained the times of the eclipses of the Sun and Moon, and the particular places of the Earth in which they should be visible. His calculations were founded upon this system, and as the events corresponded to his predictions, with a degree of accuracy which, though inferior to what astronomy has since arrived at, was greatly superior to anything which the world had then known, they ascertained to all astronomers and mathematicians the preference of his system above all those which had been current before it.

“It was, however, to astronomers and mathematicians only, that they ascertained this; for, notwithstanding the evident superiority of this system to all those with which the world was then acquainted, it was never adopted by any one sect of philosophers. Each party of them had, perhaps, by this time, completed their peculiar theory or system of the universe, and no human consideration could have induced them to give up any part of it. The supercilious and ignorant contempt with which they regarded all mathematicians, among whom they counted astronomers, seems even to have hindered them from enquiring so far into their doctrines as to know what opinions they held. Neither Cicero nor Seneca, who have so often occasion to mention the ancient systems of astronomy, take any notice of that of Hipparchus. His name is not to be found in the writings of Seneca. It is mentioned but once in those of Cicero, in a letter to Atticus, but without any note of approbation, as a *geographer*, and not as an astronomer. Plutarch, when he counts up, in his second book, concerning the Opinions of Philosophers, all the Ancient Systems of Astronomy, never mentions this, the only tolerable one which was known in his time. The elder Pliny, indeed, a man whose curiosity extended itself equally to every part of learning, describes the system of Hipparchus, and never mentions its author without some note of that high admiration which he had so justly conceived for his merit. Such profound ignorance in the professed instructors of mankind, with regard to so important a part of the learning of their own times, is, indeed, very extraordinary.”*

* *Encyclopædia Londinensis*, p. 332.

This system maintained its authority for many hundred years, and was upheld chiefly by the *authority* of the great names of Hipparchus and Ptolemy. For though Proclus and Theon wrote commentaries on the system of Ptolemy, to invent a new one would have been then considered almost an impiety against the memory of those great men. It was not till the fifteenth century that it was interfered with, when Purbach, followed by John Müller, called Regiomontanus, made some improvements, which, however, only added to the complex nature of the system of epicycles. At length, shortly after the death of Regiomontanus, Copernicus began to plan a new system. He objected to the doctrine that the revolutions of the heavenly bodies was equable only, when surveyed from a point that was different from their centres. This was contrary to the fundamental idea that had obtained among all the authors of astronomical systems, Plato, Eudoxus, Aristotle, Hipparchus, and Ptolemy, that the real motions of such beautiful and divine objects must necessarily be perfectly regular. Copernicus found in Plutarch, that some old Pythagoreans had represented the Earth as revolving in the ecliptic like a star round the central fire. By this central fire he imagined that they meant the Sun. It soon occurred to him that if the Earth revolved on its axis once a day, all the other heavenly bodies would appear to revolve in a contrary direction from east to west. This was the only really original idea for which the world is

indebted to Copernicus, as that of the yearly revolution of the Earth round the Sun he borrowed from Pythagorus, who no doubt learned it from the Indians during his travels in their country.

It is singular that the only really great truth in the modern system of astronomy, which is so very simple, that of the diurnal revolution of the earth, although due to Copernicus, is rarely associated with his name. And it is remarkable how soon the astronomical philosophers departed from the other simple idea which he advocated, viz. : that the real motions of the heavenly bodies are "perfectly regular." For Kepler shortly after discovered that the Planets do not move regularly, but at times much faster than at others. He unfortunately did not know that *the Sun moves* as well as the Planets, or he must have observed that at the time, he thought they (the Planets) appear to move slowest, they do in reality, on the contrary, move swiftest, and *vice versa*. Kepler also first formed the idea that the Earth and Planets move in *ellipses*, which of course they *appear* to do, but which I have already proved that they cannot do in reality, while the foci of the several ellipses are carried forward through space. This most essential principle in the modern system of astronomy I have already overthrown, *negatively*; and to prove which unnecessary and opposed to the facts in nature, will be the chief business of the succeeding chapter.

CHAPTER II.

THE SUN'S PROPER MOTION ADMITTED, INVOLVES THE FACT THAT THE PLANETS MOVE THROUGH SPACE WITH HIM—THE COURSE OF THE SUN, ALTHOUGH IN A CIRCLE, MAY BE TAKEN PRACTICALLY TO BE IN A RIGHT LINE—EXTENT OF THE YEARLY MOTION OF THE SUN, NOT LESS THAN 875,696,000 OF MILES!—DISTANCE OF THE SUN FROM THE CENTRE OF HIS ORBIT, 37,300 TIMES THE DISTANCE OF THE EARTH FROM THE SUN—TRUE CAUSE OF THE PRECESSION OF THE EQUINOXES SHOWN TO BE THE SUN'S PROPER MOTION—THE SUN'S AND EARTH'S COURSES TRACED THROUGH THE SIGNS OF THE ZODIAC—THE SUN'S LONGITUDE, HOW MEASURED—THE SEASONS EXPLAINED—DIRECT AND LATERAL MOTIONS OF THE EARTH EXPLAINED, AS CAUSED BY TWO FORCES—OPTICAL EFFECTS OF THE EARTH MOVING FASTER THAN THE SUN, AND SO PASSING HIM AT THE SUMMER SOLSTICE, CONTRARY TO THE ELLIPTICAL THEORY, WHICH MAKES THE EARTH MOVE SLOWEST WHEN AT THE NORTHERN TROPIC—RATE AT WHICH THE EARTH PASSES THE SUN SHOWN TO BE 1,583,333 MILES DAILY AT MIDSUMMER—IN CONSEQUENCE OF THE RAPID MOTION OF THE EARTH AND SUN, COMBINED WITH THE MOTION OF LIGHT, WE NEVER DO REALLY SEE THE ENTIRE BODY OF THE SUN AT ALL.

If we admit, as astronomers do generally now, that *the Sun has a proper motion of his own* through space, we are compelled to perceive that the Earth and other Planets move *with* the Sun, whatever be the direction in which he moves; because the contrary supposition would oblige us to feel convinced that the Sun and Planets must part company: which we know that they do not.

We know also, that at one time of the year, the vernal equinox, the Sun is seen in a line with certain Stars; and that at the period about six months later, the autumnal equinox, the same stars are seen in the opposite direction to the Sun. In the former case

the Sun is between the Earth and those Stars ; and in the latter case, the Earth is between the Sun and those Stars. In the one case, at the first period, the Sun, if he move in the direction of those Stars, is in *advance* of the Earth ; and in the other case, at the latter period, the Earth is in advance of the Sun. Thus, during the two periods, the Earth has changed its position, from being *behind* the Sun, to one in which it is *before* the Sun. It must, therefore, have *passed by* the Sun, in moving from one position to the other. But if one body pass by another, it must move faster than that other. It is, therefore, proved that the Earth moves *faster* than the Sun does, from the time of the vernal equinox, until the time of the autumnal equinox ; or, in other words, from the time the Sun enters the sign *Aries*, until he enters the sign *Libra*. It is not quite certain that the exact line of the Sun's motion is in the direction of the Stars that form the beginning of the sign *Aries*, but it is at least highly probable that it is nearly such.

Happily we are not called upon here to say, or compelled to prove, what is the exact line of direction of the Sun's course, nor to say *whether it be a perfect right line, a circle, an ellipse, or any other curve*. For our object is to show rather how the Planetary bodies move, since we have proved that they do not and cannot move, as is generally taught and believed, in ellipses, having the Sun in one focus. However, this much we think we may announce, viz. : that the Sun evidently does move, either in a

direct course, or right line, or otherwise in a curve so extremely large, that the portion we have to deal with in speaking of one year's motion, is so infinitesimally small that we may safely consider it, as is done with very small arcs of circles, similar to a right line. Yet is the linear measure of that extremely small arc passed over by the Sun in one tropical year not less than 875,696,000 miles, the arc itself not being more than fifty seconds of a degree! This of course would lead to the fact that the Sun, if he travel in a circle, must be distant from the centre of that circle about 37,300 times his distance from the Earth. For $50'' : 875,696,000 :: 360^\circ : x$;* and $\frac{x}{3.1416 \times 2} = 354,356,231,219$ miles—the radius of the circle the Sun forms in 25,920 years. This divided by 95,000,000, the distance of miles that the Sun is from the Earth, gives us 37,300 times his distance from us, as *the distance the Sun is from the centre around which he moves.*

The reason it is conceived that the Sun moves, if in a circle, as is highly probable, just 50'' per year, is that the amount of the recession of the equinoxes is *that amount*; and, if the Sun move *backwards* in the zodiac at that rate, the Stars would *apparently* move forward at the same rate, as they really are found to do. Now, it being *known* that the Sun moves, it is much more probable that he, *one body*, should, by his motion, be the true cause of

* $x = 22,265,910,720,000$ miles.

this *apparent* stellar motion, than that *all those numerous bodies should coincide* in moving exactly at this precise rate.

For all present practical purposes, however, the Sun's course through space may be regarded as a right line. And accordingly we shall so consider it; and we will now proceed to examine how far we can solve the phenomena of the Solar System upon this hypothesis.

If the reader refer to Plate I., he will observe that the Sun's course through *fifteen* signs of the zodiac, is represented by the right line A B, which depicts his course from the tropic of *Capricorn* unto the same tropic again, and the continuation of it unto the vernal equinox again at B.

The first thing to note is, that by the line ϖ , S T on the left hand, we denote the radius vector, or line reaching from the centre of the Sun to the centre of the Earth. The Sun is supposed to be at A, and the Earth at S T, about 95,000,000 of miles distant from each other. A line (dotted) is then drawn from the *south* tropic at an angle of $66^{\circ} 32' 31''$ (which is the complement of the mean obliquity of the ecliptic for 1857, January 1st), and it will be found to cross the Sun's path, exactly half-way between *Capricorn* and *Cancer*, viz.: at the first point of *Aries*, or place where the Sun will reach at the moment of the vernal equinox. It must be observed that that same (dotted) line, if continued, will reach the tropic of *Cancer*, at N T, which

imports the *northern* tropic, and that it cuts the Sun's course at an angle on both sides of $23^{\circ} 27' 29''$ which is the angle of the Sun's *extreme* declination, both north and south, commonly called the obliquity of the ecliptic.

We will now proceed to trace the Earth's course, from the time of the vernal equinox, where its place is found in the same line with the Sun, marked V E. The distance from the Earth at that point to the place of the Sun, who is then at ν , is very nearly the same (in this diagram 1.5 inch) as it is at the south tropic S T, and at the northern tropic N T, viz.: very nearly 95,000,000 miles. Let the reader now observe that the Sun's place when entering γ , *Taurus*, about the 20th of April each year, is here represented, on the line A B at γ , and that the Earth's place is shown for the same period at a , being at an angle of *thirty degrees of longitude* from the place of the Sun. And that the latter is now one-third of the distance (or nearly so) from ν to ϖ , viz.: from the vernal equinox to the summer solstice. Then, to trace farther the Sun's course; we find his place about one-third farther along the line A B at π , where he is about the 21st of May. The Earth is then at b , where the *angle of longitude* amounts to *sixty degrees*. Next we find the Sun's place at ϖ , *Cancer*, the point of the summer solstice; being one-fourth of the whole of his yearly course from ν Aries, the vernal equinox; and when he is there, about the 21st of June, we find the Earth

at N T, viz., at the *northern* tropic; where the angle of longitude is ninety degrees, the Earth now being at a right angle from the line A B, which represents the course of the Sun. Having traced the Sun's path from the vernal equinox to the summer solstice, or one-fourth part of his yearly course, we will now stop to discover, if possible, the *distance* he travels during the first quarter of the year, commencing at the vernal equinox, from whence we may easily determine the whole extent of his annual motion, and consequently the *rate* of that motion.

In the right angle ν , ω , N T (*Plate I.*), we have given the angle at ν , equal to the obliquity, viz., $23^{\circ} 27' 28''.75$ on the 1st January, 1857, according to the Nautical Almanac. The obliquity will be slightly diminished by the 21st March, 1857, but this will not affect the calculation we are about to make. We have also given the right angle and the side ω , N T=95,000,000 miles; being the Earth's distance from the Sun when at the northern tropic.*

Log. sine, $23^{\circ} 27' 28''.75$ —arith. comp.	=	0.400033
95,000,000 miles—log.	.	7.977724
Log. cosine, $23^{\circ} 27' 28''.75$.	9.962536
Log. of the distance \odot moves from	}	= 18.340293
ν to ω 218,924,000 miles	.	

* If we take a more exact account of the Earth's distance from the Sun, the result will come out slightly different. But when we reflect that the parallax of the Sun has not been so satisfactorily determined as we may hope it will be a few years' hence, when Venus will transit the Sun's disc, we conceive that it is safer to adhere to the numbers generally fixed on as the Sun's *mean* distance.

This is the amount of the Sun's motion when passing from ϖ to ϖ , through 90° of longitude; and, if multiplied by 4, gives us 875,696,000 of miles for his *annual course*.

$$\begin{array}{rcl} \text{Now from log. of } 875,696,000 & . & . = 8.942353 \\ \text{Take log. of the length of the year} & \left. \vphantom{\text{Now from log. of } 875,696,000} \right\} & 2.562591 \\ \text{365.242264 days} & . & . = \end{array}$$

$$\begin{array}{rcl} \text{It gives the daily motion} & = 2,397,516 \text{ miles} & = 6.379762 \\ & -\text{log. 24 hours} & = 1.380211 \end{array}$$

$$\text{It gives the hourly motion} = 99,897 \text{ miles} = 4.999551$$

What a magnificent idea is this! The conception is sublime. That glorious Sun, in magnitude equal to one million, three hundred and eighty-four thousand, four hundred and seventy-two such Earths as this we inhabit, rolling along through the interminable fields of unmeasured space, at the enormous rate of 99,897 miles in one hour; one short hour of sixty minutes! This gives a motion to that vast and ponderous body, which is in diameter 882,000 miles, and in weight 354,936 times that of this Earth;* a motion, we say, of 1,665 miles per minute, or of $27\frac{3}{4}$ miles in each single second of time! Well may we exclaim; "If such be the Sun itself, and such the stupendous motion of the Sun, what must its Creator be!"

Let the reader now peruse farther the course of

* If the calculations of Sir John Herschel be correct.

the Earth and Sun through the remainder of the year, as shewn in the diagram, Plate I.

One-third, or near it, of the line contained between ϖ and \sphericalangle , the Sun's places at the summer solstice and the autumnal equinox, will give us the Sun's place when entering α , Leo, about the 23rd of July each year. The Earth will at the same time be found at c , where the angle of the Sun's longitude from *Aries* will be 120° . Again, at about two-thirds from ϖ towards \sphericalangle the Sun is found at μ , Virgo, about the 23rd of August each year, the Earth being at d , and the angle of the Sun's longitude from *Aries* will be 150° . Next we find the Sun completes the portion of his course from ϖ to \sphericalangle , and arrives at \sphericalangle , the autumnal equinox, on or about the 23rd of September every year. He is now found *behind* the Earth, which has advanced beyond him, and is crossing his path at A E, the autumnal equinox, when the Sun has 180° of longitude from *Aries*, being in the opposite point.

Thus, we find that the Earth has moved from V E, where it was on the 21st March, to A E, where it is on the 23rd September; and that though behind the Sun, at the vernal equinox, 95,000,000 miles, it had reached the same line with the Sun, or overtaken it in space, though still keeping very nearly the same distance, when it got to N T, on the 21st June. And again we find that, during the summer quarter, the Earth moved so much faster than the Sun, as to get, by the 23rd September, just

about the same amount of 95,000,000 of miles *before* it, that it had previously been (on 21st March) *behind* it. Therefore, independently of its moving in a curve and thereby going much farther, the Earth has in absolute linear measure gone through space just double its distance from the Sun, or 190,000,000 of miles, *farther* than the Sun has done from the spring to the autumn equinox.

We have now followed the Sun's motion and that of the Earth from the vernal to the autumnal equinox; and it remains to trace the same motions from the time the Sun enters *Libra*, till he reach the winter "solstice" at ν , when the Earth is at the *south tropic*, and so on till the Sun again reach *Aries* at the vernal equinox at B, and the Earth is found at V E on the right hand of the diagram, and the year's course of both bodies is complete.

A preliminary remark, before we examine the course of the Sun when in the southern hemisphere, may not be out of place. The Earth has been seen to travel *faster* than the Sun, during the time the latter was in the northern hemisphere; and consequently to pass him in space and so arrive at a position *before* the Sun in its course, being still about its usual distance of 95,000,000 miles from him. It will now be found that the Earth moves *slower* than the Sun, while south of the equator. We observed that the *dotted* line from the south tropic S T on the left hand, to the northern tropic N T, *exactly divided* the line of the Sun's path at ν , half-way from ν

to ε ; and we may now remark that a similar line drawn from N T to S T on the right hand *exactly divides* the Sun's path again at ε , when moving from ε to φ . The angles of declination are here just the same as before, viz.: $23^{\circ} 27' 28''$ on both sides of the line of the Sun's motion, and the dotted line reaches from tropic to tropic. The *distance* the Earth is when the Sun is at the extreme of his declination, being apparently the *same* in each case.

It is manifest that if the Earth always *gain* upon the Sun while he appears in the northern hemisphere, it must *lose* an equal amount while he is in the southern hemisphere; or otherwise the two bodies must eventually part company. And accordingly, it will be found that, after the Earth has crossed the Sun's path at ε , it begins to move *slower* than the Sun; and consequently the latter, the Sun, has overtaken the other (the Earth), as far as regards motion forward in space, by the time it, the Sun, reaches the winter solstice, at φ , on the right-hand of the diagram.

When the Sun has passed about one-third of its course from ε to φ , it arrives at m , Scorpio, about the 23rd of October; when the Earth will be found at e , where it forms, with the Sun, an angle of *thirty degrees* of longitude from the 1st point of ε , or 210° of longitude from φ . About the 22nd of November the Sun will arrive at two-thirds of its distance from ε to φ , and be found at ξ , Sagittarius, the Earth being then at f , forming an angle with the

Sun of 60° from \sphericalangle , the longitude of the Sun being 240° from ϖ .

Again, about the 21st December the Sun will be at the winter solstice \wp , on the right hand, and the Earth at the south tropic, S T, on the right hand, forming a right angle with the Sun from \sphericalangle , the longitude of the latter being 270° from ϖ .

The Sun now goes onwards, continuing to exceed the rate of the Earth's motion; and in another month, about the 20th January, reaches a third part of his motion from \wp to ϖ , on the right hand, and is found at ♈ , Aquarius, on the right hand, while the Earth is seen at g , forming with the Sun an angle of 120° from \sphericalangle , and 300° from ϖ . Again, on the 18th February the Sun reaches ♉ , Pisces, and the Earth is found at h , when the Sun is seen to form an angle of 150° from \sphericalangle , and 330° from ϖ . Lastly, the Sun is at the point B, or ϖ , the vernal equinox, on or about the 21st March, and the Earth is found once more on the same line, being, as before, at the distance of 95,000,000 of miles from him. Thus the two bodies, the Sun and the Earth, have been traced from ϖ , on the left hand, through 12 signs to ϖ , on the right hand, being an entire year's motion. The place of the Earth is in each case laid down at an angle equal to the Sun's longitude, from that body; and at the same distance, as when on the tropics, which is 95,000,000 miles, shewn on the diagram by 1.5 inch.*

* On this scale, no slight change of distance could be exhibited.

The straight dark line drawn from the body of the Earth to the line A B, representing the Sun's course, is in each case the *sine* of the longitude: the manner in which these sines are determined will be entered upon in a future chapter.

We shall now point out how the *seasons* are shown by the relative positions of the Earth and Sun throughout the diagram we have been considering, Plate I. It will be seen that I have comprised the motion of the Sun and Earth in this diagram during *fifteen* months. This has been done for two reasons, 1st, To show the *form* of the Earth's course during an entire year, from the south tropic, ϖ , to the same south tropic, ϖ , again; which course is seen to be a curve, that forms no part of either a circle, or an *ellipse*, but is in fact, nothing but a **CYCLOIDAL CURVE**. If the reader refer to Plate II., he will see the Earth's course continued on during *two* entire years, beginning and ending with the Earth situated on the south tropic. It will there be seen that, year after year, the Earth moves on, *with the Sun*, forming continually a series of *cycloidal curves*; that is to say, one such cycloidal curve every year during its progress from the south tropic until it again reach that point.

To return to the question of the seasons. If the reader turn to the diagram, Plate III., he will perceive the Sun represented at S at the vernal equinox and the Earth at A, on the line of the Sun's motion. The north pole of the Earth, being

depressed from the perpendicular $23\frac{1}{2}$ degrees, is not of course visible; and the south pole being raised an equal amount, appears in the drawing. The Earth presents its central part to the Sun, a right line from which falls on the equator at right angles to the poles; and the rays of light, therefore, reach both poles, and produce the alternate conditions of day and night, by the rotation of the Earth on its axis, which conditions extend from the north to the south pole. In this position the days and nights are equal. If we now turn the eye to the place of the Sun at S' , we shall find it removed half-way from S , its place at the equinox, to S'' , its place at the summer solstice, being in about 45° of longitude from α , where it is found each year about the 5th of May. The Earth will now be at B , at the same distance from the Sun as when at A , but the north pole will now incline somewhat towards the Sun, which body will now cast its rays to the north of the equator, about $16\frac{1}{4}$ degrees; that being the amount of what is termed the Sun's declination, which is caused by the north pole, in consequence of the Earth's motion forward in space, becoming *inclined towards the Sun*. The days now, in our part of the northern hemisphere, exceed the nights about three hours. Again, by looking farther on the line from S to S'' , we find the Sun where he is at the summer solstice, about the 21st of June. The Earth is then found at C , having its pole inclined towards the Sun the full amount of

$23\frac{1}{2}$ degrees, and the line from the Sun's centre to that of the Earth, striking the Earth on the northern tropic, is now found to form a right angle, or 90° of longitude from γ . The Earth has now its northern hemisphere wholly illuminated by the Sun's rays, which extend 90° to the north of the northern tropic, and so reach $23\frac{1}{2}$ degrees beyond the north pole. The longest day is reached in the north, and the southern pole is buried in perfect darkness.

The Earth at C will be found to have overtaken the Sun; as from having been 95,000,000 of miles *behind* it at A, it is now (at C) found as far advanced in space as the Sun. It follows, therefore, that it has moved *faster* than the Sun; the result, therefore, is that the stars, which, when the Earth was at A were 90° from the Sun to the right hand, appear now in the same line of vision, or what is termed "in conjunction" with the Sun. Those stars are such as appear in $0^\circ 0'$ of α , where the Sun has now arrived. Let us now consider that this effect, this change of position and increase in longitude of the Sun, has arisen, not from the fact alone of the Sun's motion forward, but also from the other fact that the Earth has also moved forward in the same direction, and *at the same time* has moved *outwards* from the Sun's line of motion; or in other words, has obeyed the *direct force* which urges the Sun upon its forward course, and simultaneously has obeyed the *lateral force*, which has

thrown it out 95,000,000 of miles from the line of the Sun's course.* These two are the only forces that I can perceive to have any extensive power over the Earth; and if we find (as we shall) that, due allowance being made for the slow but regular change of the angle of the pole's depression, commonly called the obliquity of the ecliptic, the exact longitude of the Sun at any time in any two years is always proportional to the time elapsed since the

* It is remarkable that, although astronomers are aware that, if any one body seem to, or attempt to move round another body, while the latter is itself in motion, there must result from this compound motion, a curve, which has been termed a *cycloidal* curve, they have never reflected that it was evident that as the Sun is believed to move through space, or to have a "*proper* motion" of his own, the Planets must of necessity move in *cycloids* and not in ellipses. Mr. Woodhouse, at page 172 of his "Elementary Treatise on Astronomy," published in 1812, observes, while treating on the effects of nutation, and describing a diagram of this motion, "that since the true pole is supposed to move round *p*, while *p* itself moves, it is plain that the true pole must describe some curve arising from these two compound motions;" he afterwards adds, "the curve traced out by the true pole will be an *epicycloid*." He further on states that, "the epicycloidal curve will be described, if we abstract the consideration of the small circle described in consequence of the solar inequality of precession." And he says, "the imaginary description of the ellipse is supposed to proceed whilst the mean pole, the centre of the ellipse, is from the effect of precession, regressing; consequently, as in the case of the solar inequality, the true pole, by the combination of the above circular and elliptical motions, will describe an *epicycloidal* curve."

If Mr. Woodhouse had carried his researches forward on the subject of these compound motions in the heavens, and remembered the motion of the Sun, the true phenomena of the Solar System and the character and rate of the Sun's motion, would not have been left for my feeble pen to describe.

Earth passed the last equinox, we are irresistibly driven to the conclusion, that the above-named *two forces alone* act upon the Earth, and that it is *not* subject to the attraction of the Sun as taught by the Newtonian system.

If, then, we are enabled to compute the exact amount of the Sun's longitude from ϖ , at any time in any distant year, by merely taking into account the change in the *mean* obliquity of the ecliptic, and the consequent alteration in the Sun's declination at the moment for which his longitude is required, we thereby prove that the Earth moves *equally* as regards the same period in any two or more years as well as the Sun. We also prove that the idea of modern astronomers, that the other Planets and the Moon *attract* the Earth and so draw it out of its regular course, is unfounded; and so far as that idea is taken to be evidence of the general laws of *attraction* and *gravitation*, these principles are unsupported by the facts of astronomy.

Before we conclude this chapter, I would draw the reader's attention again to Plate I.; when he will perceive that it is the Earth's motion from V E, the vernal equinox, to N T, the northern tropic, that causes the Sun to *appear* to move forward in longitude; and the different angles of longitude at *a* and *b* and at N T are produced by the Earth's relative change of place *forward* and *outward*, the effects of the *direct* motion it has, com-

bined with its *lateral* motion. I would then draw attention to the fact that at N T the Earth actually *passes* the Sun; and that the increase in the Sun's longitude, afterwards, is produced by the Earth moving *faster* than the Sun, and so leaving it behind, as it were. For, although the Sun, in moving from ϖ to Ω has gone at his regular rate, of 2,397,516 miles daily, the Earth, when passing from N T to e , has, in reality gone much faster than the Sun, and got beyond it by a quantity equal to the extent of the Sun's course contained between Ω in the diagram, and the right line extending from the Earth's centre at e to the line of that course, which will be about 47,500,000 miles. This passing of the Sun by the Earth is nowhere more rapid than when the Sun is in the sign *Cancer*. The effect of the Earth passing the Sun is to make the Sun *appear* to pass the Stars in the *opposite* direction;* that is, to increase his longitude. But, as the change of declination is then at the *minimum*, not exceeding three degrees from the 21st June to the 21st July, and as the two bodies do, therefore, move nearly parallel, the parallactic effect is small in proportion, and the angular change is at the *minimum*. So that the Sun *appears* to move forward in the zodiac at the slowest rate,

* Just as when we travel in a railway carriage and pass a person on horseback, who may be going ten miles an hour in the same direction as ourselves, but if we be going fifteen miles an hour, he will *appear* to be going backwards.

viz. : about 57' per day, or about 4' daily less than he moves at the opposite period of the year.

The Newtonian system falsely attributes this effect of the *apparent* slow motion of the Sun to the Earth's moving *slower* at the time of its being at the summer tropic than at any other time. But the *reverse is the truth* ; for the Earth, when passing the northern tropic, does really move *faster than at any other time* ; and although we have seen that the Sun travels onward at a fearful rate, we must remember that the Earth rapidly *passes* him at midsummer and is, therefore, moving much faster. The rate at which the Earth passes the Sun at this time of year, on an average daily from 21st June to 21st July, may be seen from the following calculation :—

$$\begin{aligned} \text{Sun's motion in 30 days} &= 2,397,516 \times 30 = \\ &= 71,925,480 \text{ miles.} \end{aligned}$$

47,500,000 miles, the Earth passes the Sun.

$$\begin{aligned} 30) \quad 119,425,480 &= \text{Earth's motion in 30 days.} \\ \quad \quad 3,980,849 &= \text{Earth's motion daily.} \\ \quad \quad -2,397,516 &= \text{Sun's motion daily.} \end{aligned}$$

1,583,333 = rate at which the Earth *passes* the Sun.

On the Newtonian system, the Earth is supposed to move, on an average, about 68,000 miles per hour, but it will be really found to move as above, which is equal to 165,827 miles per hour, or 2,768 miles in a minute ; and this is at the amazing rate of forty-six miles every second of time !

This enormous rate of motion must have some considerable effect on the phenomenon termed the aberration of light. For it is clear that if light be, as it is found to be, above eight minutes passing from the Sun to the Earth, then the Sun, which moves 1,665 miles in one minute, must be at least 13,320 miles removed away from the place he was in when he emitted the rays which we see. It follows, therefore, that we never see the Sun in the place he really occupies, but always see the *rays* that he put forth eight minutes earlier, and that when we see them the centre of the Sun is removed 13,320 miles forward on its course. Therefore, to speak with rigid exactness, we may say, that in consequence of his rapid motion and the nature of his light, which is propagated in straight lines, we do never really see the *entire* of the body of the Sun at all.

