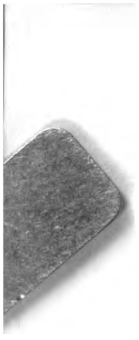

THE

DESCRIPTION and USE

OF A NEW

CELESTIAL PLANISPHERE,

ADAPTED TO THE

Latitude & Parallel of London:

INSPECTED, AND APPROVED, BY THE ASTRONOMER ROYAL

AND BEING

PROJECTED upon the PLANE of the EQUINOCTIAL,

Proves every Way convenient for illuſtrating that moſt apparent and USEFUL PART of ASTRONOMY,

The DIURNAL MOTIONS of the SPHERES.

WITH A

CONCISE APHORISM OF THE ANNUAL MOTION OF THE EARTH ROUND THE SUN;

THE NATURE OF

The PRECESSION of the EQUINOXES;

AND THE

CONSEQUENT DIRECT MOTION OF THE STARS;

With all other PRECEPTS and EXAMPLES which are requiſite in ſuch a WORK.

CALCULATED AS WELL FOR THE INSTRUCTION OF PRIVATE STUDENTS, AS TO ACCOMPANY, AND SUCCEED THE USE OF THE GLOBES IN THE FINISHING SCHOOLS,

By SOLVING all the moſt uſeful PROBLEMS in ASTRONOMY,

With the utmoſt FACILITY and EASE.

BY STEPHEN GODWIN,

Teacher of the Mathematics, in London.

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ADVERTISEMENT.

ANY Gentlemen who travel, or reside at times in Foreign Parts, may have correct *Drawings* at the shortest notice; or *Temporary Horizons*, for any Latitude, to apply to this *Planisphere*.

I also make other *Circular Planispheres, in Pairs*, to shut up together, for the *Pocket*, projected both on the South and North Poles, which contain all the Stars in both Hemispheres, of any note.—Also, *Mercator's*, and other *Charts*, chiefly adapted to solve the *Diurnal* and *Horary Motions of the Spheres*, fitted to all Latitudes, and are equally useful to the young Academic, the private Student, and the Traveller, as they convey a general, clear, and pleasing Idea of the *Positions* and *Motions* of the *Spheres*.

N. B. *Lessons of Instruction given on the most liberal Terms.*

The PREFACE.

THERE have been many Planiſpheres *invented and published, at different periods, within a century or two past, for different uses; some for* Geography, *some for* Aſtronomy *and* Chronology, *and some applicable to a few detached articles of all the three; but all that I have seen are very unsatisfactory, and some very erroneous: yet there are some* Planiſpheres *now extant, which are perfect in their kind, but not very useful, they being projected upon the Plane of the Meridian, are not capable of a Rotatory Motion, and, consequently rendered very limited: others have been projected on the Planes of the Horizon, or the Ecliptic, but none of them are adapted for, or capable of showing the Diurnal Motions; and, consequently, of very little utility, in comparison of what is wanted: my seeing these wants and defects, set me to consider, that, as the Earth's Diurnal Rotation was made upon the Poles of the Equator, so a* Planiſphere, *projected upon the Plane of the Equinoctial, would answer my utmost wishes, and would be capable, not only to solve the daily apparent Motions of the Heavens, but also far more other Astronomical Problems than any of the abovementioned can do: this* Planiſphere *is a true representation of the Celestial Sphere, in the parallel of London,*

extending to the Southern Horizon, or fifteen degrees below the Tropic of Capricorn ; *it is fitted with a circular and movable Index, consisting of an Horizon, an Hour Circle, the prime Vertical, the Meridian, and Equinoctial Colure, with a straight director above it, and moving on the center of the projection, or Pole of the Equinoctial ; it generally solves each Problem at one remove, and in less time than can possibly be done by the Globe, or by any* Planiſphere *hitherto extant, they being applicable to the use of Scales and Compasses, or of some troublesome and tedious Index: in short, a sight only, of the construction of this* Planiſphere, *will ſufficiently convince every discerning person of its superior utility and readiness in all the purposes of Astronomy to which it is intended ; also, the World will readily be aware, that the* Diurnal *and* Horary Motions *of the* Spheres *is the most useful, the most general, and practical part of Astronomy ; it is that which attracts the attention of every thinking being ; all can discern the apparent Diurnal Motions of the Heavens, and would wish the phenomena solved to their capacities ; indeed, most men are, more or less, deeply concerned in this part of Astronomy, either for profit or pleasure, or both. Who does not make some use or other of the rising, culminating, (or, passing the Meridian) and setting of the Sun, Moon, and Stars?—The merchant, the mariner, the traveller, and every public and private student, down to the peasant, who knows and regulates his times and seasons, his labour and rest, by the Sun, Moon and Stars, all have their interests in this part of Astronomy, the Diurnal and Horary Motion of the*

Spheres; and what further benefit and pleasure may we not expect to accrue among these respective classes, when this plain, easy, and familiar Treatise, (with the Planiſphere) *falls into their hands? when, by only turning the hour and minute given, and found on the Index, to the day of the month, the* Planiſphere *stands rectified for that time, and represents the true situation of the Heavens, and the Problem is performed in a quarter of a minute of time, or less; and, by continuing to move the Index to a good regulated clock or watch, not only the relative positions and situations of the Celestial Bodies with respect to each other, and to the prime Circles of the Sphere, but their Horary Progressive Motion from East to West, is most beautifully seen by day and night perpetually; which, with the extensive variety of uses that this* Planiſphere *is applicable to, cannot fail to enlighten and enlarge the understandings of every possessor of it, in the most rapid degree; and I humbly conceive and flatter myself, that if this little Work should be made an auxiliary Study in our* Finiſhing Schools, *great benefit will be derived therefrom in the education