The Sun appears to be, when at the summer tropic, just one-30th part less in diameter than when at the winter tropic. The proportions being as 1892" to 1956." But the diameter of the Sun measures just 882,000 miles; and as light takes $8^m. 7.5^s.$ to reach the Earth, the Sun must move during that time (going 1,665 miles per minute) exactly 13,500 miles; and if we divide 882,000 by 13,500, we get just 65 as the quotient, this is the portion, therefore, of the Sun's body, which is lost, as it were, to our vision. Now, the apparent diameter of the Sun at the summer tropic, is

31' : 32", and when at the winter tropic, it is 32' : 36". The mean of these is 32' : 4", and if we add one-65th part of the summer diameter to 31 : 32, we get this mean, and if we take one-65th part from the winter ditto, we get the same mean. This would seem to show a connexion between the motion of the Sun (which though equable itself, is apparently affected by the unequal motion of the Earth), and its apparent dimensions. But the subject is one for farther investigation, and is only named here incidentally. The various rates, however, at which the Earth passes the Sun, must have some effect on his apparent diameter, since more or less of his rays are evidently lost thereby.

CHAPTER III.

COMPARISON OF THE ARTIFICIAL SYSTEM OF ELLIPSES, WITH THE SIMPLE NATURAL SYSTEM OF PROPER SOLAR MOTION AND PLANETARY CYCLOIDS—ACTION OF THE MOON ON THE EARTH, MAGNETIC AND NOT OF THE NATURE OF GRAVITATION—DESCRIPTION OF THE NEWTONIAN AND KEPLERIAN THEORY BY WOODHOUSE—COMMENTS ON THE SAME—THE PROBLEM OF THE “THREE BODIES” NEVER YET SOLVED—NEWTONIAN THEORY INCOMPLETE WITHOUT IT—WHY DOES A STONE FALL TO THE GROUND?—THIS QUESTION ANSWERED—THE ARCANA OF THE HEAVENS NOT SO INTRICATE AND MYSTERIOUS AS PHILOSOPHERS AND ASTRONOMERS HAVE IMAGINED—NO REASON WHY ASTRONOMY SHOULD BE CONFINED TO MEN OF GREAT LEARNING—THE CYCLOID SYSTEM EXTREMELY PLAIN AND SIMPLE, AND OPEN TO THE UNDERSTANDING OF THE MASS OF MANKIND.

IT is perhaps advisable, as a preliminary, before entering on the evidence which I intend to offer of the non-existence of any decided disturbance of the courses of the Planets, when going through space with the Sun, by the so-called *attraction* of one, acting on the others, to give a slight sketch of the Newtonian system as it now exists. This will enable the reader to follow my arguments more easily, and to compare the simple system of proper Solar Motion and Planetary Cycloids, as it exists in nature, with the extremely artificial system, invented jointly by Kepler and Newton. The least questionable method of doing this will be to quote the statements of one of the ablest advocates of the modern theory of attraction and gravitation, and offer a running commentary on those statements, by way of introduction to the theory offered under the title of the *System of Cycloids*.

The following is from page 217, and sequent pages of Mr. Woodhouse's work:—*

“*On the Inequalities of the Earth's Orbit and Motion caused by the Disturbing Forces of the Moon and the Planets.*”

A preliminary remark here occurs as to the Moon. I do admit that the Moon may disturb the Earth in its course; not, however, upon the *Newtonian principle of attraction*; but, seeing that *magnetism* extends from the Sun to the Earth; and regarding the Earth and Moon as large magnetic bodies, we may safely conclude that they, under certain circumstances, do mutually attract and repel each other. On this subject I shall have more to say when I come to treat of the causes of the *two* forces which I say are the chief causes of the motions of the Earth and Planets in *cycloids* and not in ellipses.

Mr. Woodhouse goes on as follows:—

“It was originally proved by Newton (see Princ. Sec. 3), that a body projected from A (Plate VI., Fig. 2), perpendicularly to EA, a line joining A, and a body placed at E (the latter body attracting, according to the law of the inverse square of the distance), would describe an ellipse round E.

“The body placed at E is *supposed* to exert a *centripetal* force or attraction, proportional, at a given distance to its mass, or to the number of particles it contains.”

The reader must here understand that by *centripetal* force, or attraction, is signified a power to

* Elementary Treatise on Astronomy.

draw in or towards itself. And by the body being "*projected*," is understood the operation of another and opposing force; and that these two antagonistic forces together acting on the body at A, compel it to form the ellipse round E. The projectile force is *supposed* again (for the whole thing rests upon supposition) to have been an original "push" given to the Planets, "a long time ago," as the song says; and which *push* they have felt ever since and still obey; notwithstanding the existence of an ethereal fluid, in which they float and which is known to offer so much resistance to the comets as to retard *their* course greatly. But this little objection by the way; for I shall not now stop to examine whether, as friction will abate all known mechanical motion, the long-continued friction of the ether against the Planets must not long ago have neutralised the *push*, or projectile motion (centrifugal force), and so these bodies being subject only to the *attraction* of the Sun, should have fallen into his fiery embrace and have been utterly destroyed.

"If in E A produced [continued] we place, at an equal distance from A, another body of equal mass, and accordingly of equal attractive force with the body at E, and again *suppose* the body at A to be projected; then, since it is equally urged to describe an ellipse round the new mass, as round that originally placed at E, it can describe an ellipse round neither, but must proceed to move in a direction perpendicular to E A.

"In this extreme case, the elliptical orbit, and the law of elliptical motion, would be entirely destroyed.

“If now we suppose the mass of the new body to be diminished, or its distance from A to be increased, or if we suppose both circumstances to take place, then the derangement, or *perturbation*, of the body that is to revolve round E, will still continue, but in a less degree. An orbit, or curvilinear path, concave towards E, in the commencement of motion, will be described, but neither elliptical nor of any other class and denomination.”

The reader will bear in mind that this is exactly the case with the Earth and other Planets; for as they are all said to attract each other (“according to the mass and the inverse square of the distance,” as the astronomical cant has it), so in fact it is admitted that the path they follow, is “neither elliptical, nor of any other class and denomination.” Rather a damaging admission, this; and rather provoking to be told at one time that the Planets move in *ellipses*, and at another that they do nothing of the kind. One thing at least is certain in the system I propound, which is that all the Planets and all their Satellites move *always* and *only* in the well-known curve called a *cycloid*. I leave modern astronomers to blow hot and cold in the same breath.

“In this latter case, the new body, being supposed less than the body placed at E, may be called the *disturbing* body; disturbing indeed, by no other force than that of *attraction*, with which the body at E is *supposed* to be endowed, but which latter, from a difference of circumstances merely, is denominated a *centripetal* force.

“The disturbing body, whatever be its mass and distance, will always derange the laws of equable description of areas and of

elliptical motion. If its mass be considerable, and its distance not very great, the derangement will be so much as to render the knowledge of those laws useless in determining the real orbit and law of motion of the disturbed body. In such case Kepler's problem would become one of mere curiosity, and the place of the body would be required to be determined by other means."

Now this is, in fact, always the case to a great extent, as the astronomers are ever obliged to have recourse to *observation* to correct the errors of theory. They never have yet been able even to determine the Sun's longitude from Kepler's problem of "the equable description of areas," which means that a line drawn from the Sun's centre to the Earth's centre, called the radius vector—sweeps over equal areas of the ellipse which the Earth is *said* to form, in equal times. The ellipse itself is admitted to be broken up by the *disturbing* forces of other Planets, and of course the *areas* cannot remain equal. It will be seen that I propose to substitute for this law of Kepler's the following, viz. :—"The Planets form *equal angles* of longitude in equal times, measured from their equinoxes, in any two, or more, of their periods."

"If, however, the mass of the disturbing body be, with reference to that of the attracting body, inconsiderable, then the derangements or perturbations may be so small, that the orbit shall be nearly though not strictly elliptical, and the equable description of areas nearly though not exactly true. Under such circumstances, Kepler's problem will not be nugatory. It may be applied to determine the place of the revolving body, supposing it to revolve, which is not the case, but is nearly so, in an ellipse. The erroneous

supposition, and consequent erroneous results, being afterwards *corrected* by supplying certain small *equations* that shall compensate the inequalities arising from the disturbing body."

Here I beg the reader to notice that the *principle* on which modern astronomers go, in calculating the places of the bodies of the Solar System, is this of first making "erroneous suppositions," which they know to be such; and then making long and laborious calculations to *correct* the errors they have intentionally made. Now, I submit that my system will contrast very favourably with such a round-about principle as this. For I make none but brief and simple calculations—which go direct to the point—and are founded on no supposition, but on two easily proved *facts*; 1st, that the Planetary bodies move in cycloids, along with the Sun; and, 2nd, that, starting from their equinoctial points, they traverse the same distance, and therefore form the same angles with the Sun (called angles of longitude), in the same time in all their periods, reckoning from the said points.

"In the predicaments just described, are the bodies of the Solar System. The mass of the Sun, round which the Earth revolves, is amazingly greater than that of the Moon,* which disturbs the Earth's motion; greater also than the masses of the Planets, which, like the Moon, must cause perturbations. The Earth, therefore, describes *very nearly an ellipse* round the Sun.

"As a first approximation then, and a very near one, we may

* "The Sun is 1,300,000 times greater than the Earth, and the Earth more than 68 times greater than the Moon."

determine the Sun's or Earth's place, by means of Kepler's problem, and subsequently correct such place, by small equations, due to the perturbations of the Moon and of the Planets. But how are these small corrections to be computed? By finding for an assigned time, an expression for the place of a body, attracted by one body and disturbed by another—the masses, distances, and positions of the bodies being given—that is, by solving what, for distinction, has been called *the problem of the three bodies*.

“No attempt will here be made to compute the perturbations, by solving the problem of the three bodies. That problem presents great and peculiar difficulties; so great that, instead of a complete and general solution, mathematicians have been obliged to content themselves with an approximate one; yet, even by what we have seen, the problem is essential. Newton's theory is incomplete without it.”

Here we find it admitted by an able astronomer and mathematician that this problem has never been completely solved; and yet that Newton's theory is incomplete without it; *ergo*, Newton's theory, is still, after nearly two centuries of existence, *incomplete!* May not the reason be, not that the problem is incapable of solution, if founded in truth; but that nature abhors confusion, and is ever simple and clear in her operations; and, therefore, that no such principle as this *attraction* really exists in nature. If so, as *ex nihilo nihil fit*, out of nothing, nothing can be made; where no attraction exists, no attraction can be proved to exist.

“The perturbations caused by the Planets are as much a *consequence* of his [Newton's] principle of universal attraction, as their elliptical motion round the Sun; and, when computed according to

that principle and its law, by *long and intricate processes*, they are found to be verified in the exactest manner by observation they present, although *not the most simple*, yet the most irrefragable proof of its truth."

Unhappily for this argument, the now known *motion of the Sun through space*, utterly overthrows the *possibility* of the *elliptical* motion of the Planets; and, therefore, the "principle" of universal attraction is not upheld for a moment by *that* supposition. Then, as in this work there will be found ample evidence also that the declared *perturbation* caused by the Planets does *not* at least, *always* exist; but that each Planet moves on with an equable motion (always the same at the same distance from the equinox), and is not perturbed or affected, so as to alter in general the angles of longitude it forms with the Sun, we say that the other argument in favour of "universal attraction" is at an end. These are the two chief arguments by which this doctrine is maintained. It originated in the fertile brain of Newton, and was put forth with all the energy of his amazing intellect, in utter ignorance of the *great fact* of the Sun's *proper* motion, and of the true nature of magnetism and electricity, by which the Solar System is bound together; and it must give place to newer and more decided phases of the great truths of nature.

Let the question be asked; "How then do you account for a stone falling to the ground, if you

deny that it is *attracted* to the centre, by the power of gravitation?" To this I answer, that all bodies, connected with the Earth which I deem to be a great magnet, when forcibly separated therefrom, are still magnetic; and, like the minute particles of any magnet, separated from it, may be drawn to it again, when the separating force ceases. It is quite as easy to conceive, therefore, that a stone raised from the Earth is attracted by the Earth magnetically, as that some undefined power exists in or near the centre of the Earth, which has been called gravitation.*

It will be observed that the writer mentions that these "perturbations, caused by the Planets," are computed by "*long* and *intricate* processes."

* On these subjects much ignorance exists in the public mind, as the following letter, that recently appeared in a paper of wide circulation, evinces. In fact the theory of gravitation is continually offering anomalies of this description. The body propelled from the Earth falls to it again, not in a line direct towards the centre of the Earth which it should do, if the force of attraction were concentrated in that centre; but in a line perpendicular to the surface of still water. One great reason why more discussion and more knowledge does not exist on such matters, is the overbearing manners and disgusting insolence of public writers and of "men of science," as they call themselves. Witness the horse-laugh with which Mr. Jellinger Symons was received at the British Association, when he brought forward his ideas recently, on the subject of the axial motion of the Moon. Fools and vulgar fellows laugh; men of wisdom and gentlemen discuss.

"THE MOTION OF THE EARTH.—Sir, I should be very much obliged to you if you would allow me, to ask a question through the medium of your paper. I believe that the effect of any given propelling force will greatly depend upon the size and specific gravity of the body which is propelled; how

This is a great evil in the present system of astronomy; which renders the science a sealed book to the great mass of even the well educated and well-informed classes of society. And when we consider that, the modern system of analysis, without a knowledge of which astronomers pretend that their science cannot be either understood or practically examined, requires a long and laborious course of study; and cannot be and really is not within the calibre of the mental powers of any but a very small number, indeed, of well educated men, we need not be surprised that astronomy is so little known or heeded. How rarely do we find that even men of high standing in the Universities are practical astronomers. How small is the attendance generally at section A of the British Association. How few men of even good rank in society could, or would, undertake to

is it, therefore, that the reputed propelling force of the Earth produces only one effect upon all bodies? If a common ball of 50lbs. be projected perpendicularly into the air for four seconds, it will fall into the place whence it departed; if the Earth in the meantime have moved at the rate of at least fifteen miles a second, it must have propelled the ball in a horizontal direction sixty miles; if a small sparrow shot be projected into the air in the same way, it too must have been propelled by the Earth sixty miles; in order to find the place whence it departed, it has required a very different amount of force, in order to send the cannon ball and the sparrow shot into the air for four seconds; how is it that the propelling force of the Earth has only produced the same effect on both? and how is it that both have maintained a speed equal to the speed of the Earth which propelled them? If a dozen shot of different sizes are fired out of the same gun, let the force be what it may, the speed of each will be regulated by its size. How is it that the Earth produces but one effect, that is, its own speed, upon all bodies, be their size and specific gravity what it may?—JAMES F. LLOYD.—*Morning Star*, Feb. 19, 1857.

calculate an eclipse; or even to determine the longitude of a Planet for a hundred years back, if it were required.

But let not Nature be blamed for all this. Let us not imagine that the arcana of the heavens are so strangely complex and so intricate and mysterious, that none but the few favoured sons of learning—none but the high and mighty of the philosophical world—none but the first-class men of Oxford, and the wranglers of Cambridge, may comprehend these beautiful works of God. It is not so. But, like as in the moral world, the utterance of one false word, or deceitful sentiment, requires the offender to support the deception and conceal the falsehood by the putting forth a number of other fallacies, so has it been in the world of astronomical science; where the one false principle of “universal attraction,” and the cognate absurdity of “gravitation,” have led to a thousand false “suppositions,” each and all requiring a thousand mysterious bubbles to conceal the true character of the original errors. Nature is plain and simple. And, although the vast grandeur of her movements, as displayed in the Solar System, has been hitherto partially veiled by the fact of the proper motion of the Sun being unknown, or at least unattended to, we may rely upon it that there is nothing in the character of the “courses of the stars” to bid the great mass of mankind despair of understanding them. The motions of the Solar System, as they really and truly

exist in Nature, and as they exhibit themselves, when pourtrayed on paper, in a perpetual recurrence of the most beautiful curves, termed *cycloids*, are so extremely plain, so purely simple and easy to understand, so very decidedly free from all mystery and confusion—all pretended “perturbations” and “disturbances,” that, verily, he who runs may read them. Their very grandeur consists in great part of their extreme simplicity.

These statements will appear startling; but their perfect truth will be manifest when I assure the reader that he will find in these pages, when describing the motions of the bodies constituting the Solar System, and when setting forth and demonstrating the laws that obtain therein, nothing but what a well instructed schoolboy may follow and understand—nothing beyond the sphere of plane trigonometry and the ordinary use of logarithms.

CHAPTER IV.

MODE OF COMPUTING THE SUN'S LONGITUDE, AS GIVEN BY WOODHOUSE—
MODE OF COMPUTING THE SUN'S LONGITUDE BY THE CYCLOID SYSTEM—
ON THE LENGTH OF THE MEAN EQUINOCTIAL YEAR—VAGARIES OF THE
NAUTICAL ALMANAC ON THIS SUBJECT—ORTHODOX ASTRONOMY OF 1834,
NOT ORTHODOX IN 1857—SUN'S LONGITUDE COMPUTED ON THE CYCLOID
SYSTEM, WITH REFERENCE TO THE CHANGES IN THE OBLIQUITY OF THE
ECLIPTIC—EXPLANATION OF THE PRINCIPLES OF THE ABOVE MODE OF
COMPUTING THE SUN'S LONGITUDE AT ANY TIME—FORMULÆ FOR THE
SAME—EXAMINATION OF THE SUPPOSED POWER OF MARS TO ATTRACT
THE EARTH—MARS AT FAULT—THE ATTRACTIVE POWERS OF VENUS
TESTED, AND FOUND WANTING.

WE now come to treat of the evidence that exists of the motions of the Earth, Mars, and Venus, being in accordance with the views I have taken of the Planetary System. It will suffice to trace the courses of those three bodies, in the first place, since they are comparatively near to each other in the system, and should, therefore, act on each other very decidedly and constantly, if there really exist any such principle as that of *attraction*, independent of *magnetic* influence, and as it is understood by Newtonian philosophers in general and by modern astronomers in particular. If it exist, I say, we should, by observing the relative motions of the three Planets just named, undoubtedly be able to detect its effect, and probably be also able to determine its amount.

But I shall show that these three bodies do really move (going through space along with the Sun) in an *equable* manner, and that at the very periods when the Newtonian force of attraction, according to the inverse square of the distance, should most disturb their courses, there really is no amount of disturbance at all in the motion of any one of the three that can be shown to have anything in common with the relative places of the other two.

By way of contrast of the system of Nature, with that invented and compounded by modern astronomers, I will here first give an example of how the longitude of the Sun is found, taken from p. 214 of Woodhouse's "Treatise on Astronomy," and then exhibit the mode by which I determine that longitude on the cycloid system.

"Suppose, now," says Woodhouse, "the Sun's longitude were required for 1810, Nov. 13^d. 2^h. 3^m. 2^a."

He then refers to the Solar tables.

Table I. 1st, the <i>mean</i> longitude for the beginning of 1810, is	}	9 : 10 : 28 : 30.2
Table IV. Nov. 13	}	10 : 11 : 27 : 52.3
Table V. { 2 ^h .	}	4 : 55.7
3 ^m .	}	7.4
2 ^a .	}	.1
Rejecting 12 ^a . mean long. at time required [a]		7 : 22 : 1 : 25.7

“The longitude of the perigee is had from the same table, thus:—

Table I. Long. at beginning of 1810	9 : 9 : 39 : 22
Table IV. Nov. 13	0 : 0 : 0 : 53.6
Longitude of perigee at the time required =	9 : 9 : 40 : 15.6
Subtract this from [a] increased by 12 signs,	} 10 : 12 : 21 : 10.1
there results the mean anomaly	
With this mean anomaly enter Table VII., and	} 11 : 28 : 32 : 42.2
there results the equation to the centre	
Add to this the mean longitude [a]	7 : 22 : 1 : 25.7
	7 : 20 : 34 : 7.9

This result, $7^{\text{s}}. 20^{\circ} 34' 7.9''$, is (if no other corrections are required to be performed) the true longitude reckoned from the *mean* equinox. But, as it has been shown, the place of the equinox varies from the *inequalities of the Sun's action and the Moon's action*, in causing the precession.* Two *equations*, therefore, must be

* The reader will here observe that the precession of the equinox is attributed to the action of the Moon. But let him judge whether it is not more reasonable to attribute it to the *motion* of the *Sun*; who, if he move in a circle, at the rate of $50''$ per year, and move *retrograde* and contrary to the order of the signs, must needs cause the stars to *appear* to move *forward* in the zodiac at that rate. I submit, that the Moon, by acting as a *magnet*, may and does, when near the Earth's poles, *attract* them away from the line in which they would otherwise point, and so cause a slight change in the *Sun's declination*; and, therefore, an error in the Sun's *computed* longitude, though not in his actual and true longitude. This effect of the Moon on the Earth's poles causes the peculiar *vibratory* motion of the pole, termed Nutation.

applied to the above longitude, in order to compensate the above inequalities, and so to correct the longitude, that the result shall be the true longitude, reckoned from the *true place of the equinox*. Now, it happens, by mere accident, that in the above instance, the *lunar* and *solar* nutations are equal to 1", but affected with contrary signs. These corrections, therefore, affect not the preceding result. The correction for *aberration* has, in fact, been applied; for since that, in the case of the Sun, must be nearly constant (and it would be exactly so, if the Sun were always at the same distance from the Earth), the Solar Tables are constructed so as to include, in assigning the mean longitude, the constant aberration (20"). The variable part of the aberration (variable on account of the eccentricity of the orbit) is less than the fifth of a second. Let us see, then, whether the longitude that has been determined from a knowledge of the place of the perigee, and from Kepler's problem, expressed by means of tables, be a true result.

By the *Nautical Almanac*, for 1810, we have—

Nov. 13.	Sun's Longitude	7 ^s : 20° : 29' : 8''
,, 14.	,,	7 : 21 : 29 : 36
Increase in 24 hours . . .		0 : 1 : 0 : 28

Now, the Sun's longitude is expressed in the *Nautical Almanac* for *apparent* time : and the equation of time being—15^m. 33^s. ; the mean time is 11^h. 27^s. Hence we must find the increase proportioned to 2^h. 18^m. 35^s. , which is about 5' 47"; consequently the Sun's longitude on Nov. 13^d. 2^h. 3^m. 2^s. (mean time), was 7^s. 20° 34' 55", which differs from the preceding result by about 45"; consequently Kepler's problem is *not* alone sufficient to determine the Sun's place, but some other corrections are requisite to compensate this error of 47 seconds."

Mr. Woodhouse, in a future page, observes that, "having thus explained, in a general way, the

theory of *perturbations*, we will complete the example, by adding certain corrections, computed from that theory, to the Sun's longitude."

	s.	'	"
"☉'s longitude"	7	20	34
Correction due to D	0	0	0
" " ♀	0	0	0
" " ♂	0	0	0
" " ♃	0	0	0
" " ♅	0	0	0

Nov. 13th, 1810, 2^h. 3^m. 2^s. Sun's } 7 : 20 : 34 : 48.86."
 true long. }

At page 215, Mr. W. here has the following foot note:—"This determination of the Sun's longitude is less by about seven seconds than the longitude as stated in the *Nautical Almanac*. But this latter was computed (see Preface to the *Nautical Almanac*) from Lalande's Tables, inserted in the 3rd edition of his *Astronomy*, which differ by a few seconds from Delambre's last Solar Tables (Vince's, Vol. III.) and from which the numbers in the text were taken."

We will now proceed to compute the Sun's longitude for Nov. 13th, 1810, at 2^h. 3^m. 2^s. p.m. by a method; which is founded on the theory that the Sun and Earth move *equably* through the heavens.

The length of the tropical year is, according

to Delambre's Tables, &c., exactly $365^{\text{d}}.242264$. Now let us take the period backwards from the time of the equinox in 1856, which was by N. A. Sept. 22nd, $8^{\text{h}}.53^{\text{m}}.25^{\text{s}}$.—

$365^{\text{d}}.242264 \times 46 = 16801^{\text{d}}.3^{\text{h}}.27^{\text{m}}.34^{\text{s}}$ which, applied to the above, gives mean equinox in \simeq 1810 = Sept. 23rd, $5^{\text{h}}.25^{\text{m}}.51^{\text{s}}$.

And this taken from . . . Nov. $13^{\text{d}} : 2^{\text{h}} : 3^{\text{m}} : 2^{\text{s}}$

Leaves the *epoch*, which is exactly, } $50 : 20 : 37 : 11$
in this case }

To this add time of equinox in 1856 $22 : 8 : 53 : 25$

$73 : 5 : 30 : 36$

— $61 : 0 : 0 : 0$

Nov. 1856 = $12 : 5 : 30 : 36$

For this period the N. A. gives Sun's	} $230 : 33 : 56.6$
apparent long.	
Correction for aberration	+ 20
Ditto, "equation of equinoxes"	+ 5.17

Sun's true long. = $230 : 34 : 21.77$

Ditto, in 1810, by Mr. Woodhouse . . . $230 : 34 : 48.86$

Difference 27.09

This simple process gives us the true longitude from the *mean* equinox at any time, to within a very few seconds; when, either by observing the altitude or otherwise, it has been already determined for any other year, at that same epoch, or distance from

the equinox. It will be seen that the difference amounts to less than half a minute, when the Sun's longitude is found by the "long and intricate processes" used by modern astronomers, and when found by a mere reference to the mean motion of the equinoxes, after a lapse of forty-six years.

One thing must be observed here, which is that the length of the tropical year, taken from Delambre at $365^{\text{d}}. 5^{\text{h}}. 48^{\text{m}}. 51^{\text{s}}. 6$, is by other authorities rather different. Sir John Herschel, for instance, gives the year about $1^{\text{s}}. 9$ less than the above; and the *Nautical Almanac*, adopts the equinoctial year as $365^{\text{d}}. 242216$, which is $4^{\text{m}}. 14$ less than the assumed *invariable* length of the year, which I have adopted from Delambre's Solar Tables.

It may appear that I am not warranted in differing on this subject from some of the high authorities in the astronomical world. But before any of my readers come to this conclusion, let them peruse the following extract from page 554 of the *Nautical Almanac* for 1860, just issued from the press:—

"It may here be stated that in the Supplement to the *Nautical Almanac* for 1828, the equinoctial time is based on the mean longitude in Delambre's Solar Tables, and an assumed *invariable* length of the equinoctial year = 365.242264 mean solar days, with a recommendation that *any subsequent improvements in the Solar Theory be disregarded*. An alteration was, however, made in the *Nautical Almanac* for 1834, and continued to 1856, by substituting Bessel's mean longitude and his *variable* length of the equinoctial year. Sir John Herschel has suggested, *as an approximation to*

consistency, the correction of the equinoctial times 1827-8 to 1833-4, for the difference between Bessel and Delambre, and the permanent adoption, after 1856, of 365.242216."

Then follows a list of corrections to be made *in the length of the year*, as given in the *Nautical Almanacs* from 1827 to 1834; the most extensive of which amounts to $4^{\circ}.1472$, which in forty-six years would amount to $3^{\text{m}} 10^{\text{s}}.77$. By all which we see that the astronomers are as yet all at sea, even about the exact length of the year! They talk, indeed, of an approximation to *consistency*; but they do not even hint at reaching *truth*. It was certainly very cool of them, in 1826, to issue "a recommendation that any subsequent improvements in the Solar theory be *disregarded*," when they did not even know how soon the nature and extent of the Sun's proper motion would be discovered. The length of the year that I adopt, though possibly it may yet require a slight modification, is that based on the mean longitude in Delambre's Solar Tables; and I assume an *invariable* length of the equinoctial year, because I do not believe that nature is so volatile and changeable as our modern English astronomers. And whether I be right or wrong, my view was good orthodox astronomy from 1826 to 1834.

Before we go into the question of how far the computations of the Sun's longitude, when made by reference to the *obliquity of the ecliptic*, agree with

what has been already offered, it may be well to consider for a moment the present state of astronomical knowledge on this very interesting subject: the Obliquity of the Ecliptic.

It is known that, "half the difference of the Sun's greatest and least meridian altitudes, is equal to the inclination of the ecliptic to the equator."* And this inclination is owing to the pole of the Earth being turned away from the perpendicular; which, therefore, as the Earth passes from the vernal equinox, V E, Plate I., and overtakes the line of the Sun's advance in space, becomes greatest when the Earth is at N T, the northern tropic.† For the Earth's north pole is then most turned towards the Sun, who appears just as much to the north of the equator, as the Earth's pole is declined from the perpendicular to its orbit, or pathway. As the Earth moves regularly and equably in its course, there can be no reason why this amount of declination should not always be precisely the same when at the same distance from the equinox, unless the Earth's Pole be drawn away from its usual parallel. This is said to be the case, by the Moon attracting "the bulging

* The Elements of Astronomy. By Rev. S. Vince. 2nd edit. p. 20.

† This refers to the northern hemisphere; for when the Earth is in the other hemisphere, the Sun's declination is also greatest when the Earth is on the southern tropic, S T, and the south pole is turned to the Sun.

equatorial parts of the terrestrial spheroid," to use an expression found in books on astronomy. I believe it will be found eventually that the Moon does nothing of the kind; but that when approaching the poles of the Earth, the Moon and Earth, being both *magnets* on a large scale, the Earth's pole may be slightly drawn aside by the approach of the lunar body, or magnet; and so may, in a trifling degree, be made to vary from its usual position, in which it points always to the same star.

However, we must also remember that even this apparently fixed parallelism of the Earth's pole, is not absolutely unchangeable; for it has a certain slow, extremely slow motion, by which it is increasing the angle it forms with the plane of the ecliptic, and is approaching the perpendicular, when that angle will of course be 90° ; and the obliquity of the ecliptic will cease to be; and the seasons vary no longer, but a perpetual equality of day and night prevail all over the world. This change in the obliquity of the ecliptic, though it may be determined by the method above named, is just one of those things about which our modern astronomers are most at sixes and sevens. The French astronomers take it to be considerably more than ours. The *Nautical Almanac* for recent years has an annual statement that the "mean annual diminution of the obliquity of the ecliptic" is taken, $=0''.457$, which is of course, $45''.7$ in a hundred years. This is taken from Bessel, the German astronomer. An

officer of the Navy proposed, some years ago, to make observations in different parts of the world to determine this point, but the leading men in the astronomical world threw cold water on the proposal, and it was never done.

The following is the obliquity, as determined by different astronomers in modern times :—

<i>Tycho</i> in 1587	23 : 29 : 30
<i>Cassini</i> (the father) in 1656	23 : 29 : 2
<i>Cassini</i> (the son) in 1672	23 : 28 : 54
<i>Flamsteed</i> in 1690	23 : 28 : 48
<i>De la Caille</i> in 1750	23 : 28 : 19
<i>Dr. Bradley</i> in 1750	23 : 28 : 18
<i>Mayer</i> in 1750	23 : 28 : 18
<i>Dr. Maskelyne</i> in 1769	23 : 28 : 8.5
<i>M. de la Lande</i> in 1768	23 : 28 : 0

If we compare the last with that of Tycho, whose instruments, however, were very inferior to those now in use, we find the amount differs in a century about 45''. The last compared with that of Flamsteed gives 50''. Dr. Maskelyne's compared with Dr. Bradley's and Mayer's gives 50'', and Dr. Maskelyne's when compared with that of M. de la Lande, which he is said to have taken as the mean of several results, gives 50''. Mr. Vince, in 1801, observed that the secular diminution of the obliquity of the ecliptic might be taken at 50'', as determined from the most accurate observations. I, therefore, although Sir John Herschel puts it at 48'', prefer to take the mean at 50'', which is equal to half a second

per year. This, Mr. Woodhouse's observations in 1807 support.

1807. The Mean Obliquity . . .	23 : 27 : 58.67
1857. Nautical Almanac . . .	23 : 27 : 28.75
	24.92

This is as near as possible 25'' in fifty years, which is of course half a second per year.

Let us now investigate the *effect* upon the Earth's position, if there be any, caused by this motion of the pole; and see whether, *by taking this motion into consideration*, we are not able to determine the longitude as accurately and with infinitely less time and trouble than by the "long and intricate processes" which modern astronomers require; and which exclude all possibility of astronomy being extensively known, in anything like a practical manner.

We will take two dates, separated by a period of fifty years; when, of course, the obliquity of the ecliptic will be altered about twenty-five seconds.

Let the declination of the Sun be supposed to have been determined at mean noon on the 1st August, 1810, as = 18° 9' 14''; and from this let it be required to know the true longitude of the Sun from the *mean* equinox, at an equal epoch from the vernal equinox in 1860? The mean equinox in 1810, was on the 20th March at 18^h 19^m 34^s. mean time; and the epoch, therefore, was 133^d 5^h 40^m 26^s. after the equinox of ν .

The mean obliquity of the ecliptic (by Woodhouse), was observed in 1807 = $23^{\circ} : 27' : 53.67''$

Correct for 53 years }
at 50" per century } — 26.5

M. Obliquity, 1860 = $23 : 27 : 27.17$ Sine, Arith. Comp. = 0.400041

Deduct from observed declination $18 : 9 : 14$

For 50 years, at 75" per year . 37.5

Reduced declination $18 : 8 : 36.5$ Sine 9.493315

Sun's true long. from M. Equinox $128 : 31 : 52$ Sine 9.893356

It will be seen that the mean obliquity of the ecliptic has been reduced at the rate of .5" per year, and that the apparent declination has been reduced at the rate of .75" per year. This latter reduction gives the results very near in general, and may be accepted as a means of obtaining a very "near approximation" to the Sun's longitude, by a very simple process, neither "long" nor "intricate," and in a manner, that any person, at all accustomed to such calculations, may effect in a few minutes.

The mean equinox in 1810, being known, the same may be found for 1860, by the following means, and *vice versa* :—

$365.242264 \times 50 = 18262$ days and a fraction, which, applied to the mean equinox of 1810, gives that of 1860.

	d.	h.	m.	s.
Thus, mean equinox 1810 =	March 20	18	19	34
Above fraction reduced			2 : 43	0.5
			— 1 : 0 : 0	0.
<i>Mean</i> equinox 1860 March	19	21	2	34.5
Add the epoch	133	5	40	26
			153	2 : 43 : 0.5
Deduct therefrom	122	0	0	0.
Leaves, July 1860	= 31	2	43	0.5

For <i>this</i> time the <i>apparent</i> longitude by N.A. =	128 : 31 : 42.1
Aberration + 20".14 "equa. of equinox"—15".75=	+ 4.39
<hr/>	
True longitude ☉ from <i>mean</i> equinox =	128 : 31 : 46.49
Ditto by my method	128 : 31 : 52
<hr/>	
Difference =	0 : 0 : 5.51

I shall here introduce another such calculation, wherein we go backward, instead of forward, in time; as in the last example.

Having the true longitude of the Sun from the mean equinox 2nd of April at mean noon 1855, required, therefrom to find the true longitude of the Sun in 1833, when the Earth was at an *equal* distance in *time* from the vernal equinox?

<i>Apparent</i> long. of ☉ April 2 at mean noon by N.A. =	12 : 11 : 11.7
Correct for aber. + 20".4 equa. of equinox + 12".5 =	+ 32.9
<hr/>	
<i>True</i> long. of Sun from mean equinox	= 12 : 11 : 44.6
<hr/>	
	d. h. m. s.
Time of vernal equinox 1855 = March 20 : 15 : 54 : 0	
365.242264 × 22 = 8035 ^d . and	7 : 54 : 55.4
<hr/>	
Mean equinox 1833	19 : 7 : 59 : 4.6
Epoch from equinox	= 12 : 8 : 6 : 0
<hr/>	
	32 : 16 : 5 : 4.6
	— 31 : 0 : 0 : 0
<hr/>	
	1 : 16 : 5 : 4.6
Equat. Time	— 3 : 46
<hr/>	
Apparent Time, April, 1833	1 : 16 : 1 : 18.6

	° / "	
M. obliq. of eclip. in 1855	= 23 : 27 : 29.5	
Add for 22 years	11	
<i>Reduced</i> M. obliq. for 1833	= 23 : 27 : 40.5	Sine A. C. 0.399977
Apparent Decn. ☉ Mean } Noon, 2nd April, 1855 }	= 4 : 49 : 15.1	
Correction 22 x .75" .	= 16.5	
<i>Reduced</i> Decn. for 1st } April 16 ^h . 1 ^m . 18.6 ^s . }	= 4 : 49 : 31.6	Sine 8.924901
Apt. T. 1833 . . . }		Sine 9.324878
° / "		
True long. ☉ <i>required</i>	= 12 : 11 : 52.4	
Ditto by N. A. . . .	12 : 11 : 44.6	
Difference	= 0 : 0 : 7.8	

It appears from this, that, by correcting the declination at the given time by + or — .75" per year, for the time that may elapse, we may thus briefly and easily obtain the Sun's true longitude from the mean equinox at any period.

I shall here give an explanation of the principle on which I calculate the longitude of the Sun in preceding manner. If the reader turn to Plate I., he will observe the line drawn from the centre of the Earth at *a* to *i*, which is on the line that marks the course of the Sun, and which is perpendicular to that line. If, now, we draw another line from the centre of the Earth at *a*, parallel to the line A B, and continue it to join the line extending from ω to N T, it will cut off at *x* so much of the latter line, as shall be equal to *a, i*. And this part, so cut

off, will measure the sine of the angle of declination, when the Sun is at ε ; or when removed away one-third of his distance from ν , towards ω .* The dotted line from a to ε , is equal to the line ω , N T; both being the measure of the Earth's distance from the Sun; and as this is taken as radius, the line a , i , becomes the *sine* of the Sun's longitude when at ε . And as the line a , i , is thus known, we have two sides and the right angle, in the triangle a , ε , i , to find the angle at ε , which is the angle of the *Sun's longitude*.

The angle ω , ν , N T, is exactly equal to the maximum of the Sun's declination, in other words, to the obliquity of the ecliptic. The side ν , N T, being made radius, the side ω , N T, is then equal to the *sine* of the angle at ν , which is the angle of the obliquity. And any other angle of declination has for its *sine* a portion of the side ω , N T, proportionate to the whole line from ω , to N T. But every such *sine* (or portion of the side ω , N T), will be equal to the *sine* of the Sun's longitude, in the same manner as ω x is found to be when the Sun is at ε . We may make ω , N T, = 1.

Therefore, we may say, "as the sine of angle ν = ω , N T, is to 1, so is the sine of the declination, angle ω ν x , to ω x = to the side a , i , = sine of Sun's longitude." Hence, $\frac{\text{sine declination}}{\text{sine obliquity}} = \text{sine longitude}$.

* The reader may supply a line from ν to x ; which, being taken as radius, the line ω x , will be the *sine* of the angle ω ν x , which angle is equal to the declination of the Sun, when entering ε .

Therefore, $\log. \text{ sine obliquity (A. C.)} + \log. \text{ sine dec.} = \log. \text{ sine longitude.}$

And, as $\text{rad.} : \text{sine obliquity} :: \text{sine long.} : \text{sine declination.}$

$\therefore \log. \text{ sine obliquity} + \log. \text{ sine long.} = \log. \text{ sine declination.}$

Before we proceed to examine the motions of Mars and Venus, and investigate the amount of effect the Earth is supposed to have on these motions, by virtue of its *attraction*, we will examine whether Mars may not have some effect on the Earth. Of course, if Mars really do pull the Earth at all out of its course, the maximum effect on the Sun's longitude should be when in quartile with the Sun; since all he can do when in conjunction, or opposition, is to attract in the same direction as the Sun does, or the contrary; and so affect the radius vector, or line joining the centre of the Sun and the Earth. We will, therefore, take a case of the Planet Mars being in quartile with the Sun, which will happen, according to the *Nautical Almanac*, at 16^h 33^m p.m., on the 31st January, 1858.

The Sun will enter \sphericalangle , (by N. A.) at 14^h 33^m p.m., 22nd September, 1857. The quartile of Mars will take place, therefore, exactly 131^d 2^h after this equinox: when, according to the N. A. the Sun's apparent longitude from the *mean* equinox will be $312^{\circ} 5' 16''$. By pursuing the method I have set forth it will be found that the longitudes for the same epoch after each equinox in \sphericalangle , for the *six* years, from 1855 to 1860, will be as follows:—

Apparent long. of \odot from } $\odot \square \odot$ Jan. 31, 1858, at 16^h. 33^m. p.m.
 mean equinox of Υ . }

Years.	Longitudes.
	° ' "
1855 . . .	312 : 5 : 22.88
1856 . . .	5 : 18.45
1857 . . .	5 : 22.73
Epoch = 1858 . . .	5 : 15.97
1859 . . .	5 : 12.03
1860 . . .	5 : 15.56
	<hr/>
	31 : 47.12
	<hr/>
Mean . . . =	5 : 17.85
Epoch . . . =	5 : 15.97
	<hr/>
Difference . . . =	1.88

Another case of Mars in quartile to the Sun, took place, December 28^d 15^h 39^m in 1855.

The apparent longitude of the Sun from *mean* equinox of \simeq preceding, according to my method was, for—

The epoch in	Longitudes.
	° ' "
1855 . . .	276 : 54 : 56.67
1856 . . .	55 : 1.04
1857 . . .	55 : 12.4
1858 . . .	54 : 52.4
1859 . . .	54 : 54.8
1860 . . .	54 : 58.53
	<hr/>
	329 : 55.84
	<hr/>
Mean . . . =	54 : 59.31
Epoch . . . =	54 : 56.67
	<hr/>
Difference . . . =	2.64

The effect of Mars in the first case ought to have been to *increase* the angle of longitude; but I perceive no such increase: on the contrary, there were three occasions out of the six, in which the angle was greater than at the epoch of the quartile of Mars. The close agreement of the longitudes on these twelve occasions affords farther evidence of the accuracy of the method I propose for finding the Sun's longitude in a general and approximate manner.

But if Mars be indifferent to his neighbour Earth, perhaps we may find Venus more easily acting on the same. Let us take a case where Venus is at her greatest elongation from the Sun, when she ought to be most able to draw the Earth out of its steady course, if she ever do so at all—which she may perhaps do, indeed, by the sympathetic power of magnetism; a known and obvious force, which may be observed daily throughout nature, but not by the dreamy and mysterious force called gravitation.

Venus will be at her greatest elongation, west, on the 19th July, 1857, at 7^h 12^m. p.m.; being then 45° 37' from the Sun. Taking this as the epoch, I find it is 121^d 3^h 27^m. from the vernal equinox on the 20th March, 1857, at 3^h 45^m. p.m. by N. A. At this epoch the Sun's longitude = 116° 58' 31''⁴⁴ from the mean equinox. Then, by adding or subtracting the usual length of the year, 365^d 5^h 48^m. 51^s.6 as often as required, to find the times of the other

equinoxes, and adding in each case the said epoch of 121^d. 3^h. 27^m. we find the several longitudes, as expressed in the *Nautical* for the several years. The results are as follows:—

Year.	Sun's Longitude.		
	°	'	"
1855 . .	116	58	43.5 * Venus also in great.
1856 . .	58	34.5	along. 23rd July this
<i>Epoch</i> = 1857 . .	58	31.4	year; and in sup.
1858 . .	58	36.5	♄ ☉ July 20, 1856.
1859 . .	58	43	
1860 . .	58	40.3	
Mean . =	58 : 38.2		
Epoch . =	58 : 31.4		
Difference . =	6.6		

Alas, for Venus! The Earth is as blind to her *attractive* blandishments as it is indifferent to the powers of the god of war. For neither Mars or Venus seem capable of drawing it away from the steady and onward course it speeds along through space, in company with the Sun. And until we see better reasons than we have yet seen, to believe that the other Planets do affect that course by the power of *gravitation*, we shall resist that belief.

But, "why," it may be asked, "have not astronomers noticed these facts before, and observed that the Sun's longitude at any given epoch from the equinox, is always found to be the same to within a very few seconds?" The answer is obvious—they

never looked for these results, because they do not believe in an *invariable* equinoctial year; at least they have not done so in this country since the year 1834; when the government astronomers took up with Bessel's *variable* year. And, therefore, they adopt *perpetually varying* "equations of the equinoxes," which make the Earth dance to and fro like a harlequin, instead of progressing steadily on like a piece of noble machinery, whose builder and maker is the Architect of all the heavens and the origin of all wisdom.

CHAPTER V.

OF THE MOTIONS OF MARS AND VENUS—OBLIQUITY OF THE ORBIT OF VENUS, HOW DISCOVERED—OF THE HELIOCENTRIC DECLINATION OF VENUS AND MODE OF DETERMINING HER HELIOCENTRIC LONGITUDE—OF THE INFERIOR AND SUPERIOR CONJUNCTIONS OF VENUS WITH THE SUN—OF HER GREATEST ELONGATION, STATIONARY POSITION, &c.—OF THE THREE CYCLOIDS FORMED BY VENUS, WHILE THE EARTH FORMS TWO SUCH, IN TWO YEARS—VENUS'S COURSE TRACED THROUGH THE THREE CYCLOIDS—DIFFICULTIES OF THE DOCTRINE OF PLANETARY ATTRACTION, WHEN CLOSELY EXAMINED—INVESTIGATION OF THE SUPPOSED ATTRACTION OF THE EARTH ON VENUS—ATTRACTION AT FAULT—ATTRACTION OF JUPITER ON VENUS EXAMINED—ATTRACTION, EVEN IF PROVED TO EXIST, DOES NOT MILITATE AGAINST THE CYCLOIDS—ON THE MODE OF COMPUTING THE PLACE OF MARS—OBLIQUITY OF THE ORBIT OF MARS, HOW DETERMINED—HELIOCENTRIC DECLINATION AND LONGITUDE OF MARS CALCULATED ON THE CYCLOID SYSTEM, AND MOTION OF THE SUN THROUGH SPACE—DIAGRAM OF THE MOTIONS OF THE SUN, MARS, EARTH, AND VENUS EXPLAINED.

THE motions of the Planets, Mars and Venus, will be more especially examined in this chapter; and I think it will appear conclusively that these two bodies, one of which is about the size of our Earth, and the other about half the size, do each pursue a steady and undisturbed course through space with the Sun; and that, in so doing, they each form a *cycloidal curve*, instead of an ellipse, as the Newtonian system teaches.

Place aux dames! We will commence, therefore, with Venus, who approaches more nearly to the Earth than any other body in the Solar System, our own Satellite, the Moon, excepted.

I think it well to introduce another instance of

the non-attractive power of Venus at her greatest elongation. This will take place at 7^h. 23^m. p.m., 9th May, 1860: and will occur just 50^d. 10^h. 18^m. 15^s. after the vernal equinox that year.

Apparent long. of \odot from *mean* equinox each year at the same epoch:—

1855 . . .	49 : 19 : 32.05	
1856 . . .	19 : 58.92	
1857 . . .	19 : 34.44	♀ ♂ \odot this day, May 10.
1858 . . .	19 : 16.8	
1859 . . .	19 : 45.1	
1860 . . .	19 : 34.17 = Epoch.	

6) 117 : 41.48

19 : 36.91 = Mean.

19 : 34.17 = Epoch.

2.74 = Difference.

Thus it seems that when Venus is at her greatest elongation, she does not disturb the Earth to the extent of even 5 seconds. And it so happens that the Sun's longitude does not differ half a second on the day of her greatest elongation from what it is on the day of her conjunction with the Sun, when these things fall out at the same distance from the *mean* equinox.

It appears, on investigation, that the motion of Venus with the Sun is perfectly analogous to that of the Earth. Therefore, if we substitute the amount of the distance she is from the Sun for

the Earth's distance, we shall find the *obliquity of the orbit of Venus*, just as we have the obliquity of the ecliptic.

Thus, for the year 1832 :—

Mean obliquity of ecliptic	.	=	23 : 27 : 41	Sine	9.600026
Mean dist. of Venus from the Sun	=	.7233316	Log.	9.859338	
Mean obliquity of Venus	.	=	16 : 44 : 13.7	Sine	9.459364

Let it now be required to find the *heliocentric* declination of Venus for noon on the 13th Sept., 1832; and from the same, with the above obliquity of her course, to find the heliocentric longitude of Venus, when she was at the same distance from her equinox, on the 18th June, 1855, at 17^h 42^m p.m. ?

At 4^h 59^m 30^a p.m. on the 30th August, 1832, Venus was in 180° of heliocentric longitude, by N. A., and therefore, on the 13th Sept., 1832, at noon, she was 13^d 19^h 0^m 30^a past her equinox. And, according to Vince's Tables, she was then in the heliocentric longitude = 6^d 22° 15' 50"; from which take 6 signs, and call it ν , 22° 15' 50".

Then, to find the *heliocentric* declination of Venus at noon on the 13th Sept. 1832, we have only to say, as follows:—

Log. Sine of obliquity of Venus as above	16 : 44 : 13.7	9.459338
Log. Sine of heliocentric long. of Venus	22 : 15 : 50	9.578494
Log. Sine of Venus's <i>heliocentric</i> deen.	6 : 15 : 48.7	9.037832

We must now *reduce* the obliquity of Venus's orbit, at the same rate as that of the ecliptic is found to diminish; viz., 50" per century. And then proportion the change in her *heliocentric* declination according to the amount of her orbit's obliquity. Thus, as the correction for the obliquity for 23 years will be = 11".5, I say, 16° 44' 13".5 : 11".5 :: 6° 15' 48".7 : 4".9; which is the *correction* to be applied to the *heliocentric* declination of Venus.

I now proceed thus:—

Obl. of orbit of Venus	}	= 16 : 44 : 18.7	
in 1832			
Correction for 23 years		— 11.5	
<hr/>			
<i>Reduced</i> obl. of orbit of	}	= 16 : 44 : 2.2 S. A. C = 0.540717	
Venus for 1855			
<hr/>			
<i>Heliocentric</i> decl. of Venus		6 : 15 : 48.7	
Correction to be applied .		— 4.9	
<hr/>			
<i>Reduced</i> hel. dec. of Venus		6 : 15 : 43.8	Sine 9.037737
<hr/>			
<i>Heliocen.</i> long. Venus req.		22 : 15 : 42	Sine 9.578454
Ditto by N. A. for 1855 .		22 : 15 : 50	
<hr/>			
Difference		8	

Thus, by reducing the *heliocentric* declination of Venus in proportion with the reduction in the obliquity of her orbit, we get very *nearly* the same result, as by the "long and intricate processes" of the Newtonian system, when assisted and corrected as it is, by numerous observations. It will be here observed that the *principle* on which the whole of

the foregoing calculation is founded is entirely that of the Planet moving through space, along with the *Sun*, and so forming a cycloidal curve, in a regular and equable course. By this means the heliocentric declination of the Planet, which is the amount its pole is inclined away from the perpendicular, is found to vary also in a regular manner; but only in consequence of the angle of that pole being found to diminish at a slow, but also equable, rate of half a second per year, or 50'' per century.

Now, I may be met here by some clever critic, who will say perhaps, "but you do not *always* determine the motions *exactly* and in perfect accordance with observation." This may be granted; and it will be granted also to me, that, on first bringing forward these new ideas and, what I may be permitted to call, important discoveries, some amount of operating causes are yet probably remaining to be discovered. If the men of science of the present intelligent era will be pleased to bend their researches towards the causes of the cycloidal curves, in which it is evident the Planets move, we may expect ere long to be able to eliminate and deface every vestige of error and trace the Planetary courses in those cycloids, with an amount of *exactness* equal to that of the simplicity which I have shewn to be their leading characteristic.

It may now be well to draw the reader's attention to the fact that the Planet Venus being found in inferior or superior conjunction with the Sun and

also being seen at her greatest elongation, is very obvious and clearly to be detected, on the drawing which describes the cycloids formed by the Earth and Venus—Plate II. It will there be seen that Venus, which Planet is represented by the series of large black dots, forms rather more than three cycloids during the time that the Earth forms two such figures. This is clearly the case, because the period of Venus which is only $224\frac{2}{3}$ days $\times 3 = 674$ days; whereas the period of the Earth being $365\frac{1}{4}$ days $\times 2 = 730\frac{1}{2}$ days: which leaves Venus $56\frac{1}{2}$ days to spare. A more exact and, indeed, very near equality of motion between the Earth and Venus is found to be made in eight years. For the days in one year, or period of the Earth, $365\frac{1}{4} \times 8 = 2922$ days; and the days in the period of Venus, $224^{\text{d}}.16^{\text{h}}.40^{\text{m}} \times 13 = 2921$ days; so that Venus will in eight years return to within *one* day of the place she was in just eight years before. And thus, while the Earth forms eight cycloids, from the south tropic to the same again, Venus also forms thirteen cycloids, from her south tropic to the same again. It follows, therefore, that, if we observe Venus in any point, say in conjunction with the Sun, on any given day, we shall detect her there again, very nearly, about one day before the period of eight years is complete.

The tropical year of Venus I make to be $224^{\text{d}}.6921486$. If we multiply this into 13, we have $2920^{\text{d}}.9979318 = 2920^{\text{d}}.23^{\text{h}}.56^{\text{m}}.25^{\text{s}}.3$. And

the Earth's tropical year $365^{\text{d}}.242264 \times 8 = 2921^{\text{d}}.938112 = 2921^{\text{d}}. 22^{\text{h}}. 30^{\text{m}}. 52^{\text{s}}.9$. Therefore Venus returns to the same heliocentric longitude at the end of the eighth year, about $22^{\text{h}}. 34^{\text{m}}. 28^{\text{s}}$ before the Earth reaches the same longitude again at the expiration of the period. The conjunction of Venus with the Sun will, therefore, take place a little earlier on each occasion. But as the object of this work is not to offer evidence of matters already known, I shall add nothing more on this subject.

The drawing (Plate II.) will enable the reader to trace the various positions of Venus from the time of her being at her *southern* tropic, marked *a*, to her crossing the equinox at *b*, and then on the 10th May, 1857, she is found at *c*, where she is in *inferior* conjunction with the Sun in the 20th degree of Taurus, where a line is drawn through Venus extending on one side to the Sun and on the other to the Earth. Afterwards she is found at *d*, where she is *stationary*; and then at *e*, on her *northern* tropic, at a right angle from the line A B, which represents the course of the Sun. Then we trace her path to *f*, where she arrives on the 19th July, 1857, being at her greatest elongation, $45^{\circ} 37'$ west. And if the angle from the Earth at *g*, be measured between the Sun and Venus, as there laid down, it will shew the Planet to be that extent to the west of the luminary. So by following the Planet farther, we find her at *k*, on the 28th February, 1828, when the Earth is at *h*; and of course the line extending from the Earth to Venus crosses the Sun's course at *i*, where the Sun

then is ; and the Planet is, therefore, seen in *superior* conjunction of the Sun, being no longer between the Earth and Sun as at *c*, but on the other side of the Sun and found in the 10th degree of the sign *Pisces*.

Thus we may trace the course of the Planet, Venus, in the drawing, through 1858, first to *l*, her *southern* tropic again ; thence to *m*, her vernal equinox ; thence to *n*, her *northern* tropic ; thence to *o*, her autumnal equinox ; and finally to *p*, her *southern* tropic again on the 18th Dec., 1858.

By these facts, the reader will perceive that, as the Earth travels onward, and that for ever, in a *serpentine* course, first on one side the Sun's course, and then on the other, forming a series of beautiful cycloids, so does the Planet Venus trace a similar course, at her nearer distance from the Sun, and in like manner form these cycloidal curves.

Come we now to treat of the latitude of Venus, as seen from the Sun, commonly called her heliocentric latitude. This is the angle at which the orbit or pathway of Venus, treated as a plane, inclines away from the orbit or pathway of the Earth, also considered as a plane. It is obvious that, if the two bodies accompanied the Sun exactly in the same plane, that Venus must pass exactly between the Earth and the Sun at *each* inferior conjunction, and must be seen to transit over the Sun's disc. But this she never does, except when a conjunction takes place at the time Venus is passing through her node, or that point which is the intersection of the two planes. At this time, it

is well known that the Planet passes like a dark patch over the face of the Sun. A transit of Venus over the Sun's disc has been computed to occur December 8th, in the year 1874. The heliocentric latitude of Venus extends to about $3^{\circ} 23' 33''$, either north or south; which is when she is 90 degrees from her node.

It will no doubt be advanced by the advocates of the doctrine of *attraction*, that, "however little the evidence may be in favour of its power to affect the angles of longitude, it has, at any rate, decided influence on the radius vector of each Planet; or, in other words, that, as the Planets do vary in their distances from the Sun at the moment of their being in the same longitudes, it must be by their mutual attractions upon each other that this is effected. Well, we must leave it to the Newtonians to reconcile the difficulties that arise when we examine closely the real state of things on this head. If we take a certain number of years, say some six years consecutive, and examine whether, when the Earth, Venus, and the Sun are in one line, and when the Earth, being at its nearest point to Venus, should attract her away most powerfully according to the theory, and increase her distance from the Sun, Venus be really at a greater heliocentric distance, we find it is not so. That is to say, if we take the distance of Venus from the Sun on other occasions (when at the same distance from her equinox), we shall find her sometimes nearer and at other times

farther off; so that it cannot be at all declared positively that it is the effect of the Earth *attracting Venus away from the Sun* that increases her distance from that body; inasmuch as we find her removed not only as far, but on many occasions *much farther*, when the Earth is *not there* to exact its so-called attractive qualities.

To make this appear plain, I will here introduce a few results of this examination.

There was an inferior conjunction of Venus with the Sun at 18^h 22^m. p.m., on the 30th September, 1855, the Planet being 7° 29' from the equinox of \sphericalangle . At that time the log. of the radius vector of the Planet was (per N. A.) 9.8608872: giving the Planet's distance from the Sun as 68,962,115 miles. Then, if we take the dates of *nine* other occasions, when Venus was at the *same* distance of 7° 29' from \sphericalangle , we have the following results:—

Date.		Miles.	Miles.
1855, Feb. 18th	Planet's distance =	68,961,782	— 333
„ Sep. 30th	„ „	68,962,115	= Epoch
1856, May 12th	„ „	68,962,630	+ 515
„ Dec. 23rd	„ „	68,961,000	— 1,115
1857, Aug. 5th	„ „	68,963,000	+ 885
1858, Mar. 18th	„ „	68,905,000	+ 2,885
„ Oct. 28th	„ „	68,964,000	+ 1,885
1859, June 10th	„ „	68,960,000	— 2,115
1860, Jan. 21st	„ „	68,959,000	— 3,115
„ Sep. 1st	„ „	68,963,000	+ 885
	Mean . . =	68,962,152	
	Epoch . . =	68,962,115	
	Difference . =		37

H

These numbers are not brought out exact, but only in general to the nearest 1,000 miles; yet they shew that the distance of the Planet from the Sun was, in *five* out of ten cases, greatly beyond that at the epoch of her conjunction; and that the mean of all the distances was extremely near to that at the epoch. The question occurs—What was the cause that took the part of the Earth on those five occasions, and drew the Planet from one to three thousand miles away from the Sun? And the reflection arises again also, that if the Planets do really attract one another, if the Earth attract Venus—for instance, why, since the centripetal force does not exist a moment longer than the imaginary ellipses wherein it is said to act, why does the said Earth's attraction *cease*? Why does it not hale the Planet Venus from the heavens and deposit her safely in its own bosom? But the answer to these questions must be deferred till we come to explain the probable nature of the two forces which guide her and all the other Planetary Bodies of the system along their wondrous, strange, mysterious courses.

It may be well here to give another instance of the *variation* in the distances of Venus from the Sun, at certain points from her equinox; both when seen from the Earth in conjunction with the Sun and when not in that position.

At 13^h 13^m p.m., on the 18th July, 1860, we are informed by the *Nautical Almanac*, that Venus will

be in conjunction with the Sun. The Sun, seen from the Earth, will then appear at $116^{\circ} 33'$ from the ν equinox; and of course, when viewed from Venus, he will appear at the same angular distance from ν , viz., $116^{\circ} 33'$. The following are the several distances of Venus from the Sun, on that, and on *eight* other occasions during the years 1855 to 1860. The log. of ϱ distance at the above epoch will be 9.8621979, giving her distance from the Sun, 69,170,545 miles.

Date.		Miles.	Miles.
1855, 17th Aug.	Dist. of Venus from Sol =	69,173,585 +	3,040
1856, 28th Mar.	" "	69,169,880 —	665
" 8th Nov.	" "	69,169,595 —	950
1857, 21st June	" "	69,172,920 +	2,375
1858, 1st Feb.	" "	69,173,300 +	2,755
" 13th Sep.	" "	69,172,445 +	1,900
1859, 26th Apl.	" "	69,169,595 —	950
" 7th Dec.	" "	69,169,880 —	665
1860, 18th July	" "	69,170,545 =	Epoch
	Mean . . =	69,171,305	
	Epoch . . =	69,170,545	
	Difference . . =	+ 760	

In this instance we see that the cases wherein the Planet was at a *greater* distance than at the epoch of the conjunction were *four* out of *eight*, and we also find that the mean of all the nine instances gives actually an increased distance of nearly 1,000 miles. So that here again the Newtonian theory of mutual *attraction* is at fault; for it actually appears

that the Planet, if acted on at all at the *epoch* of the conjunction, was *repelled* by the Earth instead of being attracted.

But no doubt the answer of the Newtonians will be, that I do not consider the positions of other Planets, which were at that time acting upon Venus and pulling her in the contrary direction from the Earth; and so the result was different from what it would have been, if the Earth alone had had to do with that Planet. This seems plausible and deserves notice. True; I really do find, that Jupiter was at that time very nearly in a right line with Venus and on the opposite side of the Sun, pulling against the Earth; and, therefore, perhaps this may account for Venus being nearer the Sun than she would have been otherwise. Well, all we have to say is that, if Jupiter pulls Venus so much on this occasion, it is to be expected that he should do so still more when in *exact* opposition, which will take place on the 25th July, 1860, just a week later; and that, therefore, Venus should be *nearer* the Sun at that particular time than she usually is when at the same distance from her equinox. Let us, therefore, examine whether it be so; and, according to the facts, give Jupiter his due.

The heliocentric opposition of Jupiter and Venus will take place, as has been observed, on the 25th July, 1860, when Venus will be in $306^{\circ} 15'$ of heliocentric longitude, being, of course, removed from her γ equinox, $126^{\circ} 15'$. At which time the logarithm

of her distance from the Sun will be 9.8622682 by N. A. ; giving her distance = 69,181,755 miles.

The following are the several distances she was or will be from the Sun, on *nine* other occasions, in the six years 1855 to 1860 inclusive, when at $126^{\circ} 15'$ from her \vee equinox :—

Years.	Miles.	Miles.
1855, Jan. 10th . . .	69,185,270 +	3,515
„ Aug. 23rd . . .	69,184,700 +	2,945
1856, Apl. 4th . . .	69,180,995 —	760
„ Nov. 15th . . .	69,180,550 —	1,205
1857, June 27th . . .	69,184,415 +	2,660
1858, Feb. 7th . . .	69,184,985 +	3,230
„ Sep. 20th . . .	69,180,550 —	1,205
1859, May 2nd . . .	69,180,520 —	1,205
„ Dec. 13th . . .	69,180,710 —	1,045
1860, <i>July</i> 25th . . .	69,181,755	Epoch
Mean . . .	=	69,182,455
Epoch . . .	=	69,181,755
Difference . . .	=	690

It seems that the difference of the mean of these distances from the distance at the epoch really is a trifle in favour of Jupiter ; but before we award him the honour of being able to attract Venus out of her course, and overcome the contrary attraction of the Earth, we must ask him to account for the fact of there being no less than *five* out of the eight other occasions, when the distance of the Planet from the Sun was still less than when Jupiter was at work

with all his maximum force; although, in fact, he was on those five occasions entirely absent from the field. I think the advocates of the doctrine of the mutual attraction of the Planets will find it difficult to reconcile these facts with that doctrine. If, however, they can do so, it will not militate against the theory of *cycloidal curves* being the true courses of the Planets; because the necessity of *observation* is admitted on all hands, as Mr. Woodhouse does at page 219 of his "Elementary Treatise on Astronomy". He says that, "as a first approximation then and a very near one, we may determine the Sun's or Earth's place, by means of Kepler's problem: and subsequently correct such place, by *small equations*, due to the perturbations of the Moon, and of the Planets." He adds that, "*Observations*, it is plain, must furnish numerous results, before the formulæ of perturbations can be numerically exhibited, or, what is the same thing, be reduced into Tables."

Now, it is not the case that the place of any Planet can be always accurately determined by *any* theory alone that has hitherto existed. "The return of the Planet after any period to the same, or nearly the same place; the times of moving from one position to another; these, and other points" (says Woodhouse, p. 185) "must depend on the real curve described by the Planet and on the laws of its curvilinear motion." He adds that, "observation will be the *main* support of the inquiry; still it will not be sufficient. We must guide it by aid

derived from the discoveries of Kepler, and the inventions of Newton."

I quite agree with the above remarks, so far as they apply to the necessity of extensive observations on the heavenly bodies to correct the errors of theory; but I submit that as the *cycloid* theory gives us the longitude of the Sun and Planets more exact and far more easily, than can be done by the elliptical theory (proved we have seen to be *impossible*), we may safely accept the cycloid system as a means of getting our first and "very near" approximation; and then correct it to the point of perfect accuracy by reference to *observation*.

Having said so much on the subject of the Planet Venus, I shall conclude this chapter with only a few remarks on the Planet Mars; and endeavour to shew that the motions of that Planet are cognate to and analogous with those of Venus and the Earth. We will take the principle hitherto applied successfully to Venus, and try how it operates with the superior Planet Mars. By taking the Earth's distance from the Sun as radius, we find the obliquity of Mars' orbit in 1832 as follows:—

Mean obliquity of ecliptic 1832, } 23° 27' 41" log. sine. }	= 9.600026
Mean dist. of Mars from Sun } 1.5236923 log. }	0.182897
Sine log.	9.782923
Maximum <i>heliocentric</i> declin. of Mars, or obliq. of his course 37 : 20 : 46

If we would now find the heliocentric longitude of Mars, at any period distant from 1832, we must first find his distance in time from his equinox that year at the period when he formed any given angle of longitude with the Sun. Now, Mars crossed the equinox of ϵ , the Sun being as seen from him in 180° of longitude from γ , the 12th August, 1832, at 7 p.m.; and 43 days, 17 hours afterwards, viz., at noon on the 25th September following, he was by Vince's Tables, in the heliocentric longitude = $26^\circ 36' 58''$. Required the heliocentric longitude of Mars, from these premises, when he shall be 43 days, 17 hours from the same equinox in 1860?

To find the *heliocentric* declination of Mars on the 25th September, 1832, at noon:—

Obliquity of Mars' course in 1832 =	$37^\circ 20' 46''$	Sine 9.782923
Hel. lon. Mars, noon, Sep. 25, 1832 =	$26^\circ 36' 58''$	Sine 9.651290
Mars' Heliocentric Declination .	$. 15^\circ 46' 12''$	Sine 9.434213

Now to find the heliocentric longitude of Mars at $23^{\text{h}} 40^{\text{m}} 40^{\text{s}}$ p.m. on the 10th December, 1860, when he will be at the same distance from his equinox of ϵ . I proceed thus:—

Obliq. of Mars' course in 1832 =	$37^\circ 20' 46''$	
Cor. for 28 years, at $5''$ per year .	$- 14$	
Reduced obliquity of Mars .	$= 37^\circ 20' 32''$	Sine A. C. 0.217116

<i>Hel. dec. of Mars, Sep. 25, 1832</i>	= 15 : 46 : 12	
Cor. for 28 years proportionate to the obliquity of Mars . . . }	} — 6	
<hr style="width: 50%; margin: 0 auto;"/>		
<i>Reduced Hel. dec. of Mars.</i>	= 15 : 46 : 6	Sine 9.434167
<hr style="width: 50%; margin: 0 auto;"/>		
<i>Hel. Long. Mars required</i>	= 26 : 36 : 57	Sine 9.651283
<i>Ditto by N. A. for 1860 .</i>	= 26 : 36 : 58	
<hr style="width: 50%; margin: 0 auto;"/>		
Difference	1	

The correction for Mars' *heliocentric* declination for 28 years, with the obliquity he had in 1832, and its correction for 28 years, is found thus : $37^{\circ} 20' 46'' : 14'' :: 15^{\circ} 46' 12'' : 6''$, the amount taken from Mars' *heliocentric* declination at the epoch in 1832, because the obliquity of Mars, like that of the Earth, is decreasing.

I shall now introduce to the reader's notice a simple diagram, to explain how it is that, having set aside all idea of *circular or elliptical motion*, among the bodies of the Solar System, and shewn that we may regard the Sun's course as a right line, we are able thus to determine the places of the Earth and Planets by reference to plane trigonometry only.

In the diagram of the motion of the Sun and the Planets Venus, Earth, and Mars, *Plate VII.*, the line A B represents the Sun's course from the vernal equinox, on the 21st March any year until the summer solstice on the 21st June. The Sun is therein represented by the circles, and his place at the vernal equinox is shewn at ν . His place when removed

from thence 30 degrees, or to the first punctum of the sign Taurus, is shewn at γ ; and his place entering the sign Gemini, in 60 degrees of longitude from γ , at π ; while his place when entering Cancer, the point of the summer solstice, is shewn at ω . The figures 1, 2, and 3, denote the relative places of σ , Mars; \oplus , the Earth; and φ , Venus, when each is on the equator; the Sun then appearing to them in the first point of γ . The curve from σ^1 , to M, denotes one-fourth of the whole *period* of Mars, during which he passes from the line of the Sun's course at σ^1 , to the point where he is at a right angle to that course, at M; which is, in fact, the *summer tropic* of Mars. The curve from \oplus^2 , to E, denotes, in the same way, the positions of the Earth during one-fourth of a year; while it passes from the vernal equinox at \oplus^2 , to the summer tropic at E. The other, or smallest curve, from φ^3 , to V, in the like manner, points out the one-fourth of the *period* of Venus, while passing from her equinox at φ^3 , to her *summer tropic* at V.

Now, if we observe the Sun's place at γ , we shall perceive three lines running therefrom to V, E and M. The *first* denotes the line of *heliocentric* declination of Venus; which at the maximum, or when the Sun is on the summer solstice of Venus, is now at an angle of $16^\circ 44' 4''.5$. The *second* denotes the line of solar declination, as seen from the *Earth*; which at the maximum, or when the Sun is on the summer solstice of the Earth, is at an

angle of $23^{\circ} 27' 28''$,* this year 1857. The *third* line denotes, in like way, the line of solar, or heliocentric declination of Mars; which at the maximum, or when the Sun is on the summer solstice of Mars, is at an angle of $37^{\circ} 20' 22''.9$ in 1857.

When the Sun has removed 30 degrees in longitude from ν , and is found at ε , exactly one-third from ν to ε , if Mars be found at $\sigma 4$, then will the line from ε to $\sigma 4$, represent the *radius (vector)* of Mars, or his distance from the Sun, the same as the line from $\sigma 1$, to ν , and as the other line from ε , (near B) to M. These lines are equal in the diagram; and the latter being taken as the measure of Mars' distance from the Sun, when at his maximum declination, the line from the Sun's path at a , which joins $\sigma 4$, will be the *sine of 30 degrees, the angle of the longitude of the Sun*, as seen from Mars when at that point. And this line will be proved to be equal to the *sine* of Mars' heliocentric declination, when the Sun seen from Mars, has 30 degrees of longitude from ν . Thus, the sine of Mars' *greatest* declination, (= the angle M ν ε) : Mars' distance from the Sun ε M, :: the sine of Mars' declination when at $\sigma 4$: εf . But εf , is seen to be one side of a parallelogram, $f, \varepsilon, a, \sigma 4$; of which the line $a, \sigma 4$, is the opposite and equal side; therefore, $a, \sigma 4$, is

* This is the *mean* obliquity of the ecliptic for this year 1857. But the *Nautical Almanac* for 1857, gives the greatest *apparent* declination on the 21st June = $23^{\circ} 27' 37''.4$.

equal to ϖf , which point f , being joined to ν , will form the angle of Mars' heliocentric declination; viz., ϖ, ν, f ; the line ϖf , being the *sine* of that angle, of which ν, f , is the radius.

Let us now trace the motion of the Earth in like manner. If we take \oplus^3 , for the place of the Earth when the Sun enters ν , and the point E, for its place when it reaches the northern tropic and the Sun is found at ϖ , the summer solstice, then will \oplus^g , be the place of the Earth when the Sun reaches the point marked 45° . The Sun *there* will have 45 degrees of longitude, being half-way removed from ν to ϖ . And the line $g \oplus, b$, will be the *sine* of that angle and be also equal to the *sine* of the Sun's declination, ϖe . This may be proved in the same way as in the case of Mars just above given; for the two lines $g \oplus, b$, and ϖe , are the opposite sides of a parallelogram; and, therefore, equal in length. And if we join e to ν , the angle e, ν, ϖ , will be equal to the angle of the declination of the Sun when he has 45° of longitude from ν ; the line ϖ, e , being the *sine* of that angle of declination, of which ν, e , is the radius.

The same reasoning applies to the Planet Venus. This body may be conceived to be at ϱ^3 , being *equally distant* from the Sun at ν , as she is from him when he is found at 45° , viz., when she is at ϱ^h ; and again as she is from him when the Sun is entering Gemini, at π ; and she is at ϱ^k ; and lastly as she is, when the Sun is at ϖ , and Venus on

her northern tropic at V. Then, if we move Venus along the portion of the cycloidal curve she forms from φ^s , to V, until she reach φk , we find the Sun, as seen from Venus, entering π , and forming an angle of 60° of longitude from ν ; of which the line from φk , to c , forms the *sine*. And this line again is seen, for the same reasons as before, to be equal to ϖd ; which is the *sine* of the angle of the *heliocentric* declination of Venus, as may be seen by joining d with ν , which line will be the radius, and ϖd , the *sine* of that angle.

In like way does the diagram shew that if the three bodies Mars, Earth, and Venus, should all happen to come into a right line when the Sun was in 15° of Taurus, or in 45° of longitude from ν , then would their several places be shewn by φh , $\oplus g$, and σ^s ; and the several right lines from those places, which extend as perpendiculars to the Sun's course A B, and which are $\sigma^s x$, and $\oplus g, b$, and $\varphi h, i$, would be all *sines* of the angle of 45° formed by the Sun from each of the three Planets. And a right line drawn from the place of each Planet, parallel to A B, and joining ϖ, M , would cut off from ϖ , and measure the *sine* of the angle of that Planet's solar declination and be equal in length to the sine of the Sun's longitude with the various radii, viz., 45 degrees.*

* Such a right line is the *dotted* line drawn in the diagram from each Planet to join the line ϖM , and parallel to A B.

It has been already shewn, by ample instances, that these several angles of longitude, calculated on this principle and in accordance with the theory of the *Sun's* direct and equable motion through space and the corresponding motion of the Planets in *cycloidal curves*, do agree with observation and come out correctly, when calculated by the simple and unerring rules of plane trigonometry. Let those persons who seek for truth explain away this gigantic mass of evidence of the reality of this theory, plain to be seen and easy to be apprehended, if they are able.

CHAPTER VI.

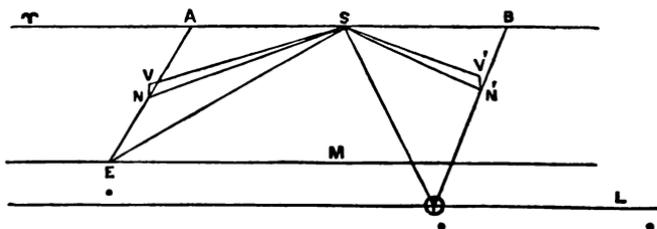
PROBLEM OF FINDING THE GEOCENTRIC LONGITUDE OF A PLANET FROM THE HELIOCENTRIC PLACES OF THE SAME—EXEMPLIFICATION IN THE CASE OF VENUS, WHEN EAST OF THE SUN—DITTO WHEN VENUS IS WEST OF THE SUN—THE SAME PROBLEM IN THE CASE OF A SUPERIOR PLANET—THE GEOCENTRIC LONGITUDE OF MARS COMPUTED—THE SOLUTION OF THESE PROBLEMS BY PLANE TRIGONOMETRY SHOWN TO BE A CONFIRMATION OF THE TRUTH OF THE SYSTEM OF CYCLOIDS.

THE application of the system of cycloids to the solution of the problem of finding the *geocentric* longitude of a Planet, when the *heliocentric* places of that Planet have been determined, comes now to be considered. Persons accustomed at all to astronomical calculations, on the system of ellipses, are aware that there is much that is complex and that requires careful study to understand and complete the calculation of a Planet's place in the heavens, upon that system. But it will be seen that, by the method I propose, the whole calculation, being based on plane trigonometry, merely comprises the solution of a simple problem, viz.:—having two sides given and their included angle, to find the other angles of the triangle.

It must be understood that I am now treating purely of the finding the *geocentric* longitude; and that the *heliocentric* places are assumed to have been already determined.

Let it be required to find the geocentric longitude of Venus, at noon, on the 19th April, 1857? The heliocentric longitude of Venus by N. A. = $196^{\circ} 6' 3''$, which gives the Sun's longitude, as seen from Venus, = $\sphericalangle 16^{\circ} 6' 2.6''$. The heliocentric *latitude* of Venus = $2^{\circ} 55' 4''$ N. The logarithm of the radius vector of Venus = 9.8581427; and that of the Earth is = 0.0022439: the true longitude of the Sun being $\sphericalangle 29^{\circ} 21' 42.5''$ from the mean equinox.

In the diagram annexed, it will be seen that the right line \sphericalangle , A S B, represents *the course of the Sun*



through space; and S the *place* of that body at the time named; while E is the place of the Earth, V that of Venus, in her orbit; and N the place of Venus, reduced to the plane of the Earth's course, the short line N V shewing the extent of the heliocentric *latitude* of Venus.*

The angle \sphericalangle S E = the longitude of the Sun from the Earth. The angle \sphericalangle S V = the longitude of the Sun, seen from Venus, which we will, for brevity, call the heliocentric longitude of Venus.

* The reader will please confine his attention to the *left* hand portion of the diagram annexed.

The angle N S E = $29^{\circ} 21' 42''.5 - 16^{\circ} 6' 2''.6 = 13^{\circ} 15' 39''.9$. Now, to find N S in the triangle V N S, where V S N is the heliocentric latitude of Venus, we have N S = V S \times cosine V S N: whence logarithm N S = -1.8575793 , and logarithm of E S is given. Hence we have the logarithms of two sides and their included angle, to find the other angles in the triangle S E N.

The calculation is as follows:—

Long. of the Sun + 20.3'' aberration =	29 : 21 : 42.5
Heliocentric Longitude of Venus . . .	16 : 6 : 2.6
	13 : 15 : 39.9 = N S E
Log. V S . . . — 1.858143	
Log. Cos. 2 : 55 : 4 — 1.999437	
	Log. N S . = —1.857580 = N S .7204100
Log. E S . . = 0.002244 = N S 1.0051814	
	From 180 : 0 : 0 Sum = 1.7255914 L. A C = —1.763062
Take N S E = 13 : 15 : 39.9	Diff. = .2847714 Log. — 1.454496
Sum of un- } known \angle s } = 166 : 44 : 20.1	
Half ditto 83 : 22 : 10	Tangent 0.934628
Half diff. of do. 54 : 50 : 22	Tangent 0.152186
	138 : 12 : 32 = E N S
	13 : 15 : 39.9 = N S E
	28 : 31 : 48.1 = S E N Angle of <i>Elong.</i> of Venus
	180 : 0 : 0

We have now the angle $S E N = S E A$, the angle of elongation of Venus; which + or — the Sun's longitude will give the *geocentric* longitude of Venus. Thus, $M E S$ is, by alternate angles, equal to $E S A = \gamma S E$, the longitude of the Sun; and $M E S + S E N = M E A = \gamma A E$, which is the *geocentric* longitude of Venus.

$$\begin{array}{r}
 \text{Thus } S E N = 28 : 31 : 48.1 \\
 M E S = 29 : 21 : 42.5 \\
 \hline
 M E A = 57 : 53 : 30.6 \quad \text{The geocentric longitude} \\
 \text{Do. deduced from R. A. } \left. \vphantom{\begin{array}{l} M E A \\ M E S \end{array}} \right\} 57 : 53 : 30 \quad \text{of Venus required.} \\
 \text{and dec. in N. A. } \left. \vphantom{\begin{array}{l} M E A \\ M E S \end{array}} \right\} \\
 \text{Diff. } \quad \quad \quad .6
 \end{array}$$

We will now introduce another instance, wherein Venus, being to the west of the Sun, the angle of her *elongation* must be *subtracted* from the longitude of the Sun, contrary to the method pursued in the last case. Let the heliocentric places given, be; 1st—Longitude of the Sun, $116^{\circ} 41' 20''.8$, corrected for aberration; 2nd—Logarithm of radius vector of the Earth, 0.0069400; 3rd—Heliocentric longitude of Venus, $340^{\circ} 43' 32''.7 = \gamma 160^{\circ} 43' 32''.7$; 4th—Heliocentric *latitude* of Venus, $3^{\circ} 22' 53'' S$; 5th—Logarithm of radius vector of Venus, 9.8618604.

These places are for noon on the 19th July, 1857; for which time the *geocentric* longitude of Venus is required? We proceed as before: (*see the diagram, page 120; of which the right-hand portion*

only is to be considered; and for \oplus substitute E in the calculation).

Log. Rad. Vec. of $\varphi = S V' - 1.8618604$

Log. Cos. $V'S N' 3:22:53 - 1.9992430$

Log. $N'S \quad \quad \quad = -1.8611034 = .726278$

From $180: 0: 0$ L. E S = $0.0069400 = 1.016111$

Take } $44: 2: 11.9^*$ Sum = 1.742389 L. A C = 1.758854

Sum } $135: 57: 48.1$ Diff. = $.289833$ Log. = 1.462147

Half $67: 58: 54 =$ Tangent 0.893191

Hf. dif. $22: 21: 32 =$ Tangent -1.614192

$90: 20: 26 = E N'S$

$44: 2: 11.9 = N'S E$

$134: 22: 37.9$

$180: 0: 0$

$45: 37: 22.1 = S E N' \text{ Elongation of Venus.}$

$116: 41: 20.8 = L E S = \gamma S E$

$71: 3: 58.7 = \text{Geocentric long. of Venus.}$

$71: 3: 44.2 \text{ Ditto by N. A.}$

Diff. 14.5

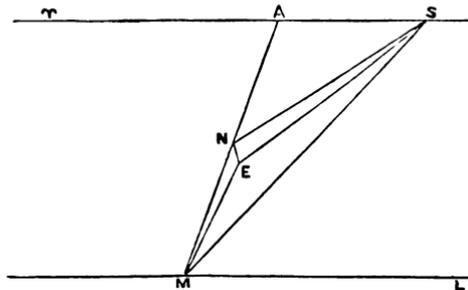
It may be as well to shew how I operate to find the *geocentric* longitude of a *superior* Planet; as the system is slightly different; inasmuch as I conceive the Planet in question to be in the place of the

* This is the hel. long. φ —long. \odot ; both taken from γ .

Earth, in these two former cases ; and then find *the longitude of the Earth, as seen from the Planet*, which being increased 180° , gives the longitude of the Planet required.

Let it, therefore, be required to find the *geocentric* longitude of MARS, at noon, on the 20th April, 1858 ?

The data for this are ; 1st—Heliocentric longitude of Mars, $221^\circ 57' 53''.5 - 180^\circ = \sphericalangle 41^\circ 57' 53''.5$; 2nd—Logarithm of the radius vector of Mars, 0.1941538 ; 3rd—Heliocentric *latitude* of Mars, $0.12' 27''.5$; 4th—Longitude of the Sun, $30^\circ 5' 42''$; 5th—Logarithm of radius vector of the Earth, 0.0023280.



In this diagram we have the line \sphericalangle A S, which represents the usual *course of the Sun through space* ; the line E S, which shews the distance of the Earth from the Sun, E being the Earth's place, and S the place of the Sun ; the line M S, which represents the place of \sphericalangle and its relative distance from the Sun ; the line N E, shewing the heliocentric

latitude of Mars, N being the Earth's place, when reduced to the plane of the Planet's course; the line N S, the distance of N from the Sun; the line A N M, being that in which the Earth appears, *seen from Mars*, and the angle γ A N, being its *martial* longitude required; which, increased by 180° , gives the *geocentric* longitude of Mars.

The calculation is as follows:—

Heliocentric longitude of Mars	=	41 : 57 : 53.5	from <i>Aries</i> .
Long. of the Sun + 20.3" aber.	—	30 : 6 : 2.3	
		11 . 51 : 51.2	= Angle M S N
L. σ dis. from \odot	=	0.1941538	
Hel. lat. Mars, } 0° 12' 27.5" Cos. }	}	9.9999970	
Log. M S	.	= 0.1941508	= M S 1.563689
Log. N S	.	= 0.0023280	= N S 1.0055744
From	180 : 0 : 0		
Take M S N	= 11 : 51 : 51.2	Sum = 2.5690634	Sine A C — 1.590225
Unknown \angle s	168 : 8 : 8.8	Diff. = .5583046	Sine — 1.746871
Half ditto.	84 : 4 : 4.4	. . .	Tangent 0.983354
Half diff.	= 64 : 26 : 46	. . .	Tangent 0.320454
	148 : 30 : 50.4	= S N M	
	11 : 51 : 51.2	= M S N	
	19 : 37 : 18.4	= N M S = <i>Elongation</i> of the Earth, seen from Mars.	
	180 : 0 : 0		

Then the angle $N M S = 19^{\circ} : 37' : 18''.4 + \text{angle } L M S = 41^{\circ} : 57' : 53''.5 = L M A = 61^{\circ} : 35' : 11''.9$, the *martial* longitude of the earth, from γ , which increased by $180^{\circ} = 241^{\circ} : 35' : 11''.9$ the *geocentric* long. of Mars required.

241 : 35 : 11 = Ditto deduced from R. A. and dec. in N. A.

Thus have we traced the method by which the system, founded on the proper motion of the Sun, and the formation of cycloidal curves, by the Earth, Venus and Mars, enables us to determine the *heliocentric* and *geocentric* longitudes of the inferior and superior Planets. It is clear that these results, coming out on all occasions in correct agreement with observation, demonstrate the reality of that system. It is for this object only they are here introduced; and, therefore, very great nicety of calculation has not been attended to; though never more than a very few seconds of difference will be detected when these longitudes are deduced from the right ascension, and the declination as given in the *Nautical Almanac*.

The reader will observe that in the diagram last inserted, on the 20th April, 1858, Mars will have arrived at M; and, *from that Planet*, the Earth will be seen in the line M N A, forming an angle of longitude = $\gamma 61^{\circ} 35' 11''.9$, as has been proved.

It may be possible that some persons, who have been accustomed to consider the *apparent* motion only of the Sun, caused by the *real* motion of the

Earth, may confound this *apparent* motion of that body with the absolute, *proper* motion I have now for the first time, I believe, introduced fully to public notice. And as, since such a misconception would lead to the idea that *the line of the Sun's motion* in the various diagrams I have offered to the reader's notice, describes a *curve* in the heavens, whereas in fact that line is always intended to signify a *right line* only, I am induced to present a more explicit diagram, (Plate IV.) In this it will be seen that the portion of a cycloid formed by the Earth while moving from the point of the vernal equinox past the northern tropic, unto the autumnal equinox, is marked 1, 2, 3, 4, 5, 6, 7. The line from 1 to 7, denotes the line of the Sun's absolute, *proper* motion through space; from γ through ϖ to \sphericalangle . But I would particularly guard and caution the reader from supposing that any part of this line, for instance, that portion contained between γ and ϖ , should be considered as a portion of the *curve* of the ecliptic; or that it has any reference whatever, either to the ecliptic, or any other of the great circles of the heavens, as they are termed. On the contrary, I mean the large circle, with γ contained therein, to represent *the point in space* where the Sun is at the moment of the *vernal* equinox; when, if the Earth be at 1, the body of the Sun will be, of course, referred by the eye to the *first* point of the sign **ARIES**, near 7.

By continuing to trace the Sun's motion, we shall find him, when removed one-third of his course from 21st March to 21st June, at the point marked 2. And he will then appear to be entering the sign TAURUS; being then, in fact, as seen from the Earth at 2, in 0° of that sign, and having, so far as *appearances* go, moved from γ $0^{\circ} 0'$, over 30 degrees of longitude. Then, when the Sun arrives at the point shewn by the large circle, marked ϖ , (being *half* of his *proper* motion from the time of the vernal to that of the *autumnal* equinox) he will be seen from the Earth, as if he were entering the sign CANCER. The Earth will then be at the point 4, having removed over one moiety of its course from the vernal equinox at 1, to the autumnal equinox at 7; and it will *then* be found to form a *right angle* with the line of the Sun's course. The Sun being seen in line with the Stars commencing the sign CANCER, will form the amount of a right angle, or 90° from the first point of ARIES at 7.

Now, as regards *longitude* in the 'heavens, measured along the zodiac, from ARIES to CANCER, things will be exactly the same as if the Sun had *stood still* in the heavens (as the Newtonian system supposes) at the point γ , and the Earth had moved, not from 1, through 2 and 3 to 4, but had formed one quarter of a circle, or gone through one-fourth of its course, keeping always at the same distance from the Sun. However,

we have seen that the Sun has *not* stood still while the Earth moved from 1, the point of the vernal equinox, to 4, that of the northern tropic, but has moved forward in space one-fourth of its annual rate. The Earth has, in fact, also passed over the same distance as the Sun from γ to ω , *plus* the 95,000,000 of miles it was *behind* the Sun, when at 1; having got equally *forward in space*, and been at the same time *repelled* out from the line of the Sun's course (1 to 7) by an equal amount of 95,000,000 of miles, its distance from the Sun at 4.

If we admit this forward motion of the Sun (which I have amply proved in the early part of this essay), then are we forced to admit that the Earth has moved from 1 to 4; and consequently has *not* moved in a circle or anything at all approaching thereto; but has really advanced forward in that portion of a *cycloid* formed between 1 and 4.

It has seemed to me to be advantageous to introduce these remarks here, that my readers may see that I do not build my arguments in favour of the Sun's proper motion and the *cycloid* system merely, or, indeed, even considerably, on the facts of the heliocentric and geocentric motions of the Planets being traceable on that system. Because I may be met by the objection that these motions are equally to be traced—though perhaps not so readily—on the system of ellipses. But I adduce

evidence in the first place that the system of ellipses with a moveable focus is *impossible*, because it involves the physical absurdity of simultaneous motion in opposite directions; and, secondly, that the combined effects of the *proper* motion of the Sun through space and the Planets with him *must* produce a serpentine course on the part of these latter bodies, eventuating in cycloid curves. And then, lastly, I shew that the motions, being supposed to be such as I declare, there is no difficulty in tracing the heliocentric and geocentric longitudes of the Planets in the manner I have attempted; which *confirms* the arguments in favour of the system I have propounded.

Now that I have shewn beyond dispute that the places of the principal bodies in the Solar System may be ascertained, both as they appear from the Sun and from the Earth, by taking for the *principle* of the calculation the theory that embraces the *proper* motion of the Sun, at the rate I have set forth, and the cycloidal curvilinear motion of the Planets, it may be well to ask the reader to pause. The object of such pause should be to enquire, whether, amidst all the *glitter* of modern "physical astronomy," there be not something which is *not* gold? The character of modern philosophy, like that among the ancient Greeks, is not quite free from suspicion. It is not now for the first time that this has been observed. Let the following passage from Lord Bacon's critique on the works

of the more eminent philosophers, be offered as proof of this assertion :—

“ We plainly perceive, that the sciences will not be considerably advanced, till men shall be once made thoroughly acquainted with the proper characters and merits of those ancient and modern philosophers they so much admire. The present design is, therefore, to deal roundly, and fix a mark upon such pretended philosophers as we take to have been more fabulous than the poets; debauchers of men’s minds, and *falsifiers of the works of nature*, and to make at least as free with that degenerate, servile tribe, their followers, flatterers, and the hirelings *who corrupt mankind for gain*.”

Who does not see that, had Bacon lived in our day, he might well have re-written and re-asserted all that he said of the vain fops and silly, empty coxcombs, of his own time; and applied his sarcasms to some great names and mighty dons who figure away at the meetings of our *savans*; and to the toadies who scribble in scientific journals in support of men and things, which, like Newton’s theological writings would, if TRUTH alone had rule, be declared “unfit to be published!”

Let the reader, who has followed me thus far, be pleased to consider how simple and how easy to conceive is the system I propound. Let him only cast his eye on the curve formed by the Earth, or Venus, or Mars, from the point when either body is upon the line of the Sun’s course, and the latter is seen in the first point of the sign Aries, until they reach their several tropical points (see *Plate VII*). Let him next glance

at the complex and confused explanation of the motion of the Earth and Planets in ellipses, as given in modern books on astronomy. And then let him reflect on the *reason* why these very simple facts of astronomy have not been seized on by the modern practitioners of the science. What is that reason? I boldly answer that it is to be found in the very grievous vanity and self-sufficiency of the moderns. They cannot even give a modicum of praise to ancient observers and computers. If they mention the fathers of the science at all, it is mostly with a sneer or the utterance of some contemptuous phrase. What can be more depreciating than the tone of their remarks generally, whenever any kind of question arises as to the amount of knowledge possessed by the ancients? Nothing; except it be the fulsome praise they lavish on the gods of their idolatry, the founders of "Physical Astronomy."

Mr. Woodhouse, for instance, at p. 331 of his "Treatise on Astronomy," launches forth in this style. "We have now gone through the explanation of the three principal lunar inequalities, which were discovered before the time of Newton and the rise of Physical Astronomy. These inequalities were by reason of their magnitude, *fished out*, (as a late writer has significantly expressed it.) Ah, "fished out," indeed; and so, nobody is to get any credit for observation and intelligent research, "before the time of Newton."

In like way, *Mr. Vince*, in page 139 of his "Elements of Astronomy," when noticing the Moon's evection, as stated by Ptolemy, observes, "It is *very extraordinary* that Ptolemy should have determined this to so great a degree of accuracy." This is the usual tone of modern astronomers. But let them not retort on me that I attempt to depreciate their science. It is not so. I am willing to give them; to give Newton and the founders of "Physical Astronomy;" and also to give to Ptolemy and every individual, ancient or modern, his or their just due. But what I am now depreciating is the arrogance and insolence and ignorance of modern writers on astronomy, who forget, when they boast of having arrived at so much perfection, that they have not hitherto even got so far on the road to perfect knowledge as to have ascertained the law of the certain, and yet amazing proper motion of the great soul and centre of the system, the glorious Sun itself!

CHAPTER VII.

ON THE MOTION OF THE FIRST SATELLITE OF JUPITER—THE CORRECT PREDICTION OF THE ECLIPSES OF JUPITER'S SATELLITES, NO DECISIVE PROOF THAT THEY MOVE IN ELLIPSES—THE ASTRONOMERS PLAYING THE PART OF THE BOTTLE CONJUROR—DIAGRAM OF THE TRUE AND REAL MOTIONS THROUGH SPACE OF JUPITER AND HIS FIRST SATELLITE ACCORDING TO THE NEWTONIAN THEORY—THE MOTION OF THE SATELLITE THEREBY PROVED TO BE A CYCLOID—DIAGRAM OF THE SAME MOTIONS ACCORDING TO THE THEORY OF THE PROPER MOTION OF THE SUN—THE MOTION OF THE SATELLITE THEREBY SHEWN TO BE A MORE BEAUTIFUL CYCLOID—FALLACIOUS APPEARANCE OF THE PHENOMENA AS SEEN FROM THE EARTH.

I PURPOSE to offer in this chapter a few remarks and calculations on the *apparent* motions of the Satellites of the Planets in the Solar System ; and then I shall endeavour to prove that the ellipses which they *appear* to form are not such in reality, but are the result of the motion of their primaries being wholly *neglected* by astronomers. It follows that when we neglect and leave out of sight, entirely, a very important element in the computation of any kind of motion, or, indeed, of any other thing, we cannot by any possibility expect to get a really true result. Now, the custom among astronomers is to consider only the attraction of the Planet upon its Satellite, and the mutual attraction of the Satellites on each other—in cases where there are more than one—and then to take into consideration the general laws, as they are termed, of centrifugal and centripetal forces,

and so frame a calculation, by which to determine the place in which the Satellite should appear at any given moment. And then, if the said Satellite do so appear, as regards its angular distance from certain stars, or from the Planet, they forthwith conclude that, not only their calculation is correct, but that the *principles* on which it is founded, are thereby proved to be true! Now, they have no excuse for thus leaping to a conclusion. History has over and over again shewn us that sundry and various *principles* and methods of calculation, from the concentric cycles of Hipparchus, down to the eccentric epicycles of Regiomontanus, have been alike rewarded with correct results. Yet nobody in their senses will for a moment pretend, that those old fashioned systems were based on the *real facts*, as they exist in nature. Why, then, are we to be told that, because modern astronomers are able, by the Newtonian *principles* of "Physical Astronomy," as they delight to designate them, to foretell accurately the moment when the first Satellite of Jupiter shall be *eclipsed*, there is in that fact decisive evidence that such Satellite really moves in an *ellipse* round Jupiter? The answer to this question should not be given till it be remembered that by supposing the *Sun* to rise bodily in the east and progress forward to the west, we may foretell accurately the moment when he will be on the meridian. And yet we know very well that this is all *mere appearance*; and that the Sun does

not rise bodily in the east, nor progress one inch towards the west ; but that there is *another* cause for his coming to the meridian ; which lay hidden in the womb of nature, unknown and unsuspected by all the most able astronomers in the world, until the Monk of Worms—Copernicus—hit upon the happy thought, that all this *apparent* motion of the glorious Sun could be explained by the mere supposition that the Earth itself turned, once in 24 hours, round upon its axis.

The question may be thus answered. The evidence that the first Satellite of Jupiter forms an ellipse round the Planet, once during each of its periods, is not conclusive, but may be declared to be hollow and deceptive ; because (mark well the “because”) it has never yet been proved that it is *possible* for one body to form an ellipse round another, while that other is *itself* in motion. Before astronomers have a right to ask us to believe that the eclipses of the first Satellite of Jupiter concurring with the times calculated on the elliptical theory, are decisive evidence of the truth and reality of that theory, they should have quietly asked whether they could not be equally well explained upon some other theory, which is not obliged to *conceal the fact* that the primary itself, the *focus* of the ellipse, is in rapid and continuous motion all the while.

In fact, the astronomers have been this long while playing the part of the bottle conjuror. This

very notable individual politely invited a vast number of the lieges to witness the interesting experiment of a man getting into a quart bottle. The folk assembled accordingly and were somewhat disappointed, when the conjuror made his escape without even an attempt at performing the promised experiment. This disappointment might have been avoided, if the people, before they came together to witness the trick, had possessed the wisdom to request the experimental philosopher to explain and prove that it was *possible* for a man to get into a quart bottle. Let us make the experiment not of the bottle, but the ellipse, for our own satisfaction. Let us take a diagram of the *real* and *true* motion through space, not only of the first Satellite of Jupiter during its period, but of the body of Jupiter itself, during the same period. And let us trace these motions carefully, and then determine whether the *line of motion* of the Satellite should be termed a circle, an ellipse, or a cycloidal curve. We are necessitated to adopt, for this examination of the matter, the supposed Newtonian ellipse of Jupiter *round* the Sun, or at any rate a circle, having for radius the distance of Jupiter from the Sun. But we will also examine subsequently what results arise from adopting the *true* amount of motion that Jupiter has through space *with* the Sun. For these purposes two distinct diagrams will be needful; the first, founded on the false idea that Jupiter forms an ellipse *round* the Sun, will, of course, present a

false and exaggerated result ; although even that will prove that the first Satellite of Jupiter must move in a curve, which is cycloidal ; but the second diagram, founded on the *true* motion of Jupiter through space, *with* the Sun, will display the true and beautiful cycloid which the first Satellite does really form once in every forty-two hours and a-half, that being the extent of its period.

In pursuing this investigation, I shall take the data from Sir John Herschell's Treatise on Astronomy, which may be depended on for the accuracy of all such matters.

Half the equatorial diameter of the Earth being 3,963 miles, if we multiply that number into 10.86, we get the half of the equatorial diameter of Jupiter = 43,038 miles. Now, the mean distance of the first Satellite of Jupiter, expressed in equatorial radii of the Planet, is 6.04853. Therefore, $43,038 \times 6.04853 = 260,317$ miles, the *mean distance* of the first Satellite of Jupiter from the centre of the same. The mean distance of Jupiter from the Sun is about 494,263,720 miles, and the mean sidereal period of the Planet is 4,333 days. If, therefore, we multiply the former number by 2, and then by 3.1416, we shall get the circumference of the supposed orbit of Jupiter, presuming it to be a circle, which for this calculation we may safely venture to do. And then if we divide this orbit by the number of days, we shall get the amount of 716,722 miles as the daily extent of the forward motion of Jupiter

in his orbit. This again, divided by 24, presents the *hourly* motion of Jupiter as just 29,863 miles.

Now the period of the sidereal revolution of the first Satellite of Jupiter, is $1^d\ 18^h\ 28^m$ which we may call 42.5 hours. This we will divide by 4, giving us $10^h.625$ for the quarter of the period of the Satellite, that is to say, $10^h\ 37^m$.

If we multiply the hourly motion of Jupiter in his orbit by 10.625, we get the number of miles that Jupiter moves forward while the Satellite is passing through *one-fourth* of its period, viz., 317,294 miles. From which it appears that while the Satellite passes through one quarter of its period, the Planet moves over a space larger than the mean distance of the Satellite, by just 56,977 miles. If, therefore, we represent the distance of the Satellite by 1 inch, we must represent the motion of Jupiter in $10^h\ 37^m = 1.2$ inch.

It will be seen that upon this basis the diagram Fig. 1, Plate V. is drawn; which represents the actual relative motions and positions of Jupiter and his first Satellite during one period of the latter, or 42.5 hours, viz.: from the time the Satellite is seen from Jupiter in conjunction with a given Star, until it be again seen in conjunction with that same Star.

Let the line A B in the diagram Fig. 1, Plate V., represent the portion of the orbit of Jupiter passed over by him in twice 42.5 hours. It is represented as a right line, because the departure from a right line is so trifling that we cannot very well shew it

on so small a scale. Then, on the left hand, is seen a large circle, representing Jupiter, with the figure γ in the centre. The small circle marked a , represents the place of the first Satellite, and the line γa , measures one inch and depicts the Satellite's mean distance from the Planet. This said line is supposed to point to a given Star, which appears in conjunction with the Satellite when viewed from Jupiter, at a given epoch.

The place of Jupiter at the end of $10^h 37^m$ from the epoch, will be at γ , 1. And as the Satellite will still be found at one inch from Jupiter, its place will be at b . This latter point, which it is essential to understand well, to be able to judge of the correctness of the diagram, will be obvious, if we only reflect that, if Jupiter did not move forward, but remained stationary at γ , and the Satellite (as is generally supposed) moved *round* the Planet in the direction from a to A , it would in *one-fourth* of its period have reached A ; still being one inch away from its primary. However, we know that such is *not* the case; and that, as Jupiter never does cease to move *round* the Sun (by the Newtonian system), he must have reached γ 1 in that period, and the Satellite must either part company from him, which it would do, if it went to A , or must have followed him and arrived at b . The Star with which the Satellite was in conjunction when at a , will now be seen at an angle of 90° from the Satellite, when viewed from Jupiter, because the Satellite has in

fact passed over one-fourth of the course it goes through in one period, and as the Jupiter astronomers may not be cautious enough to remember that they are themselves in motion, but may forget the essential fact of Jupiter's own motion through space, it may *appear* to them, as it does to our astronomers, that the Satellite, *because* it has changed the angle of measurement from the given Star 90° , has *really formed a quarter of a circle*; whereas it has in truth done nothing of the sort, but merely passed from *a* to *b*; which is, as may be seen by the diagram, no portion whatever of either circle or ellipse.

We will now proceed to trace the motions of the two bodies during the remaining three-fourths of the 42.5 hours. At the end of a second $10^h 37^m$ Jupiter will be seen at $\gamma 2$, and as the Satellite will then be at 180° from the Star it was in conjunction with when at *a*, it must needs appear at *d*, when viewed from Jupiter; and it is clear, therefore, that it must have passed from *b*, through *c*, to *d*; along the dotted line. In the third portion of its period, or in another $10^h 37^m$, Jupiter will pass on to $\gamma 3$, and the Satellite, which will then form an angle of 270° from the point it started from, will be found (still at one inch from Jupiter) at *f*; and so again at the end of the fourth $10^h 37^m$ the Planet will be found at $\gamma 4$, and the Satellite at *g*; where it will again be seen from Jupiter in conjunction with the given Star it was seen with at the epoch, which commenced its period.

Let the reader now run his eye along the dotted line that forms the curve from *a*, through *b*, *c*, *d*, *e*, and *f* to *g*, which is the course the Satellite has run through during its *period* of 42.5 hours; and then let him declare that the astronomers are right, and that the said curve is an ellipse! This he cannot do, as it is obvious that the curve formed by the Satellite is a *cycloid*; which appears again by tracing the Planet and its Satellite through a second period of forty-two days and a-half, as may be done in the farther portion of Fig. 1, where Jupiter's place at the end of each 10^h. 37^m. will be seen at \sphericalangle 5, \sphericalangle 6, \sphericalangle 7, and \sphericalangle 8; and the Satellite's several places at *h*, *i*, *k*, *l*, *m*, and *n*.

But though the Satellite is, even upon the false principle of Jupiter's supposed motion *round* the Sun, thus shewn to move in a *cycloid*, it is a harsh and exaggerated curve and far from the truth. The really true and beautiful cycloid curve, formed every forty-two hours and a-half by this first Satellite of Jupiter, will appear on inspecting Fig. 2, Plate V. We there have also taken the right line A B, to represent the course of Jupiter through space as he moves on in company with the Sun, during the period of 42.5 hours, in which his first Satellite goes through all the phases of its course, and forms that *apparent* ellipse, which has misled the astronomers of our day, and induced them to treat it as if it were a reality and not a mere *appearance* or optical illusion. In this figure we have taken the distance of

the Satellite from Jupiter, which is 260,317 miles and represented it by one inch, as in Fig. 1. But the distance that Jupiter himself moves along his course A B, we have taken thus:—the *hourly* rate of motion of the Sun through space, we have previously shewn to be, in round numbers, 100,000 miles. Then, as Jupiter never parts company from the Sun, but is always found very nearly at the same distance, common sense declares that he also must travel through space at the same average rate. Therefore, multiplying the mean hourly motion of Jupiter by 42.5, we get, for the amount of space over which Jupiter passes during one period of his first Satellite, 4,250,000 miles. Then if we take one-fourth of this distance for his motion in one-fourth of the Planet's period, we shall find it to come very nearly to the distance of the Satellite from the centre of the body of Jupiter multiplied by 4. Thus—distance of Satellite = $260,317 \times 4 = 1,041,268$ miles; and the above number of $4,250,000 \div 4 = 1,062,500$ miles. Therefore, we must depict the motion of Jupiter in one-fourth of the period of his first Satellite, or in $10^{\text{h}}. 37^{\text{m}}$, by a space of four inches, representing 1,000,000 miles, if we take one inch for the line that represents the Satellite's distance from the Planet.

Accordingly we have represented the place of Jupiter at the epoch, when his first Satellite is found in conjunction with a given fixed Star, by the large circle at A, and the first Satellite at *a*; the line \sphericalangle *a*,

being, as in Fig. 1, just one inch in length. Then at the end of $10^h 37^m$ Jupiter will have moved from ν , to $\nu 1$, over the distance of four inches. But the Satellite will then be found, as seen from the Planet, at an angle of 90° from the said Star, and *being* still at the same distance of one inch from Jupiter, *must* needs be represented to be at b ; and *must* needs have passed along the *dotted* line from a to b . So again, during the second quarter of the Satellite's period, the course of Jupiter will be another million of miles through space, and we must place him at $\nu 2$; while the course of the Satellite will be from b , through c to d , where it will be found at an angle of 180° from the Star it was seen with at the epoch; and still at the usual mean distance from the Planet. We have now to trace the course of Jupiter, during the third quarter of the Satellite's period, from $\nu 2$ to $\nu 3$; and the Satellite from d , through e to f ; where it will be again seen at an angle of 90° from the Star it was in conjunction with at first, having passed through 270° of its *apparent* circular course, as seen from Jupiter, and as seen from the Earth. The last quarter of the Satellite's period, completing the 42.5 hours, gives us Jupiter advanced another million of miles (still speaking in round numbers), and we find him at $\nu 4$, while the Satellite has reached g ; and is again seen from Jupiter in conjunction with the same Star as at the epoch, when the period commenced.

Of course, the Satellite has *appeared*, if viewed from Jupiter, to have gone through 360° , and so *formed a circle*. And, if there be any very clever astronomers, inhabitants of that Planet, who take *appearances* for realities, and do not choose to consider their *own* motion through space, while the Satellite *seems* to dance round them, I think it probable they may have some such fallacious theory afloat, as the Keplerian and Newtonian doctrine of circular or elliptical motion. And further, as there may be a few philosophers also, residents of the first Satellite itself, they must, during the 42.5 hours of its period, see the monster Planet Jupiter *apparently* pass through all the circle of the heavens, only in the opposite direction; and, if they be profoundly ignorant of the laws of motion and of their own especially, or deeply wedded to some fancied theory, they may with equal truth and reason, declare that it is Jupiter which goes *round the Satellite*, as some "wise men" do, that the Satellite goes *round Jupiter*—both being equally false and equally preposterous.

Let the reader now cast his eye along the *dotted* line shewing the course of the Satellite through its period of forty-two hours and a-half from *a*, through *b*, *c*, *d*, *e*, and *f* to *g*. He will then perceive that the said body has gone through neither circle or ellipse; but has in reality formed a beautiful *cycloidal* curve. And this curve will be found to be quite analogous to that formed by the Earth

in one year, only far more elongated; as the real space passed through by Jupiter during one period of its Satellite is about 16 to 1, as compared with his distance from the Satellite; whereas that passed through by the Sun, during one year, is only about 9.2 to 1, compared with the distance it is from the Earth.

Of course, I might burden my page with similar investigation of the motions of the other Satellites of Jupiter; and also those of Saturn and Uranus; but this would be useless; as, if the case be proved with one, it is proved by all; for, *ex uno disce omnes*; since the same laws of motion obtain among all the bodies of the Solar System. In short, we may be assured that it is *impossible* for the Satellites to form any other curve, when moving through space in company with their primaries, than that denominated a *cycloid*.

This fact once admitted, our astronomers and mathematicians have nothing to do but to investigate the laws of that *lateral* force, which, acting at right angles to the line of direct motion of the Sun, first repels the Planets and their Satellites from that line and then attracts them back again; thus, alternately producing two opposite motions, such as are effected with a pith ball, first attracted and then repelled by a body giving out a sufficient amount of electricity.

It appears to me that the stupendous agent in the operations of nature, known as electricity, may be that which produces the *lateral* motion of the

Satellites in our system. When the Satellites are *inside* the line of the Planet's course, as refers to the Sun, they have the *light* of the Planet as well as that of the Sun thrown upon them. This, *if light be a modified electric action*, would cause them to be more highly electrified. When *outside* the Planet's course they have less light, and are less electrified. This may explain their alternate attraction and repulsion to or from the Sun.

I shall conclude this chapter by begging the reader to reflect and to remember that, if the first Satellite of Jupiter do really move as I have described, it must occur that, on looking at it from this Earth, it will be seen first on one side and then on the other of the Planet; and, as the motion of the Planet itself cannot be immediately detected and does not become obvious, it is very easy to *imagine* that the motion of the Satellite, the only body of the two seeming to move at all, is a circle. And, on closer investigation, as the moving body when on one side of the *apparently* stationary body, is nearer to the *apparent* focus of its motion than when on the other side, to conclude that the seeming circle is really an ellipse. But farther and more exact examination of the phenomena demonstrates that the Planet moves nearly in a right line with immense rapidity, and that the Satellite moves with equal swiftness on the average, and forms a beautiful *cycloidal curve* during each of its apparently elliptical periods.

CHAPTER VIII.

ON THE NATURE OF GRAVITY—SIR JOHN HERSCHELL'S ARGUMENTS IN FAVOUR OF GRAVITY REFUTED—A STONE FALLS TO THE GROUND, NOT BY THE POWER OF GRAVITY, BUT BY MAGNETIC ATTRACTION, WHICH DRAWS ALL BODIES TO THE EARTH—THE MOON ACTING AS A MAGNET, MAY DISTURB THE PARALLELISM OF THE EARTH'S POLES, AND SO PRODUCE "NUTATION"—FOUR DISTINCT ARGUMENTS FOUNDED ON KNOWN FACTS, TO PROVE THAT THE MOON DOES NOT AND CANNOT MOVE IN AN ELLIPSE—SIR JOHN HERSCHELL'S EXPERIMENT OF THE "STICK" AND "STRING," SHOWN TO BE DELUSIVE AND FALLACIOUS—NEWTON'S DEMONSTRATION THAT GRAVITATING BODIES, MOVING IN EACH OTHER'S NEIGHBOURHOOD, MUST MOVE IN ONE OR OTHER OF THE CURVES KNOWN AS CONIC SECTIONS, SHOWN NOT TO APPLY TO THE PLANETS OR THEIR SATELLITES, AND THEREFORE NOT TO THE EARTH AND MOON—THE LAW OF GRAVITATION THUS PROVED NOT TO EXTEND TO THE SOLAR SYSTEM—DEMONSTRATION THAT THE MOON MOVES IN A CYCLOIDAL CURVE.

THE domain of the Solar System should be entered with a spirit of simplicity—for it contains nothing but what is very simple—but the pride of the mathematicians and their neglect of the most plain and obvious facts, have rendered the whole body of astronomy, as regards the Solar System, a mass of complex fallacies. The common sense of mankind ought to be at war with the mathematics, so far as they have been applied to astronomy, because they have hitherto engendered nothing but fallacious theories; while they have completely concealed from the eye of the multitude of mankind the beauties of that noble work of God, the Solar and Planetary System; which, when truly explained, may be rightly appreciated by a mere schoolboy, if

provided only with a knowledge of decimals, logarithms, and the principles of plane trigonometry. If it were permitted, in treating on such subjects as now engage our attention, to be guilty of a pun, I should say that astronomers, in establishing their favourite theory of gravity, argue most ludicrously in a vicious circle, though with abundant gravity all the while, and apparently unconscious of the ridiculous effects of the attempts to establish as an admitted principle, the very principle in question.

To elucidate this observation, I will quote from Sir John Herschell's "Treatise on Astronomy," a few passages at pages 234, and following; and then point out how little is proved, and how much is taken for granted.*

After some remarks on the nature of *gravity*, Sir John asks, "Is it not reasonable to imagine that the same force of gravity *may* (since we know that it is exerted at all accessible heights above the surface, and even in the highest regions of the atmosphere) extend as far as sixty radii of the Earth, or to the Moon? And may not this be the power—for *some* power there *must* be—which deflects *her* at every instant from the tangent of her orbit, and keeps her in the *elliptic* path, which experience teaches us she actually pursues?"

* I must here repeat, that it is not the individual astronomer I attack, in this or any other case, but the erroneous system the astronomers, as a body, have erected.

No, Sir John, we cannot believe in the *power*, because we cannot discover the *effect*. We have seen no evidence in your book that the Moon, or any other body, *can* move in an ellipse, while the *focus* of the ellipse is itself in rapid motion; which, as regards the Moon, is the case, because the Earth (which is the focus of the ellipse you say she forms) is for ever *moving*, according to your own admission, at the mean rate of 68,000 miles an hour; but in accordance with the theory I propound, of the *proper* motion of the Sun, at the mean rate of 100,000 miles per hour. But, on the contrary, we are convinced that, if the Moon really did move in an ellipse round the Earth, there are times, just after New Moon, for instance, when she must be moving in the very contrary direction of the Earth; and when, if this lasted for only two hours and a-half, the Moon would be at double her usual distance from the Earth. But this you know, learned Sir, she never is. And this, therefore, is *one* fact which refutes all the "experience" you speak of, as teaching you that the Moon actually pursues an elliptic path.

Sir John proceeds thus:—"If a stone be whirled round at the end of a string, it will stretch the string by a *centrifugal* force, which, if the speed of rotation be sufficiently increased will at length break the string, and let the stone escape. However strong the string, it may, by a sufficient rotatory velocity of the stone, be brought to the utmost tension

it will bear without breaking; and if we know what weight it is capable of carrying, the velocity necessary for this purpose is easily calculated. Suppose, now, a string to connect the Earth's centre, with a weight at its surface, whose strength should be just sufficient to sustain the weight suspended from it. Let us, however, for a moment imagine gravity to have no existence." [Pray, how are we to imagine weight without gravity, if we are to believe this latter to be the *cause* of bodies having weight?] "And that the weight is made to revolve with *limiting velocity* which that string can barely counteract; then will its tension be just equal to the weight of the revolving body; and any power which should continually urge the body *towards the centre* with a force equal to its weight, would perform the office, and supply the place of the string if divided. Divide it then, and in its place let gravity act, and the body will circulate as before; its tendency to the centre, or *its weight*, being just balanced by its centrifugal force." [Here we see that weight and gravity are mixed up one with the other, each denied and each *supposed*, as it suits the philosopher to fancy; while all the while we know that no such experiment has been made, or can be made; and that no safe philosophy, no indisputable *knowledge*, can be based upon such a flimsy foundation as to "*suppose* a string to connect the Earth's centre," &c., for by it we are asked to admit the very thing in question, viz., this said *gravity* towards

the Earth's centre. Is not this arguing in a circle? Yet we have good authority for disputing it, being told that a stone thrown from the hand obliquely upwards, is, in its descent (when of course the force given it by the hand has ceased) found to have motion, *not* towards the centre. That authority is Sir John Herschell himself, at page 233.]

The writer afterwards continues the subject thus:—"In order that a body at the distance of the Moon (or the Moon itself) should be capable of *keeping its distance* from the Earth by the outward effort of its centrifugal force, while yet its time of revolution should be what the Moon's actually is, it will appear that *gravity*, instead of being as intense as at the surface, would require to be very nearly 3,600 times less energetic; or, in other words, that its intensity is so enfeebled by the remoteness of the body on which it acts, as to be capable of producing in it, in the same time, only $\frac{1}{3,600}$ th part of the motion which it would impart to the same mass of matter at the Earth's surface * * Now, in such a diminution of energy with increase of distance there is nothing *prima facie* inadmissible."

Here we must take breath, and beg to tell the learned pundit that we cannot agree to this. We think it not only "inadmissible," but monstrous to imagine that this fancied, invisible, and may we not add, *immaterial* power, called *gravity*, shall act through a distance of thirty times the diameter of the Earth, upon the Moon, and "deflect her at every instant

from the tangent of her orbit." We simply ask whether the said action of gravity be *by means*, or *without means*? If *by means*, then comes the question, what are those means? Are they physical and material, or are they independent of matter, spiritual and æsthetic? Does the centre of gravity at the Earth, or does the whole spheroid, each separate particle, *act*? And, in either case, how can these bodies act where they *are not*? From the Earth, at least from the extremity of the atmosphere of the Earth, to the surface of the Moon is a space of over 230,000 miles. Now there is either a space *void of matter*, extending that 230,000 miles, or there is therein existing *some matter*. If the former, how is it possible that one material particle can act on another through a vast vacuum, wherein exist no means upon which it may act? If the latter, then we presume it is *ether*, that fine ethereal fluid, supposed to fill all space, by and through which the grosser particles of earthy matter extend their influence to the other gross material particles of the Moon. The imagination reels before the attempt to picture the possibility of such heterogeneous masses acting together in any way. The idea was all very well for the Seventeenth Century, and for the dreamy brains of the philosophers of that day; but who does not see that, if it had been first started now, in our day, it would have been puffed away by the power of steam or shattered into atoms by the lightning force of electricity? We are a practical people. The attraction of mag-

netism we can see and understand; the attraction of electricity we can measure and define, and bend to our service; these we know; but the attraction of *gravitation* is a myth; and to it we address the words, "Who and what art thou?"

Sir John Herschell puts the case thus. He says, page 236, "The argument, therefore, stands thus:—on the one hand, *gravity* is a real power, of whose agency we have daily experience. We know that it extends to the greatest accessible heights, and far beyond; and we see no reason for drawing a line at any particular height, and there asserting that it must cease entirely; though we have analogies to lead us to suppose its energy may diminish rapidly as we ascend to great heights from the surface, such as that of the Moon." [In the name of wisdom and truth, what possible height on Earth, or connected with it, can at all be compared with that of the Moon, which is far over 230,000 miles away?]

"On the other hand, we are sure that the Moon is urged to the Earth by *some* power, which retains her in her orbit, and that the intensity of this power is such as would correspond to a diminished gravity, in the proportion—otherwise not improbable—of the squares of the distances. If gravity be *not* that power, there must exist some other."

Ah, there lies the rub. "Some *other* power" there undoubtedly is; not by which the Moon is urged towards the Earth; for she is as often urged away from

the Earth ; but some other power by which a stone is made to fall to the ground. Has not Farraday proved, beyond dispute, that nearly all known bodies may be considered as either magnetic or diamagnetic? And if the Earth be a huge magnet, does it not appear evident that a stone may be compared to a particle of a magnet chipped off from it, which, if placed within the scope of its attraction, will be drawn to it again? Here is a reason *sufficient* to account for why a stone falls to the ground, and why all bodies are drawn to the Earth. But there is no reason to assert that the magnetic attraction of the Earth extends to the Moon, which yet remains to be proved, notwithstanding Sir John Herschell says, " We are sure the Moon *is* urged to the Earth and so kept in her elliptic path ;" for, as we deny the *fact* of her having any elliptic path, we of course dispute the cause of its existence. Still we are not disposed to deny that the Moon, being also a large magnet, may, when approaching either pole of the Earth *deflect* that pole from its true parallelism, and so cause the effect termed by astronomers Nutation, though not in the way they conceive.

We may eventually consider more of Sir John Herschell's arguments, while, as he pleases to express it, " working his way upwards to the law of gravity from a general consideration of the Moon's orbit." But we shall first undertake to prove that the path of the Moon is not anything like an ellipse, but is really and truly a *cycloid* curve, which is very

much more elongated and drawn out than those formed by the Satellites of Jupiter, in consequence of the much greater length of the Moon's period.

The heads of the arguments we shall offer are chiefly these. 1st.—That if the Moon moved in an ellipse, or circle, round the Earth, her course of motion, just subsequent to the period of her change, must be *opposite* to that of the Earth; and that, therefore, the two bodies, moving in opposite directions, for even a short time, must part company; which they do *not*. 2nd.—That at the time of the Moon's first quarter, the Moon, if she go round the Earth, must be crossing the Earth's course and moving at right angles thereto, or nearly so, for a time; which compels the necessity of supposing her to be *stationary*, as to the onward course round the Sun, and, therefore, to be left behind by the Earth, which never ceases to "move on;" which again is *not* the case. 3rd.—That if the Moon moved round the Earth, when at the full, she would never be able to catch the shadow of the Earth; and there could, therefore, never be a lunar eclipse; which it is known there frequently is. 4th.—That when the Moon is crossing the Earth's course again at the time of the *last* quarter, she must move at right angles thereto, or nearly so, for a time, and must, therefore, be stationary, as regards the onward course of the Earth, which must (whenever the Moon is in her node at the time) inevitably come into direct collision with the Moon; which it does

not. 5th.—I shall shew that Sir John Herschell's idea of the "*stick*" and the "*string*," as described at page 240 of his Treatise, &c., is delusive and fallacious; and proves, if rightly examined and divested of optical illusion, not that the Earth and Moon do really revolve round their so-called centre of gravity—but that they do, in fact, if the Newtonian System be true, form each a *cycloidal curve*, more or less elongated, as they are more or less distant from their mutual point of suspension. And *lastly*, I shall demonstrate the true *cycloid* which the Moon forms during her *apparent* course round the Earth, from the moment of her conjunction with a given fixed Star, until the time of her again appearing in a line with that same Star. In doing which I shall shew that, when the Moon *seems* to pass by certain Stars and move towards the opposite direction the Earth is moving in, she does not *really* so move at all; but is all the time moving in the same direction as the Earth; and that her *apparent* or *seeming* motion (which misleads the astronomers) is merely the effect of an optical illusion, analogous to that which makes a carriage on a common road, running in the same direction with a railway train, going faster, *appear* to the spectators in that train to be falling back, and going in the opposite direction, to which it really travels at the moment.

First.—We have to prove, that if the Moon moved in an ellipse or circle round the Earth, her course, just subsequent to the period of her change,

must be *opposite* to that of the Earth; and that, therefore, the two bodies, moving in opposite directions, for even a short time, must part company; which they do *not*.

In the diagram, Plate VIII., we will take E, to represent the place of the Earth, at noon on the 24th February, 1857, when there was a New Moon in $\times 5^{\circ} 53'$. Let M signify the place of the Moon at the time, the line E M being one inch in length and representing the mean distance of the Moon from the Earth, or 237,000 miles. And let the line E M \odot , shew the line from the Earth to the Sun, passing through the Moon at M.* Then, as we find that the Moon will have moved through an arc of longitude in *twelve hours* equal to $7^{\circ} 16' 30''$, and (if visible) would *appear* to the left hand, or to the *east* of the Sun, at *y*; seemingly passing along the arch from M to A, it follows that, if this be true, she must have arrived at *y*; the angle M E *y*, being $7^{\circ} 16' 30''$. Now, let us ask where the Earth was at this time, viz., at midnight on the 24th February, 1857. If we suppose the Earth to move to the west, making the Sun *appear* to move to the east, then it will move towards *x*; and, if we neglect the slight curvature of its course, and take it to move at its mean rate of 68,000 miles an hour, it will be

* This will not be strictly correct, as the Moon had $2^{\circ} 39'$ south latitude at the time; but for the purpose of this explanation, we may neglect the latitude of the Moon.

found at x , being removed $68,000 \times 12 = 816,000$ miles from its place E , at the time of the New Moon.

A very easy calculation will shew that, if $E y = 237,000$ miles, and $E x = 816,000$ miles, and the intermediate angle, $y E x = 97^\circ 16' 3''$ the side $y x = 878,130$ miles. But the angle $M E x$ is a right angle, and added to $M E y = 7^\circ 16' 30''$, it gives us $y E x = 97^\circ 16' 30''$. And, therefore, the side $y x$ may be proved to be $878,130$ miles; which shews that, if the above statements be correct, the Moon at y , will be removed that distance from the Earth at x ; therefore have we made $E x = 3.44$ inches and $E y = 1$ inch, that being the proportion between $878,130$ miles and $237,000$ miles. Hence, therefore, we find the Moon $641,130$ miles farther from the Earth at midnight on the 24th February, 1857, than her mean distance! Strange phenomenon! which none of our astronomers have noticed.

But the reader may ask, "Is it so?" Certainly, we reply; if the Moon really do move, after passing the Sun at the New Moon, or change, *towards* the east, or in the order of the signs; and the Earth do really move in the opposite direction and so make the Sun *appear* to move to the east, then we contend against the world, that the Moon and Earth are moving in *opposite* directions, and necessarily and imperatively must part company. It will be said, perhaps, "but we know that the Moon moves to the east, after the change, for we can *see* her each

evening, increasing her angular distance from the Sun; and we must surely believe our eyes, as well as the assertions of the astronomers." Gently, friend! It is not always safe to believe even our own eyes; and it is certainly seldom safe to believe the assertions of the astronomers. If we believe our own eyes, without reflection, we shall believe that the trees and distant objects, such as usually are termed fixtures, churches and houses, &c., really dance along and pass one another, because when we travel swiftly on a railroad they *appear* to do so. This is an optical illusion, known to be such by all but drivelling idiots; and to most persons known to be caused by the change in the parallactic angles of vision. Just so is it that the Moon *appears* to move from the line joining the Earth and Sun, viz., E ☉ in the diagram, Plate VIII., towards the *east*; because the *Earth is moving towards the west*. In fact, if the Moon stood still at M, and the Earth only moved on to *a*, then would the same angle appear between the Moon and Sun, the former *appearing* to have gone towards the east. But though this might explain the phenomenon for a time, it would not do so when the Earth has arrived farther along its course, as at *x*. When the Earth reaches *x*, the Moon, if she be at the same distance from the Earth as when at M, must appear at *z*; and she will *there* appear at the very same angle of $7^{\circ} 16' 30''$ to the *east* of the Sun, who will be seen in the direction of O. And thus it becomes evident, that the Moon (as well as

the Earth) has been moving all the while towards the *west*, though she *appear* to be moving to the *east*.

It is also evident that during the twelve hours following New Moon, and while the Earth moves 816,000 miles to the west (according to the Newtonian System) as expressed in this diagram by the line $E x$, the Moon moves along the *dotted* line $M z$, and in fact moves through space as far as the Earth, minus only the extent of the line, which should express the sine of the angle $M E y = 7^{\circ} 16' 30''$, or the similar angle $z x O$, with the radius = 237,000 miles. The sine of that angle will measure 30,012 miles; so that $M z$, the Moon's course in the twelve hours, is equal to $E x$, the Earth's course in that time—30,012 miles. Then, $E x$, 816,000—30,012 = 785,988 miles; which the Moon moves really and truly to the *west*, while she is supposed to move in the opposite direction, at the rate of 30,012 miles in twelve hours. Alas! for appearances! They are not always to be trusted to, even when endorsed by the highest names in the astronomical world.

It is clear from all this that the Moon, while moving from M to z , is by no means moving in either a circle or an ellipse. She does not, however, move in a right line exactly; and I hope to shew, hereafter, that her course, always concave to the Sun, is really and truly a series of *cycloidal* curves. At present I would call the reader's attention to the fact, that the Moon, during the twelve hours subsequent to the New Moon, moves, though in the same

direction as the Earth, not quite so rapidly. In fact, her hourly motion is about 65,500 miles per hour, when near the change, being something like 2,500 miles an hour less than the mean motion of the Earth, by the Newtonian System.

It must be observed that the above reasoning will apply very nearly to the motion of the Moon, if we adopt the true system of *proper* motion of the Sun. But in this case, the mean motion of the Earth will be about 100,000 miles an hour; and, of course, the extent of its motion to the west in twelve hours, will be 1,200,000 miles, and that of the Moon will be some 30,000 miles less, or 1,170,000 miles. In either case we see that the Moon must move nearly as far and as fast as the Earth, or she would be left, "far, far away." And as it is beyond all question that the Moon *never is* left behind, never does part company from the Earth, we submit that it is *proved* that she does *not* move as she *appears* to move; and that, therefore, she does *not* move in an ellipse.

Secondly.—At the time of the Moon's first quarter, the Moon, if she go round the Earth, must be crossing the Earth's course and moving nearly at right angles thereto for some time, which compels the necessity of her being *stationary*, as to the onward course round the Sun; and, therefore, to be left behind the Earth, which never ceases for a moment to "move on;" which again is *not* the case.

If the reader will again glance at the diagram,

Plate VIII., he will perceive that during the whole time which elapses from the period of New Moon, when the Moon is at M, until the first quarter, when she seems to reach A, the Moon is supposed to be moving to the *east*, and in the contrary direction to the motion of the Earth from E towards *x*; that is to the *west*. And the amount of such motion of the Moon during that time is exactly equal to her distance from the Earth, viz., 237,000 miles, which is represented in the diagram by one inch, from E to A. Of course, if the Earth *stood still* at E, this would, no doubt, be a correct representation of things. But as during one-fourth of the Moon's synodical period, or 7.3825 days, the Earth, moving 1,632,000 miles a day, would have moved on to the *west* (round the Sun by the Newtonian System), just 12,048,246 miles, it would be removed away from the Moon above fifty times her mean distance, not a vestige of the poor Moon would remain to be seen; she would be utterly lost sight of and extinguished to our view. As this never occurs, we may rest assured that either the Earth itself does *not* move, or the Moon moves along with it to the *west*, and so does not move to the *east* of the Sun during her *first* quarter, or from M to A in the diagram, as astronomers teach. I leave them to ride on which horn they may please of this dilemma.

To proceed—we may observe that if the Moon really did move to the *east* from M, she would arrive in about seven days after the change at *b*,

and from thence would move onwards to A; during which time she will be very nearly *stationary*, as regards the line A x ; for she will, when at b , be equally advanced from A towards x , as is the point c ; and so will remain nearly until she reach the point d , about half-a-day after the first quarter. And it is plain that while moving from b to d , the Moon moves nearly at a right angle to the line A x , the course of the Earth's path. If so, she *must* in this case be left behind again; for the Earth, during this period of about eighteen hours, will move on towards the west, 1,220,000 miles; and so be removed over five times the usual distance from the Moon—a fact that *never* occurs. This again *proves* that the Moon does *not* move to the *east*—and, therefore, *does not move as astronomers declare*.

Thirdly.—If the Moon did move round the Earth as generally supposed, she would never be able at the time of Full Moon, to catch the shadow of the Earth; and it, therefore, follows, that we could never see a *lunar* eclipse; which, however, is a phenomenon *seen* frequently to occur. From which it is proved that the Moon does *not* move round the Earth, as generally taught and believed.

Let the diagram, Plate IX., Fig. 1, represent the Earth at E, casting its shadow a little beyond the circle, which represents the supposed orbit of the Moon. Let the dark spot at m , signify the Moon, nearly at the full, and about to enter the shadow. If the Earth remain stationary, the shadow will also

remain stationary, and in about three hours and a-half the Moon, having passed through the shadow, will reappear at *a*; and, if she move in a circle (which for this elucidation we may assume she does) she will pass on, up the circle from *a*, towards *E 1*, where she will arrive at her *last* quarter. But if the Earth move on 68,000 miles an hour towards the west, then in three hours and a-half it will have moved 238,000 miles and reached the point marked *E 1*. And as, undoubtedly, the Earth will take its shadow with it, the Moon, when emerging therefrom, must needs appear at *m 1*. It follows that, *while in the shadow*, the Moon has not moved from *m* to *a*, but has moved through space from *m*, to *m 1*; and has gone, therefore, rather farther than the Earth, or rather more than 238,000 miles. It is *proved*, therefore, that the Moon does *not*, during a lunar eclipse, move in any portion of either a circle or ellipse; but does really move at that time *nearly* in a right line; yet it may be shewn that her motion is then slightly *curvilinear*, and concave to the Sun, and that it forms a portion of the *cycloid* she describes in each synodical period.

Fourthly.—When the Moon is again crossing the course of the Earth, at the time of the *last* quarter, she must move nearly at right angles thereto, for a time, and must, therefore, be *stationary* as regards the onward course of the Earth, which must (when ever the Moon is in or near her node at the time) inevitably come into direct collision with the Moon; which it does *not*.

To prove this statement, I refer the reader to the diagram, Plate IX., Fig. 2. Let the large circle represent the Moon's monthly course from New Moon to New Moon, and S the line pointing to the Sun. And let E represent the place of the Earth, at the time the Moon had arrived at *a*, being within about three hours and a-half of her *last* quarter. At the moment of the *last* quarter the Moon, if she move in the circle, will be found, of course, at *m*, crossing the Earth's course from E to *n*; and if the Moon be in or near her node at the time, as frequently happens, she will be in the same plane as the Earth, and lying exactly in the way of the Earth's motion through space. Then, as during the time (three hours and a-half) the Moon moves from *a* to *m*, the Earth, going at the mean rate of 68,000 miles an hour will move 238,000 miles towards *m*, and will have reached E 1, there *must* inevitably be a *collision* between the Earth and Moon! But as this dire event never does really happen, we may rest assured that the Moon *never does really move in that part of a circle* represented by the curve from *a* to *m*; and never does move from F, her place at Full Moon to *m*, her supposed place at the *last* quarter. It is, on the contrary, evident that when the Earth has reached E 1, the Moon, still keeping her usual distance from the Earth, will be found at *n*; and that from the time she was at *a* (or in the three and a-half hours the Earth moved from E to E 1) she will have travelled along the *dotted* line from *a* to *n*;

which line is no part of either a circle or an ellipse, but is slightly concave to the Sun and part of a *cycloid* curve. Having now shewn, by *four* distinct arguments, that it is *impossible* the Moon can move in anything approaching to a *circle* or ellipse about the Earth, I have next to shew that—

Fifthly.—The idea of the moon's motion, as illustrated by Sir John Herschell, at page 240 of his "Treatise on Astronomy" by means of the "stick" and the "string," is delusive and fallacious, and that the experiment proves, if rightly examined and divested of optical illusion, not that the mimic earth and moon do really revolve in an ellipse round their centre of gravity, but that they do, in fact, each form a *cycloidal* curve, more or less elongated, as they are more or less removed from their mutual point of suspension, while they *appear* to revolve around that point.

To make this argument clear to the reader, I shall introduce the very words of the paragraph I am about to refute, as found at page 240 of the work above named.

"It is in consequence of the *mutual* gravitation of all the several parts of matter, which the Newtonian law supposes, that the Earth and Moon, while in the act of revolving, monthly, in their mutual orbits about their common centre of gravity, yet continue to circulate, without parting company, in a greater annual orbit round the Sun. We may conceive this motion by connecting two unequal balls by a stick, which, at their centre of gravity, is tied by a long string, and whirled round. Their joint *systems* will circulate as one

body about the common centre to which the string is attached, while yet they may go on circulating round each other in subordinate gyrations, as if the stick were quite free from any such tie, and merely hurled through the air."

It will be seen that the two balls are said to "go on circulating round *each other*," though we are told just before that "the Earth and Moon revolve monthly, in their mutual orbits *about their common centre of gravity*." This is rather contradictory, for it is clear that, if the Earth—the heavy ball—circulate round the centre of gravity, represented by the string, situated close to it, then it is not possible for it at the same time to circulate round the Moon—the small ball—situated at a distance. There cannot surely be two distant centres to the same circle. However, passing by this loose way of wording the argument, which only shows the imperfect conception the writer had of this fancied motion, we will come to the question of "what is the *real* curve formed by each of the two balls in this experiment? We say that, if the "string" which suspends them—if the point of suspension remain *fixed*, and the "stick" be made to revolve, that then each ball will form an exact circle, the radius of which will be equal to the distance of the said ball from the point of suspension. (See Plate X.) To prove this, let the balls be furnished each with a pencil, resting on a plane, and let the stick be made to revolve. Then, if the large ball be one inch from the point of suspension, it will describe a circle of one inch radius; and if the

the small ball be three inches from the point of suspension, it will describe a circle of three inches radius. This much is certain.

But now, to discover the effect produced by the "string" at the centre of gravity being "whirled round," we have only to *move* the point of suspension (shown by G in the figure, Plate X.) and carry it rapidly along the plane either in a right line, an ellipse, or a circle. In any case, the balls at M and E, and the pencil points at *p*, and *p*, representing the Moon and Earth (still understood to be kept *revolving* round the point of suspension), will form no circle, no ellipse, nor anything else but a series of *cycloidal* curves, exactly representing those actually and necessarily formed by the Earth and Moon through space, if the Newtonian System be true, and the Earth do really revolve in an ellipse round the Sun. But if, instead of an ellipse, the Earth itself move, as I have proved, in a *cycloid* about the Sun, then will the curve formed by the *Moon*, in one synodical period, be found to be much more elongated and drawn out, nevertheless it will still form nothing more or less than a *cycloid*. To comprehend this well, the reader has only to consider attentively the diagram representing Sir John Herschell's famous "stick" and "string" experiment.

If the two balls be suspended by the "string" at G, then, as the large ball revolves round the small circle of one inch radius, from *p* to *s a b*, and back to *p*, so will the small ball revolve round the large

circle of three inches radius, from M to B W S, and back to M. And while G, the centre of suspension, remain *fixed*, and the revolution of the balls go on, the pencils at *p p* will continue to mark those circles. But what will be the effect? Certainly, the circles being concentric, the small ball will revolve round the large one, but the large one will *never* pass round the small one. Therefore, Sir John Herschell states the case erroneously, when he says that they will "go on circulating *round each other.*" However, "what will be the effect when we alter the circumstances and make the centre of suspension itself G, move forward, for instance, towards W?" Let G move forward one inch, to the place occupied by the centre of the large ball, while this is striving to revolve from its present position upwards towards *s*. The result must needs be, that it will rise and yet be propelled forward at the same time, so that its centre will be found at about *e*, and the pencil point *p*, under it, will be found at *x*; the ball having passed along the *dotted* line, extending from it to *e*, and the pencil having traced the other *dotted* line from *p* to *x*. At the same time the smaller ball will have moved in a different direction, but will equally have *deserted the circle* it would continue to form, while G was stationary. The ball at M would, in fact, have moved forward towards W, as far as the line *i f g*, but would also have moved towards B, and the centre of the ball would, therefore, be

found to have moved to f , and the pencil under it would have traced the *dotted* line from p to g .

Hence we see that the small ball, representing the Moon, will, instantly that the *focus* or *centre* of her motion begins to "move on," commence to form a *curve*, totally different from either a circle or an ellipse, and which, if completed for her whole period, will indubitably be found to be a *cycloid*.

Now, if this motion of the balls, representing the Earth and Moon, be satisfactorily seen to be such as I have described, and if the evidence that I have adduced under the four first distinct heads of this argument, and that of the motion of the Earth with the Sun, and of the Satellite with Jupiter, be carefully considered, the reader must feel convinced that the conclusions of the mathematicians are certainly erroneous, as to the form and nature of the curves, which "bodies moving in each other's neighbourhood," *must* necessarily produce.

At page 237, Sir John Herschell tells us, when speaking of the effects of gravitation, that Newton has demonstrated that "under the influence of such an attractive force mutually urging two spherical *gravitating* bodies towards each other, they will each, when moving *in each other's neighbourhood*, be deflected into an orbit concave towards the other, and describe, *one about the other*, regarded as fixed, or both round their common centre of gravity, curves whose forms are limited to those figures known in geometry by the general name of conic sections. It

will depend, he [Newton] shows, in any assigned case, upon the particular circumstances of velocity, distance, and direction, *which* of these curves shall be described—whether an ellipse, a circle, a parabola, or an hyperbola, but one or other it *must* be.”

Let the reader observe, that a *condition* of this demonstration of Newton is that the bodies be “*gravitating*.” And if, therefore, we admit the truth of Newton’s law in this case, we are by no means bound to believe that it extends to bodies “moving in each other’s neighbourhood,” which are *not gravitating*. Hence, if we can prove, as we have done, that the Planets and the Sun, the Planet Jupiter and his first Satellite, and the Moon and Earth, being all “bodies moving in each other’s neighbourhood,” do *not* move in either “ellipse, circle, parabola, or hyperbola,” the crushing consequence ensues, that these, being all spherical bodies, are *not gravitating* bodies towards each other!” And that, therefore, in spite of theories and theorizers, we have yet to look for evidence in the Solar System that there exists any such thing as a *universal* law of gravitation.

I have now, *lastly*, to demonstrate the true *cycloid* that the Moon forms during her apparent course round the Earth, from the moment of her conjunction with a given fixed Star, until the time of her appearing again, after about 27^d. 7ⁿ. and 43^m., in a line with that same Star.

Unfortunately, we cannot here, although it may

be more wanted than in any other case, have recourse to a *diagram*, to trace the motion of the Moon during her sidereal period. The reason of this is, that the Moon's mean distance from the Earth, although it be 237,000 miles, is so minute, when compared with the portion of space that the Earth passes through in the period of the Moon's *apparent* revolution, viz., $27^{\text{d}}. 7^{\text{h}}. 43^{\text{m}}$, that a diagram to exhibit it fairly to the eye is much too long to be introduced into this work.

This will appear evident, if we consider that the Earth, travelling at the rate of 68,000 miles an hour (according to the Newtonian theory), or 1,632,000 miles a day, will, during the Moon's above-named period, actually move through 44,589,504 miles. This is above 188 times the Moon's distance from the Earth; and, therefore, if we describe that distance by even *half an inch*, we shall require a diagram exactly seven feet ten inches in length to depict the course of the Earth and the cycloidal curve of the Moon's motion. But, under these circumstances, we can, from frequent experience, instruct the reader, who may desire to satisfy his curiosity, how to draw a diagram that will truly and elegantly describe the curve formed by the Moon each month.

Having fixed upon a Star, from which to trace the Moon's motion, take an ephemeris in which the Moon's longitude is given daily, and find some period when the Moon happens to be with that

Star at noon or midnight. Say, for instance, "Regulus." This Star is in about $147^{\circ} 50'$ of longitude. The Moon will be found in this longitude at midnight on the 9th August, 1858.

Then, having provided a roll of paper (such as paper-hangers use to line rooms with, before they paper the walls, will do well), let it be well pasted on to calico. The length required will be about six yards; and it may be about two feet wide. A right line must be first drawn, to represent the course of the Earth during twenty-eight days. If great exactness be required, the curve of the Earth's motion during the period, either on the Newtonian or the Cycloid System, must be determined and drawn accordingly. But I am supposing that a near approximation to the actual state of things will suffice. Should it be desired to represent the Cycloid System, then, as the mean motion of the Earth is about 100,000 miles an hour, or 65,572,000 miles in $27^{\text{d}} 7^{\text{h}} 43^{\text{m}}$, the diagram will require to be over twenty-three feet in length.

On the left hand of the diagram represent the Earth, by a small circle, about half an inch in diameter. Now, as the Moon's mean distance 237,000 miles, multiplied into $6.9 = 1,635,300$ miles, and the average motion of the Earth is daily 1,632,000 miles, we may, if we represent the Moon's distance from the Earth by one inch, represent the Earth's daily motion by 6.9 inches. Let, therefore, the small circle representing the Earth be drawn again,

on the line that denotes the Earth's course, just 6.9 inches to the right of the first circle. And in like manner depict the Earth's place each succeeding day for twenty-seven days in all, after the first, each being 6.9 inches apart from the others. This done, draw a line perpendicular to the line of the Earth's course, from the centre of the first Earth, on the left hand, upwards, and at one inch from the centre of the Earth make a little circle, about one-tenth of an inch diameter, to represent the Moon. You may continue the line from the Earth to the Moon a little way and depict a Star, to represent Regulus; the Moon being thus shewn to be in conjunction with that Star. Next, begin to lay down the relative place of the Moon at each succeeding twenty-four hours, taking the Moon's longitude each midnight until she again come to be in the same longitude as Regulus; which will, in this case, be about four hours before noon on the 6th September, 1858; being about twenty-seven days and near eight hours from the previous conjunction with Regulus. The first midnight after that of the 9th August, the Moon is found in $162^{\circ} 3'$ of longitude; and is, therefore, apparently $14\frac{1}{4}^{\circ}$ past Regulus, having seemingly moved to the *east*; but this it will be manifest, by the diagram, is nothing but an optical illusion; and that in *reality* the Moon, having accompanied the Earth to the *west*, but not having moved so fast as the Earth, will be *seen* at the same angle of $14\frac{1}{4}^{\circ}$ to

the left of the Star. The Moon's place must be laid down still at one inch from the Earth; but, a line being drawn from the centre of the Earth perpendicular to the Earth's course, denoting the direction of the Star,* the Moon must be placed at an angle of $14\frac{1}{4}^{\circ}$ to the left of that line, and, as said before, one inch distant from the Earth's centre.

The Moon's place at the *second* midnight will be in longitude $175^{\circ} 53'$, being 28° to the left of Regulus. This must be shewn by placing her at that angle from the line extending from the centre of the Earth, perpendicular to the Earth's place, forty-eight hours after the conjunction; still minding to let her be one inch distant from the Earth. So every day's motion of the Moon in longitude must be shewn, by laying down her place one inch distant from the Earth, and at the angle she forms at each succeeding midnight from Regulus. Thus at midnight, on the 16th August, the Moon will be in longitude $239^{\circ} 27'$, being 92° nearly from her conjunction with Regulus; and, therefore, having just crossed the Earth's course, being 2° past the right angle from the Star. So on the 23rd August, or fourteen days after the time of her conjunction, she will be in longitude $323^{\circ} 40'$, being within 4° of the opposite point of the Star, the Earth lying very

* The immense distance of the Star prevents any apparent change in its position, notwithstanding the Earth's motion.

nearly in the right line between the Star and the Moon. And again, twenty-one days after the conjunction, we find the Moon at midnight, in longitude $56^{\circ} 12'$, having passed, by a little more than 1° , the right angle to the Star once more, and being close upon the line of the Earth's course. At length, nearly four hours before noon, on the 6th September, the Moon's longitude and that of the Star $147^{\circ} 50'$ will be found again to coincide. If all the positions of the Moon, as well as the Earth, be thus laid down for every succeeding midnight, and a neat *dotted* line be drawn from the place of the Moon at the conjunction through *each* of her positions during this her sidereal *period*, it will appear *plain* and *indisputable* that she has therein described a *cycloidal curve*.

On inspecting the curve formed by the Moon as we have just described, two things will be more especially remarked. *First*.—That the Moon, while on the *same side* of the Earth's course as the Star, will *appear* to move to the *east*, when viewed from the Earth, without considering the proper motion of the Earth itself. But this is an optical illusion, arising from the fact of the Earth moving bodily to the *west*, at a faster rate than the Moon does, and so, in fact, leaving her behind, *pro tanto*; which makes it *appear* that she is actually moving *backwards* as refers to the Earth's direct motion onwards to the west.

Secondly.—When the Moon is on the *opposite*

side of the Earth to the Star, she will, of course, be moving in the same direction as the Earth, as in the former case, and as she always really is; but in this case, she will *appear* to be moving as she truly does move, viz., to the west; and this *appearance* will be correct, because she will be going faster than the Earth and *passing* it; as the diagram will clearly prove, since on the 16th August, the Moon will be found on the line of the Earth's course at a right angle from the Star, but *behind* the Earth; whereas, on the 30th of August, she will also be found on the line of the Earth's course again, at a right angle from the Star, but *before* the Earth.

CHAPTER IX.

THE DIRECT FORCE WHICH IMPELS THE SUN AND PLANETS THROUGH SPACE—WHY THE SUN DOES NOT MOVE IN A RIGHT LINE—ANCIENT INDIAN ASTRONOMY IN PROOF OF THE PRECESSION OF THE EQUINOXES—SIR JOHN HERSCHELL ON THE PRECESSION SHEWN TO BE ERRONEOUS—CAUSES OF THE LATERAL MOTION OF THE EARTH AND PLANETS—EXPLANATION OF THE LATERAL MOTION BY REFERENCE TO THE ACTION OF ELECTRICITY AND MAGNETISM, AS EMANATING FROM THE SUN—MODIFIED HYPOTHESIS OF THE CAUSE OF LATERAL MOTION APPLIED TO THE ACTION OF THE SATELLITES AND THE MOON—DIMINISHED MOTION OF THE MOON AT NEW MOON—ACCELERATED DITTO AT THE FULL MOON—ATMOSPHERE OF THE MOON, THOUGH EXTREMELY SMALL, SUFFICIENT TO BE ACTED ON BY ELECTRICITY.

It may be well to add a chapter to this essay, with a view chiefly to offer my ideas on the causes of the two *forces*, which manifest themselves in the Solar System; and which are, as already mentioned, the *direct* force, that impels the Sun and Planets through space; and the *lateral* force, which compels the Planets and their Satellites to deviate from the line of direct motion constantly followed by the Sun; and so to undulate or serpentine about the Sun; and thus to form Cycloidal Curves. Also, I think, that an interesting topic to introduce, will be the important, yet necessary effects, both of a cosmical and geological nature, that must result from the principle I have enunciated, of the constant and *perpetual* change in the obliquity of the

ecliptic, or inclination of the Pole of the Earth towards the plane in which the course of the Earth's motion is found to lie.

On the subject of the *direct* force which impels the Sun and Planets through space, at an average rate, as we have shewn, of about 100,000 miles per hour, we can say but little. All probability is in favour of the course of the Sun being, as already intimated, in a circle, having its centre removed to the enormous distance of about 37,000 times the distance of the Sun from the Earth; which is somewhere near upon 1,000 times the distance of the outermost Planet of our system (Neptune) from the Sun. I have little doubt that the advocates of the Newtonian System of ellipses will, instantly on the idea of the proper motion of the Sun being mooted, hanker after the notion of an ellipse; and conclude it most probable that the Sun moves in an elliptical orbit. Of course, we are not in a position to determine the question, if they insist on it; only we may remark that, having hitherto failed to discover any such thing in nature as a *real* ellipse, however many apparent ones there may be, we must demur to the notion of the Sun so moving, until good evidence of the fact can be produced.

If the Sun were really to move in a right line through space, we think the fact would have been ere now detected by an apparent crowding together, or closing in of the stars in the direction of the point

from which he were receding, and a proportionate opening out, or separation of those other Stars, towards which he were approaching. The result of such effects would be to make some constellations to grow less expansive, and others to grow more so. But, as nothing conclusive of this kind has been observed, we may fairly infer that there exists no such right-line motion, as regards the great light of heaven, and that, therefore, the real and proper motion of that vast body is, in truth, in a circle. This appears still more probable, when we reflect that, if the Sun do actually move in a circle towards the west, *all* the constellations must necessarily *appear* to move, as they actually do appear to move, in the contrary direction, or towards the east, that is to say, according to the order of the signs of the zodiac. And, if the motion of the Sun, be exactly that amount yearly, which is given for the precession of the equinoxes, viz : about 50" per annum, then it must amount to 3,600" = 1°, in seventy-two years, or 30° in 2,160 years, which is just the rate at which the so-called fixed Stars appear to move forward. And they will, therefore, appear to pass through all the signs, and return to their original positions in twelve times 2,160 years, viz. : in 25,920 years, which period was known to the ancients as the great year of Plato.

A very curious fact, connected with this subject, may be observed in the zodiac, which M. Gentil brought from India. It appears that the Star

Aldebaran was therein represented as being 40' before the vernal equinox, that is to the west of it, in the year 3102, B.C., which was the epoch of the tables of Tirvalore, used, I believe, universally by the ancient Indian astronomers. The present longitude of Aldebaran is about $67^{\circ} 46' 30''$, which added to $40' = 68^{\circ} 26' 30''$. The time elapsed from 3102 B.C., to 1857 A.D. = 4,959 years, which, allowing a regular motion of $50''$ per year, gives $68^{\circ} 52' 30''$, differing only by $26'$ from the place of Aldebaran, as observed by the Indians, and requiring a correction of only thirty-one years in the above long period to become exact. Thus, the precession would be about $50''.03$ per year, to make the present position of Aldebaran agree with that observed 3102 years B.C. But this is supposing the precession (which I attribute to the proper motion of the Sun) to be *equable* and independent of the "inequality in the precession," said to have been discovered by La Grange, but which, like a good many other notable discoveries, dependent on the mystery of *gravity*, will be found to have no foundation in fact,

The amount of the precession, according to Sir John Herschell, is $50''$ l. yearly, but on this subject, as on that of the rate of change of the obliquity of the ecliptic, there exists much difference of opinion among modern astronomers. On comparing several of their decisions, I conceive that the mean will be about $50''$, and I therefore adopt that amount as

an extremely near approximation to the truth as presented by nature.

While on this subject, I may allude to some remarks made by Sir John Herschell regarding the effect of the joint operation of the precession and the nutation of the pole. At page 173, of his "Treatise, &c.," Sir John remarks that "the path which it [the Pole] will pursue in virtue of the two motions, subsisting jointly, will be neither an ellipse nor an exact circle, but a gently *undulated ring* like that in the figure." The reader is then referred to a figure given at page 175.*

At page 329, Sir John writes as follows:—"The precession of the equinoxes consists in a continual retrogradation of the node of the Earth's equator on the ecliptic * * The immense distance of the Planets, however, compared with the size of the Earth, and the smallness of their masses compared to that of the Sun, puts *their* action out of the question in the enquiry of its cause, and we must, therefore, look to the massive though distant Sun, and to our near though minute neighbour, the Moon, for its explanation. This will accordingly

* By referring to Sir John Herschell's book, it will be seen that this drawing of the motion of the pole, in a presumed ellipse, the focus of which is constantly *in motion*, just represents a series of *cycloidal* curves. And it will offer a further piece of evidence, not now requisite, as I have adduced such in abundance and *ad nauseum*—that such *cycloidal* curves necessarily result from such combined motions.

be found in their disturbing action on the redundant matter accumulated on the equator of the Earth, by which its figure is rendered spheroidal, combined with the Earth's rotation on its axis. It is to the sagacity of Newton that we owe the discovery of this singular mode of action."

Here the reader will see that the Planets are now thrown overboard, and "*their* action put out of the question." Yet we are told by Newton that "*every particle* of matter in the universe attracts *every other particle, &c.*" So that we perceive the astronomers can make their favourite theory of "attraction" act or not, just as it suits their convenience, when building up a fancied hypothesis. After a long and laboured effort at explanation of this funny idea of the Sun and Moon pulling the "molecules" that constitute the redundant parts of the Earth near the equator, first this way, then that, Sir John concludes, at page 331, by reminding his reader that touching this matter, "no dynamical subject is open to more mistakes," a fact which, if the readers of Sir John's book have not already discovered, they may venture to carry fire upon the Thames without any danger of producing combustion. Let the reader wade through the misty pages of the Chapter XI., of Sir John Herschell's book, already referred to, for an "explanation" of the complex and mysterious theory of solar and lunar causes of the precession, and then let him revert to the simple and natural idea that

the Sun, by moving retrograde in a circle, concentric with, and placed within that formed by the signs of the zodiac, at the rate of 50" of an arc yearly, produces the effect known as the precession, or more properly the re-cession, of the equinoctial points. And let common sense determine which theory should be adopted.

It may now be asked, whether I believe that the Star Alcyone, or any point in its vicinity, is the centre around which the Sun moves perpetually. My reply is that facts, not having been hitherto sought for, are still wanting to determine this interesting question. And as I wish to advance nothing that does not appear to me to be founded on sufficient facts, I decline to offer any mere speculation on the subject. The go-a-head Nineteenth Century-men must please to remember that, it may be the intention of Providence to leave some matters for the Twentieth Century-men to discover.

The question of the cause, or causes, which produce the *lateral* motions of the Planets and their Satellites is more within the grasp of our observation. But even these are extremely abstruse and recondite; and nothing more can at present be advanced than a few crude ideas, founded on some facts in nature, which appear to be analogous to the possible causes of the *lateral* motions to which I have just adverted. Should my critics be pleased, however, to reject these hypothetical ideas, I shall in nowise feel myself treated unjustly; unless, indeed, they choose to mix up with their condem-

nation an attempt to overthrow the *facts* of these lateral motions, which may be and must be true, although my mode of explaining their causes be shewn to be even wholly mistaken.

The fittest way to examine the matter may be to begin with the *lateral* force, which causes the Earth, after having appeared as at $\frac{v}{x}$ on the left hand of the explanatory diagram, Plate I., where it is moving after the Sun (whose place is supposed to be at r) to quit the line of the Sun's motion A B, and to be found, after the lapse of three months, at N T, having been *repelled* out at a right angle from that line; and that to the distance of 95,000,000 of miles. For the line ϖ , N T, represents the radius vector, which is that extent. The Earth, being so thrust out from the line A B, and at the same time carried rapidly forward to the west, passes from $\frac{v}{x}$, its place at the vernal equinox, through a and b , to N T, thus forming a fourth part of its annual cycloid; and at a , where it is found in about thirty days, when the Sun is entering ϖ , it has left the line of the Sun's course not less than about 47,578,000 miles, that being the comparative length of the line reaching from a to the line A B, and perpendicular thereto. Now the question is, "What force is it that so drives the Earth out from the direct line of the Sun's motion during those thirty days, at the rate of over one million and a-half of miles per day?"

To answer this question at all satisfactorily, we must have recourse to some consideration, founded on known facts in nature. Among these we may

name the fact, that the observations made on electricity, warrant us in saying that it is intimately allied with the action of solar *light*. And, therefore, without going into long and elaborate arguments and exhibiting the results of numerous experiments, we submit that, when the Earth is on the equator, as at $\frac{V}{E}$, and the rays of light from the Sun fall in right lines on all parts of the Earth's surface, from pole to pole *equally*, the *maximum* effect must be then exhibited. Now, if we consider that the Sun, in flying through space at the enormous rate of 100,000 miles an hour, and rotating on its axis once in about twenty-five days, by which 4,600 miles of its equatorial surface must pass a given point every hour, must necessarily throw off a vast amount of electricity every moment, chiefly in the line of its course, we must see that a marked effect must be at all times produced on the Earth thereby. It has appeared to me that when the Earth has arrived on the line of the Sun's course, being *behind* that body, the electricity flowing from the Sun, will *combine* with that naturally adhering to the Earth, and, in consequence of its rapid flux, carry it off, either wholly or in great part, and so denude the Earth of electricity, more or less, when it arrives at the vernal equinox.*

* If this state of things exist, such a loss of electric matter from the Earth would cause great atmospheric commotion about the period of the vernal equinox; which fact is known to obtain.

Then, as the atmospheric extent of the Earth must be somewhat diminished in volume, by the loss of its electricity, it will present less resistance to the ethereal fluid, existing through space; and, in obedience to the *direct* force, at all times impelling all the bodies of the Solar System *forward*, will go forward swifter than the Sun.

By this means the Earth will, in about three months after the vernal equinox, move forward 95,000,000 of miles *faster than* the Sun, and be found at N T, in a line with the Sun, then *appearing* to enter *Cancer* at ϖ (Plate I.)

The point now is to determine why the Earth, when at Υ , and beginning to move *faster* than the Sun (for the above reasons), should not move on the same line as the Sun, viz. A B, and so rush into the Sun's embrace and be destroyed. This is the real question of the *lateral* force that drives the Earth out to N T.

As above, we have considered the Sun as a focus, whence emanates electricity, so now we must consider that the Sun is *known*, by numerous experiments and observations to be, if not the main cause, at least a potent operating cause, of the phenomena of terrestrial *magnetism*. We have, therefore, to remember that the Earth, also considered as a magnet, while moving from V E to N T, is presenting its *north* pole more and more to the Sun, and, therefore, is repelled out from the Sun (which is moving in the mean while, along the line A B, from the point

of τ , to that of ϖ), and this as the ordinary consequence of magnetic *repulsion* of similar poles; for we conceive the *north* pole of the Earth to be at present in a *plus* condition of magnetism, and so repelled by the Sun.*

Come we now to trace the motion of the Earth, N T, through *c* and *d*, to $\frac{A}{E}$, the point of the *autumnal* equinox. Shortly after leaving N T, the northern tropic, the Earth is found at its maximum distance from the Sun, and as it progresses through space towards *c*, it begins to turn its north pole less to the Sun, its northern declination diminishing; and, therefore, the Earth is *less* repelled from the Sun, and again approaches the line A B, which is that of the Sun's course. At length, about the 23rd September, it reaches that line, and crosses it at the autumnal equinox. But now the Sun's rays are again acting *directly* on the Earth from pole to pole, producing equal day and night, and surcharging the Earth's atmosphere with abundant electricity, which is *not* carried off as before by that flowing from the Sun, because it does not have its flux in that direction. But, on the contrary, the accumulation of volume caused by the electric atmosphere, rests with the Earth, and presents an obstacle to its passing through

* At the same time the whole effect *may* arise from the entire Northern Hemisphere of the Earth being acted on by the rays of *light*—which may produce in a direct manner that repulsion we have here attributed to magnetic action.

the ether;* the consequence being, that the Earth no longer moves faster than its mean motion, which is also the mean rate of motion of the Sun, but begins to move *slower*, and so the Sun gains upon it, and when the Earth reaches S T, on the 21st December, the Sun has overtaken it, as to the *direct* line of motion, and is found at ϖ (on the right hand). The Earth still moves slower than the Sun, passing through g and h , till it reach the line of the Sun's course again, at the time of the vernal equinox ν (on the right hand), when the Sun will be found once more in *advance* of the Earth at τ , near B.

Now, we have to account for why the Earth, when at \hat{E} , should leave the line A B, and be *repelled* out again to S T. This, we confess, is more difficult to do with satisfaction, consistently with the known laws of the action of magnetic bodies one on the other, than anything we have hitherto met with in our investigation of the action of the *lateral* force which acts upon the Earth and other Planets. We have no desire to offer opinions in a dogmatic manner; but we submit, that it may be possible that even the *south* pole of the Earth, when it begins to present itself to the Sun after passing the line A B,

* This idea of the effect of electricity, when abundantly present, acting as heat, its analogue, is known to do, viz., separating the particles of matter in the atmosphere, and so rendering its *volume* greater, is one by which I some years since attempted to explain the remarkable agitation of the barometer during storms, when great fluctuation of electricity is known to be observed in the air. (See the publications of the *London Meteorological Society*.)

at the *autumnal* equinox A E, may be in a condition *antagonistic to the magnetism of the Sun*, and so become more and more repelled while it passes through *e* and *f*, till it reach S T, the *southern* tropic. At least, we may conceive the south pole (or rather the entire southern hemisphere) of the Earth, as it becomes affected more and more by the *light* of the Sun, is *magnetised*, and is, therefore, prevented approaching the Sun entirely, which nevertheless it does to some extent at the present time, chiefly when just past the *south* tropic and in its perihelion point.

After the 21st December, the southern hemisphere of the Earth begins to turn away from the Sun, and the body of the Earth begins gradually to approach the line of the Sun's course again (the south declination of the Sun diminishing), until once more we find it on the said line at $\frac{v}{2}$, when again the phenomena of the vernal equinox are renewed, &c.

A modified view of this hypothesis of the cause of the *lateral* motion, may be applied to the action of the Satellites; and, of course, therefore, to that of the Moon. Thus, if we consider the circumstances of the Moon, as she is more or less acted on by the *light* reflected from the Earth, we see the following state of things obtain. When the Moon passes the FIRST Quarter, she begins to receive less light than the average from the Earth; and when she reaches the opposition from the Sun, commonly called the place of Full Moon, the Earth must appear wholly dark to her, but as she proceeds in her course

towards the *last* quarter, the Earth throws more and more *light* on to her till it again amounts to the average.

Now, let us conceive that the *effect* of the light, reflected on to the Moon from the Earth, is to *add* to the amount of electricity in her atmosphere. It will follow that the particles thereof become more extended, or expanded, and that, in consequence, she must, being a larger body, present a larger surface to the ether, and so encounter more *resistance*, and, therefore, move slower through space. If this be so, the period of the *maximum* amount of light received by the Moon from the Earth, must be that at which she will be most electrified, become, in fact, a larger body, suffer most resistance from the ether, and thence, *move slowest* through space. Now this period is evidently that of New Moon, when the whole hemisphere of the Earth turned towards the Sun, reflects its light in a direct line upon the Moon. And this is the very time when the Moon actually does move *slowest* through space. For, even if we assume the Newtonian mean daily motion of the Earth at 1,632,000 miles, it may be proved that the Moon actually moves during the forty-eight hours, in the midst of which the change occurs, about 94,500 miles less swiftly than the Earth. Of course, if we take the mean motion of the Earth, according to the system of "proper solar motion," by which the Earth is shown to move about 100,000 miles per hour, the Moon will be

found to differ still more in the relative rate of her motion, compared with that of the Earth.

Let us, on the other hand, take the case of the Moon when beyond the *first* quarter, outside of the course of the Earth, and so moving towards her place at Full Moon. At this time she will have the *least* amount of light from the Earth; will, therefore, have her atmosphere least electrified and expanded, and thence will offer a smaller volume to the ether; and, therefore, meet less resistance; and, still obeying the *direct* force, will move forward through space at the *maximum* rate. And so again we find that during the forty-eight hours nearest to Full Moon, the Moon actually moves about 94,500 miles swifter than the Earth, which she then passes at the most rapid rate.

Here we see a difference of 189,000 miles in the motion of our Satellite at these two periods, or about 4,000 miles an hour, coinciding with the periods when the maximum and minimum amount of *light* fall on her from the Earth (even by the Newtonian theory), which would amount to nearly a difference of 6,000 miles an hour, if computed on the true theory of "proper solar motion;" and we submit, that this difference in the Moon's motion, being always found to exist, may be readily accepted as a *fact* explained satisfactorily by the hypothesis I have endeavoured to set forth. No doubt I may be met here with the objection that I am all along assuming that the Moon *has* an atmosphere, which modern

philosophers dispute or deny. But let me remind the reader, that the arguments generally depended on to prove the non-existence of a lunar atmosphere, will none of them suffice to disprove the possible existence of an atmosphere about the Moon *sufficient* to produce all the effects for which I have argued ; as if it extend only a mile, or less even, it may when expanded by the action of electricity, be quite as dense as the major portion of those extremely ethereal substances called comets, which are admitted—I may say, known—to be dense enough to be acted on and retarded in their progress by the action of the universal ether.

The subject of the cause and consequences of the obliquity of the ecliptic and of the changes it undergoes, is too important to be considered at the close of a chapter. I must, therefore, refer the reader to the one which follows.

CHAPTER X.

OBLIQUITY OF THE ECLIPTIC NOT CAUSED BY THE "ACTIONS OF THE PLANETS," AS STATED BY SIR JOHN HERSHELL—THE THEOREM OF LA GRANGE, TO DEMONSTRATE THE STABILITY OF THE SYSTEM, UNFOUNDED—THE OBLIQUITY NOT "OSCILLATING," BUT PERPETUAL—ECLIPTIC AND EQUATOR WILL COINCIDE IN 168,898 YEARS—RESULTS OF THEIR DIFFERENCE IN 4,000 YEARS—GREATER RISE OF THE NILE—GEOLOGICAL CONSEQUENCES OF THE TROPICS HAVING PASSED OVER EUROPE—THE SUN VERTICAL TO LONDON 302,146 YEARS SINCE—THE CONSEQUENCES—VERTICAL POSITION OF THE SUN, THE CAUSE OF GEOLOGICAL PHENOMENA—FORMATION OF LAKES AND INLAND SEAS—INCREASED DISTANCE FORMERLY OF THE EARTH FROM THE SUN—THE EARTH APPROACHES THE SUN—TIME WHEN THE EARTH MUST FALL INTO THE SUN AND BE DESTROYED—ORIGIN OF THE EARTH AND PLANETS—PERIOD WHEN THE EARTH FIRST EXISTED—THE SUN ONCE AT THE POLE—DITTO VERTICAL TO NOVA ZEMBLA—CAUSE OF TROPICAL PLANTS AND ANIMALS IN THAT ISLAND AND IN BRITAIN—CONCLUSION.

THE obliquity of the ecliptic and its variation by an extremely slow yet regular motion, was early known to astronomers. It has not failed to become the subject of much wild speculation among the great mathematical men, who have inferred results quite opposed to the usual simplicity of nature; and, as in other cases, replete with complex ideas of *motion*, mixed up, perhaps more than in any other case, with the mysteries of attraction, to unravel which were a task for a thousand Hercules. The whole mass of these complex and contradictory theories of "compensation" is built up and established upon the doctrine of universal gravity and its illegitimate daughter "attraction." Having already proved that, since the Earth and other bodies of the

Solar System, do not *really* move, and *cannot* move, in either of the figures of conic sections (which is an absolute and indispensable Newtonian *condition* of “gravitating” bodies), I am warranted in knocking away the wedges that support the whole mystery, and for ever launching into the ocean of truth, to float out of all mental sight and memory, the monster vessel denominated “mutual attraction.”

But let it not be said that we have not allowed the advocates of this stupendous error to state their own case. I am not, however, about to follow Sir John Herschell through the miry mazes of this absurdity; where he *attempts* to explain the causes of the inclinations of the orbits of the Planets and their mutual action on each other, through twelve or thirteen mortal pages of spasmodic efforts at *reasoning*, broken in upon ever and anon, by declarations that “calculations of this nature require a very high analysis for their successful performance;”* and that there is a “law” that cannot easily be expressed in *words*; † and, “we shall endeavour to render these modifications *intelligible*, as far as they *can* be made so without the intervention of analytical formulæ.” ‡

It will suffice to state the sum and substance of all this gallamatia of astronomical confusion, by giving Sir John’s own words at pages 327 and 328, of his work, where he gives us the wonderful result.

* Page 314 of Treatise, &c. † Page 321. ‡ Page 329.

“It is clear, therefore,” he says (though other men would exclaim, “yes, *clear* as the murky darkness of Erebus”) that the total variation of the Planetary inclinations must be comprised within very narrow limits indeed. Geometers have accordingly demonstrated, by an accurate analysis of all the circumstances, and an exact estimation of the acting forces, that such is the case; and this is what is meant by asserting the *stability* of the Planetary System as to the mutual inclinations of its orbits.

“By the researches of La Grange (of whose analytical conduct it is impossible here to give any idea), the following elegant theorem has been demonstrated:—

“If the mass of every Planet be multiplied by the square root of the major axis of its orbit, and the product by the square of the tangent of its inclination to a fixed plane, the sum of all these products will be constantly the same under the influence of their mutual attraction.”

Sir John proceeds:—

“If the present situation of the plane of the ecliptic be taken for that fixed plane (the ecliptic itself being variable like the other orbits), it is found that this sum is actually very small—it must, therefore, always remain so. This remarkable theorem alone, then, would guarantee the *stability* of the orbits of the greater Planets; but from what has above been shewn, of the tendency of each Planet to work out a *compensation* on every other, it is evident that the minor ones are not excluded from this beneficial arrangement.”*

* The reader will observe, that when this was written the great Planet Neptune was unknown, and the discovery of some thirty minor Planets (now found to be as plenty as blackberries) had not yet been made. And it is worthy of note, that when La Grange gave out this noted theorem, the true mass of Jupiter had not been ascertained. Surely these great and important discoveries must in some way affect the “compensation” theory: if things were “all right” before, there must be a screw loose somewhere now!

Now, unfortunately for this celebrated theorem of La Grange, from which such comfortable conclusions are drawn, it is founded almost wholly on the *assumption* of an *elliptical* orbit; which has been demonstrated to be merely an *appearance*, and to be utterly *impossible* as an absolute *ens* in nature, because of the *proper* motion of the Sun, its imaginary *focus*; and what is not so founded is made to depend on the supposed influence of the "mutual attraction" of the Planets; itself a perfect myth, an airy nothing, and a name alone; because, resulting from that doctrine of universal *gravity*, already amply proved to be a fallacy, having no part in the real motions of the bodies of the Solar System, a mere mathematical fiction, hollow as the wind, very complex and laborious, and useful only, as a means of computing the places of the heavenly bodies, until the true, proper motion of the Sun should be known, and the real courses of the Planets determined to be in a series of cycloidal curves.

To pursue the remarks of Sir John Herschell on the subject of the ecliptic, we find, at page 328, he continues thus:—

"Meanwhile, there is no doubt that the plane of the ecliptic does actually vary by the actions of the Planets. The amount of this variation is about 48" per century, and has long been recognised by astronomers, by an increase of the latitudes of all the Stars in certain situations, and their diminution in the opposite regions. Its effect is to bring the ecliptic by so much per annum nearer to coincidence with the equator; but from what we have seen, this diminution of the obliquity of the ecliptic will not go on

beyond certain very moderate limits, after which (although in an immense period of ages, being a compound cycle resulting from the joint action of all the Planets) it will again increase, and thus *oscillate* backward and forward about a mean position, the extent of its deviation to one side and the other being less than $1^{\circ} 21'$."

Sir John here mentions "an immense period of ages," as if it were incalculable almost; but really this $1^{\circ} 21'$ are only 4,860", which, if divided by 48", as the secular variation, would give only 10,125 years, which is not so very "immense," when compared with some of the great periods the geologists deal with; millions of years, &c. However, let this pass, and let us examine some of the great and surprising results that must ensue from this variation of the plane of the ecliptic, should it be found that universal *attraction*, on which the "actions of the Planets," which Sir John Herschell mentions, depend, should prove to be a mere bubble of the Seventeenth Century; which I think my readers will, by this time, begin to feel confident is the case.

If the variation of the plane of the ecliptic, which I have already shown to be as near as possible 50" in a century, should be found to exist, quite independent of any "actions of the Planets," and to be perfectly analogous to the variation I have discovered in the planes of the other Planets' orbits or courses, by which discovery I have shewn that we are enabled correctly to compute their several heliocentric longitudes; then, I say, we may fairly question the above doctrine of Sir John Herschell's,

that this variation will not go on, and that "the diminution of the obliquity will not go on," but will "*oscillate* backward and forward about a mean position." Should the known and observed secular variation of the ecliptic *actually go on*, then it follows that in due course of time, the obliquity will cease, and the pole of the equator will reach an angle of 90° from the plane of the ecliptic. In other words, the ecliptic and equator will coincide, and the Earth will travel along with the Sun, at all times presenting its poles equally thereto, or rather not presenting them at all, but having the rays of the Sun fall equally on all parts of the Earth's surface, producing a perpetual equality of days and nights; as now occurs only at the equinoxes, when the Earth is crossing the Sun's course.

Whatever the cosmical effects of such a coincidence of the ecliptic and equator may be, matters little to the present generation of mankind. Because, as the angle that the Earth's pole is turned away from the perpendicular to the ecliptic at present is about $23^\circ 27' 29''$, which are equal to $84,449''$, and as the diminution goes on at the rate of $50''$ per century only, or half a second per annum, it will, of course, require the amazing amount of double that number of years, viz., 168,898 years, to bring about this coincidence.

However little it may be worth our while, therefore, to speculate on such a vast futurity, we may find much to interest us in the examination of the

necessary effects that must have resulted from the angle of the pole having been so much greater than it is now, in the early ages of the world. For example, if some 4,000 years ago, when the tropic must have extended rather more than thirty-three miles to the north of its present point, and the Sun became vertical for several days over the Isle of Philæ, it would be likely that its powerful action would cause a *higher* rise of the Nile than at present occurs. So, in accordance with this, we find that Dr. Lepsius discovered at the temple of SENNEH, rock inscriptions of the rise of the Nile, which “prove that the river, above 4,000 years ago, rose more than twenty-four feet higher than now, and thereby must have produced totally different conditions in the inundation and in the whole surface of the ground both above and below this spot.”*

But if such an effect would be produced by the tropic being only half a degree farther north than at present, we may well conceive that 6,000 years earlier, when the tropic would be in twenty-five degrees of north latitude, the rise of the waters

* “Letters from Egypt,” &c., by Dr. R. Lepsius, page 239. If asked *how* the Nile should be made to rise higher by the Sun going farther to the north, I reply, that the nearer the Sun became vertical to the Mediterranean Sea, the more powerful would be the evaporation therefrom. And, as the wind blows almost constantly from the north, the vapours so raised must be carried towards the sources of the river, to be condensed; and thereby add to the volume of its waters, which begin to rise so soon as this evaporation commences.

would be in proportion, and would reach some *sixty* feet higher than at present. It is difficult to suppose that it was not by some such continual yearly overflowings to this vast extent, that the immense deposits of sand were formed in the vicinity of the Nile river, now known as "the Lybian Desert." These may be conceived to have been partially caused by the waters of the Mediterranean rising simultaneously with those of the river, and so depositing some of its vast beds of sand, such as now exist near the mouths of the Nile, far inland on each side of the river.* For we are to remember that every year the Sun reached a greater north declination; and in far-gone days was vertical over those very mouths of the Nile themselves. It is no answer to these arguments to say, that this must have been some 36,000 years earlier still; because we insist that all these vast changes, as, indeed, all other similar geological phenomena, bear the character of being produced by extremely slow, but yet extremely potent operating causes: both of which conditions we meet with in the very gradually changing positions of the vertical Sun, viz., only *one* mile of latitude in 120 years. Thus, on whatever spot the Sun was vertical at Midsummer in these far-gone periods, he returned to that spot (to within a

* That the Red Sea and the Mediterranean once formed a junction, appears to be undoubted.

mile) and became vertical there again for not less than that long course of time.

If we now enquire what results must have occurred from the Sun being vertical farther and farther to the north, as we go more into the depths of time, we shall at once observe that for many ages he must have been in that position all over the south of Europe, as the tropic gradually extended to the north, until at length it reached the latitude of Southern Britain. And it is interesting to ascertain, that since the latitude of St. Paul's, taken at $51^{\circ} 32'$, differs from the present obliquity of the ecliptic, or inclination of the pole from the perpendicular to its course, just $28^{\circ} 4' 33'' = 101,073,$ we have double this number of years, viz., 202,146 years, since the tropic passed over the latitude of London, and *the Sun was vertical to the present site of St. Paul's.*

Let us now enquire of what nature must have been the phenomena upon the face of those parts of the Globe, if such ever really were the case; and then let us examine whether the geological facts, known to have existed, coincide in character with those phenomena. For, if so, we shall have very satisfactory evidence that the Sun *has* been in the north, and *has* produced effects similar to what he now produces within those tropical regions, to which his vertical action is now confined. This being proved, the conclusion is irresistible that the motion of the pole is not *oscillatory*, as Sir John Herschell conceives, but is, indeed, *continuous*; and that it is

to the solar action we must look chiefly for the causes of those fearful revulsions, which, attended with stupendous inundations and earthquakes, led to the geological changes that science has discovered—without having yet determined satisfactorily their true origin. And if we decide that this origin may be satisfactorily taken to have been due, though even in part only, to this *vertical* action of the Sun, we have “confirmation strong as proof from Holy Writ,” that the motion of the pole has ever been independent of the imaginary “actions of the Planets,” that fiction of astronomers, founded on that other fallacy of theirs, denominated “universal attraction.”

If we turn our attention to the tropical regions of the Earth, especially to those portions in the vicinity of the tropics themselves, or within a few degrees thereof, what do we witness? On the one hand immense rivers, such as the Mississippi on one continent, and the Ganges on another; and vast and extensive Archipelagos on the other hand, such as the West Indian Islands in the Atlantic Ocean, and the innumerable islands spread out from Java to New Caledonia, and beyond, in the Pacific. Now, these islands bespeak frequent and potent exhibitions of volcanic action, almost always accompanied with earthquakes and attended by sudden inundations; which effects appear quite consistent with causes having for their basis the violent action of solar heat, when reiterated within a brief period.

This is, in fact, the case when the tropical action of the Sun is confined to a few degrees of latitude, and when that body is never removed beyond about forty-seven degrees from the zenith of those regions; being every year vertical twice to each part situated within about twenty-three degrees of the equator. Accordingly, if we examine the Globe within the tropics, we everywhere find an abundance of islands, the smaller of which (with the exception of mere coral reef) appear to have been thrown up to the surface by volcanic action, as we have witnessed within these few years past, or to have been rent away from adjacent lands by earthquakes. Now, that these phenomena should have happened by the action of internal heat in the Earth is, I am aware, the dream of some philosophers. But, if so, why should the action of that internal heat be confined to the equatorial regions of the Globe? We see nothing remarkable of this kind beyond thirty degrees of latitude, either north or south; yet the so-called central heat should be as liable to act over the remaining two-thirds of the entire Earth, methinks, as in that particular one-third of the said Earth.

But if these violent phenomena, which have resulted in the formation of numerous mere islets, and also numerous large and capriciously formed islands, such as Sumatra, Borneo, and New Guinea, as also the obvious rending away of Australia from the Malay

Coast by some vast convulsion, and the almost rending away the Continent of South America from its northern neighbour, about Mexico and the Isthmus of Panama; if, I say, these things be due to the continuous action of an almost vertical Sun, then do we see plainly why few such phenomena present themselves to our view much beyond the tropical regions.

To understand this, we have only to consider that when the tropics extended from thirty to forty degrees on each side of the equator, the Sun remained but a very brief period vertical to any one point; and that when the solar course extended still farther to the north and south of the line, his visits were still more transient and the effects of a vertical Sun less and less observable, *as relates to the production of islands and the disruption of continents*. Thus, when the pole inclined above thirty degrees and less than forty degrees from the ecliptic, and the Sun consequently became vertical twice a year to all points situated between thirty and forty degrees of latitude, we find that some degree of violent action ensued, and the result was that in the Mediterranean Sea, which lies within those limits, there are numerous islands, great and small; but when we get to the north and south of these points there are comparatively very few. And if we reflect that, when the Sun reached to within forty-five degrees of the pole each way, he had to travel over ninety degrees of

declination in exactly the same time that he now takes to pass over forty-seven degrees, we see at once that he must have moved nearly twice as swiftly in declination; and that, therefore, his vertical action, being much less continuous, must have been much less powerful. Still, when the tropic passed from the fiftieth to the sixtieth degree of latitude, that vertical action was capable of effecting *some* convulsions; and, accordingly, we find the Islands of Great Britain on one side, and those of the Aleontian Archipelago, and Foxes' Islands on the other. While even when the Sun passed vertical to the portions of the Earth, situated between seventy and eighty degrees from the equator, and made a very brief stay over any one point there each year, this vertical action was sufficient to form the islands of Nova Zembla, New Siberia, and Spitsbergen, as also those other recently discovered insular spots, the now well-known "Melville Island," and a few others in that vicinity.

Let me not here be misunderstood to mean that a vertical Sun, even in the present tropical regions, will suffice to effect great disruptions in a *direct* manner, and, as it were, by the mere action of heat. Nature does not operate in this curt style. But where intense heat is continuous, as well as frequent, there must necessarily exist rapid and extensive *evaporation*; and, as no chemical action of this kind can go on, without great electrical disturbance, we

at once perceive that this potent, natural agent is called into play; and, as we know no limits to its power, we may readily conceive that volcanic phenomena must ensue. And then, when the vertical heat is found to cease, or even merely to diminish, there must follow an equal degree of *condensation*; and thence farther electrical action, probably an effort to restore the equilibrium, by which earthquakes may and must be generated, with all their stupendous consequences. Now, if we imagine the Sun to have been vertical over that space of the Earth, comprised between the fortieth and fiftieth degree of latitude; and that this vertical position recurred every summer while the pole passed over the ten degrees, or 36,000 seconds of an arc, at the rate of half-a-second a year (as I have proved it must have done), we find the remarkable fact that this state of things must have endured just 72,000 years! And that for several weeks, about the longest day of each of those years, a raging, vertical Sun must have shone daily without setting over the northern portions of the Atlantic and Pacific Oceans, producing intense *evaporation*. The subsequent *condensation* of those vapours must have been vast and rapid; and we need scarcely be surprised that great inundations ensued, and that enormous lakes were formed in those latitudes in North America, and that other vast lakes were also formed in the similarly situated portions of Europe and Asia, such as the

Caspian, the Sea of Aral, and others, as also the Euxine or Black Sea, and Sea of Azof.

To fully appreciate the potent action of the Sun's rays, when approaching the zenith of these northern regions, we must remember, that during several weeks in the summer, the Sun was not only vertical at noon, but that he never disappeared below the horizon at all for a long period. Thus, when the tropic extended to forty-five degrees north of the equator, and the Sun was vertical at Midsummer to Lake Huron, Ontario, &c., there must have been almost perpetual day for several weeks, and the Sun merely skimming along the horizon for a further period of some weeks, because, even at the equinox, he was only forty-five degrees from their zenith.

It will appear evident, on consideration of these circumstances, that for a period of from ten to twelve weeks, there must have been excessive *evaporation* going on in those regions in the summer; and that during the same period in winter, when the Sun scarcely appeared at all for an equal period, there must have been a relative *excess* of *condensation*. But, no doubt the vapours taken up in the summer, were deposited in the shape of long and continuous rains in the autumn and early portions of the winter. It would result, that for ages there must have been periodical floods and concomitant overflowing of the adjacent seas and lakes, leaving vast accumulations of sand, which are accordingly found to extend over

about forty degrees of longitude, and to form the great desert of Shamo, to the north of Thibet. Similar results were effected over vast portions of Africa.

When we get beyond fifty degrees of north latitude, we find an entire absence of these vast and extensive sandy deserts. And yet we find a certain amount of lakes in the American Continent, as also, indeed, about the borders of the Baltic Sea. We can, however, hardly believe that the same relative amount of evaporation could have existed over those regions, even when the Sun traced his course vertically over Great Britain, and other countries lying between the fiftieth and sixtieth parallels of latitude. The reason is, that we must take another cosmical element into our consideration, which is the *increased distance of the Sun from the Earth* at that far-gone period. This great fact of the *diminishing distance* of our Earth from the Sun, has never forced itself on the notice of our modern astronomers; because it can only be discovered by reference to the *proper* motion of the Sun itself; of which, adherence to the Newtonian theory, has compelled them, while admitting its existence, to ignore its consequences. This fact will be easily understood, if we consider that the angle of declination of the Sun, when on the tropics, is the *same* as the angle of inclination of the Earth's pole, from the orbit in which it moves, which angle is called the obliquity of the ecliptic; and which we have seen to be continually *diminishing* at the rate of 50" per century.

Thus we shall find that, *when* the Sun was vertical to the site of St. Paul's, taken to be in latitude $51^{\circ} 32'$, which was 202,146 years ago, the distance of the Earth from the Sun, was very nearly double what it now is, viz., about 187,000,000 of miles.* From which we are not to conclude that

* This is shewn by the following simple calculation :—

As sine $23^{\circ} 27' 29''$ AC	0.400032
To 95,000,000 miles, log.	7.977724
So sine $51^{\circ} 32'$	9.893745

To 186,853,435 miles, log. 8.271501

This curious fact of the constantly diminishing distance of the Earth from the Sun leads to the very important doctrine that there is no eternal "stability" in the Solar System, as the astronomers teach. But, on the contrary, we may shew that the Earth *must* at last fall into the Sun, and be consumed; as the words of Scripture evidently import. Such, also, must be the destiny of all the other Planets; for they are all steadily, though slowly, approaching the Sun; and must eventually become again one with that body; from which it is extremely probable they were originally thrown off by the vast centrifugal force, caused by its rapid rotation on its axis.

I compute that the present yearly rate at which the Earth is approaching the Sun is about 530 miles. But it is not quite regular in its amount—and I consider we may infer that the event of the Earth's junction with the Sun's body will occur in about 172,000 years from the present period. I deem it very probable that the Earth, when it was projected from the Sun, began to rotate, *with its axis in the plane of its orbit*. If this were so, the period of its existence, as an independent body, may be exactly calculated. For the pole of the Earth has at this period departed from the plane of its orbit, just $66^{\circ} 32' 31'' = 239,551$ seconds of an arc; and as the rate of its polar motion is half-a-second per year, it follows that double that number of years, or 479,102 years is the true age of the Earth.

the Sun's action on the Earth was diminished in exact proportion to the square of the distance ; yet we may, perhaps, admit that it was very greatly diminished nevertheless. And if so, we must still infer, that for very many ages, the summer period in the latitude of Britain, was attended with an amount of heat, almost equal to that of the present tropics, and that evaporation and condensation went on with a degree of violence or intensity that must have covered the land with lakes and vast muddy streams, in which the sauriens, and other such monsters, could disport themselves with satisfaction ; while it would have been impossible for ordinary quadrupeds to have existed.

But when the tropics began to recede from these latitudes, a different state of things ensued. Intense summer heat existed from the long stay of the Sun above the horizon, for some weeks near the solstice ; and from the near approach of that body to the zenith every summer for many thousands of years. So that a rank and abundant vegetation must have been in existence ; fitted for the larger kind of mamalia, whose remains demonstrate that such a tropical climate did once obtain here. And as the intensity of solar, vertical action had diminished, and its direct consequences, violent evaporation and condensation, were less, we find evidence that the sauriens began to gradually disappear, as the mamalia became more numerous. The reason being,

that the climate suitable for the former, was no longer existing, while that calculated for the latter endured for many subsequent ages.

It was during these ages of the greater mamalia, that we attribute the remains of monkeys and other tribes to whom tropical heat was genial. But these gradually emigrated towards the south, as the tropics gradually withdrew from the northern portions of Europe, and the summer heat diminished.

The existence of the remains of coniferous trees, and of various other tropical productions, vegetable and animal, which exist in vast abundance all through *Nova Zembla* at this moment, demonstrates the fact that the tropics once extended even to the latitude of those islands, viz., seventy-four degrees. Hence we have the strongest confirmation of our theory, that the pole of the earth was once in the plane of its orbit; at which time the Sun passed twice during the summer vertically over the Islands of *Nova Zembla*. There is no other possible device or imagination of man, save only the monstrous and preposterous notion of the action of internal heat, to explain how and whence came the remains of monkeys and elephants, and coniferous plants to be found, as found they are vastly to abound, in *Nova Zembla* and other parts to the north of the frozen regions of Russia. After the disruption of those islands from the main, by some vast earthquake, those animals could not escape to the south, but

perished as the tropical Sun receded; and their very numerous remains still tell the tale of his former presence in those regions.*

The conclusion of the whole matter is, that geological phenomena combine with astronomical facts to prove the doctrine of the continuous motion of the pole; which results from the theory of the *proper* motion of the SUN through space; and the necessary concomitant motion of the Earth, the Planets and their Satellites, in CYCLOIDAL CURVES.

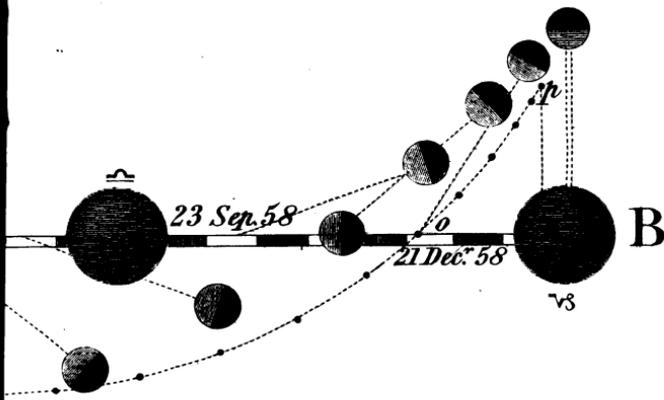
* In no other part of Europe are such unaccountably *numerous* remains of tropical animals to be found; the reason being obvious, that, as the climate gradually altered for the worse, these creatures had the instinct to quit the north; which they could not do, as far as regards the Islands of Nova Zembla, when they became separated from the Continent. The disruption of the British Isles from the Continent must have been subsequent to the period of its tropical climate; as the few remains of southern animals therein are not more than may be accounted for on the ground of accidental deaths and chance interment of their skeletons.

Now, if the "internal heat," we hear about, could produce the vast numbers of tropical mamalia in Nova Zembla, how is it that the same cause did not create the same amount of such animals in Britain or in Europe generally? Surely, if the northern position of Nova Zembla always shut it out from solar heat, it must have had a vast deal more than its share of *internal* heat! And if so, the neighbouring parts of Northern Russia should have enjoyed the same heat, and produced nearly the same remains, &c.; which they do not.

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215

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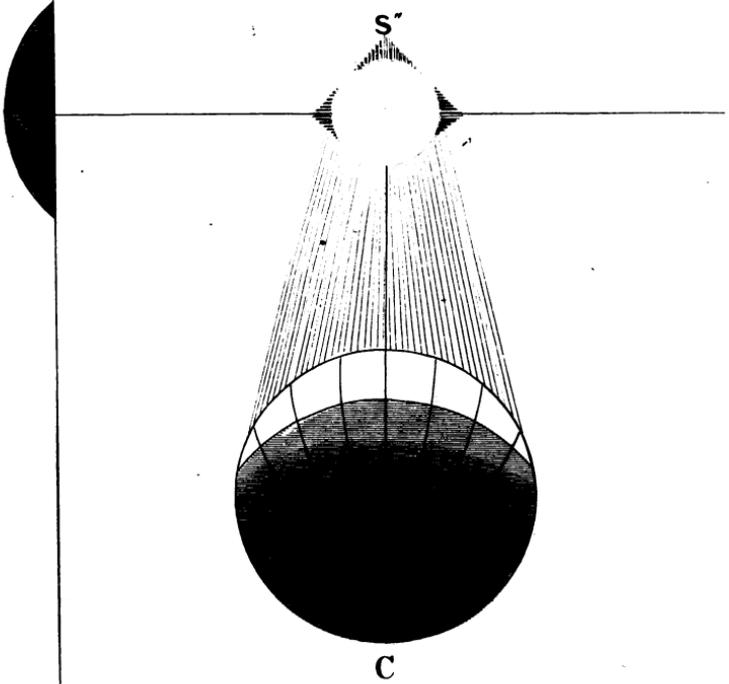


tidal curves,

of the VERNAL EQUINOX

DETERMINED *and*

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Fig 1.

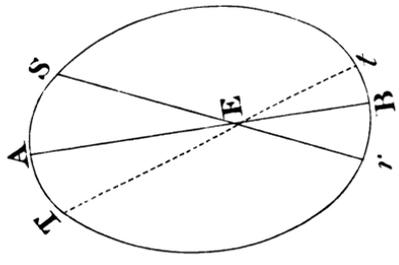
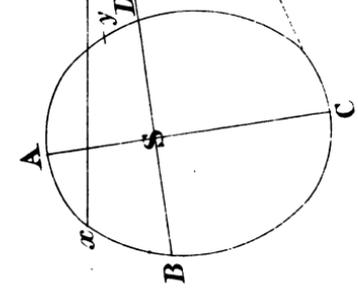
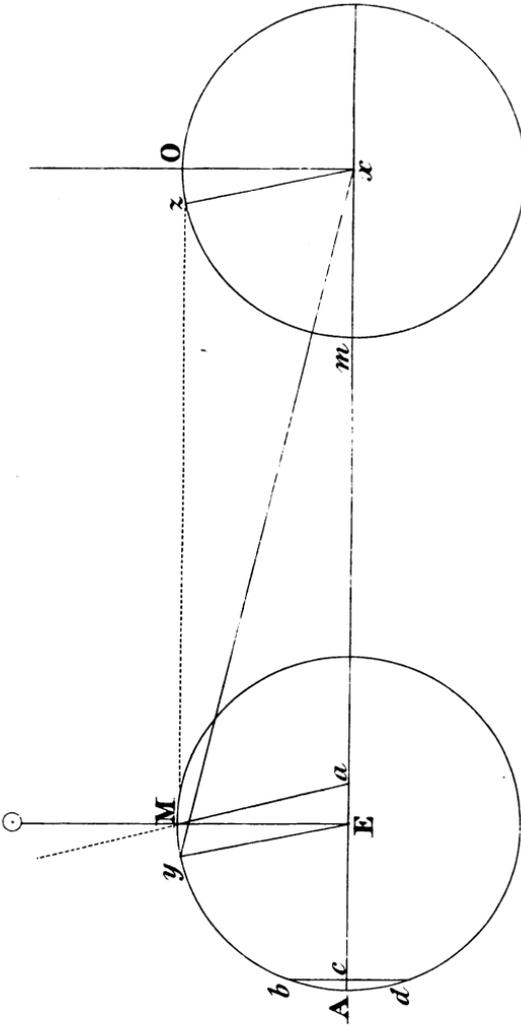


Fig 2.

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PLATE VIII.



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Fig. 1.

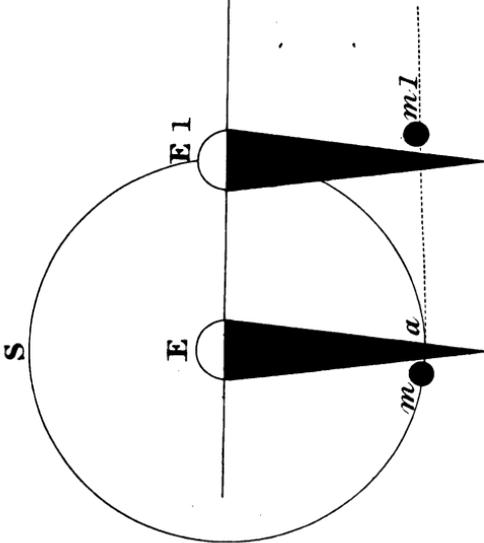
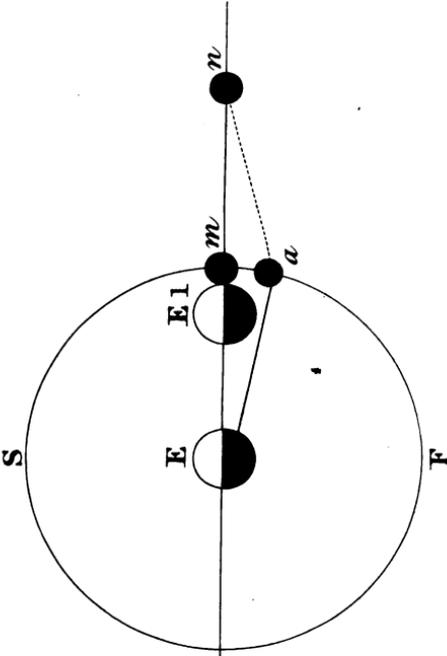
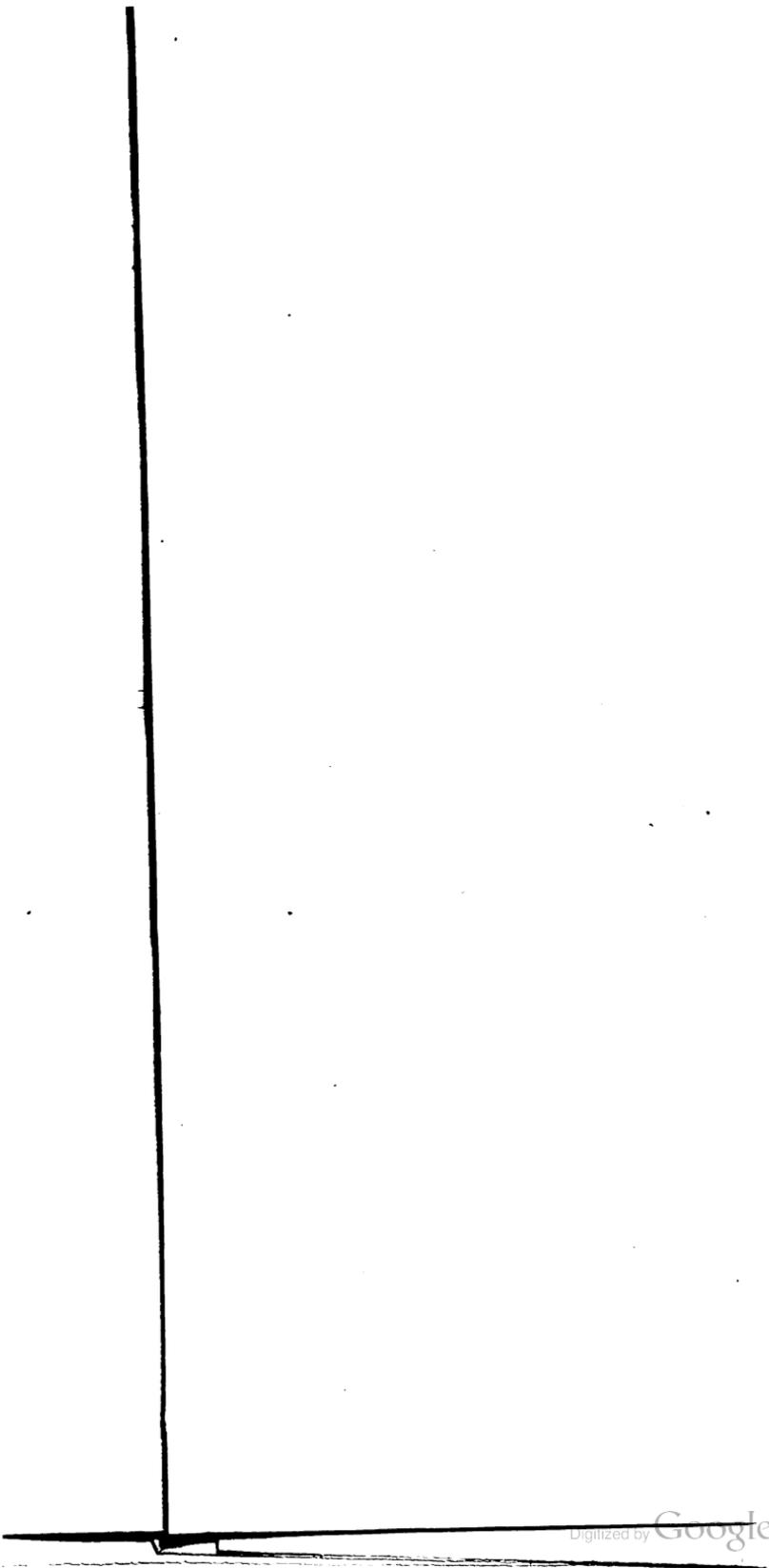


Fig. 2.



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PLATE V.

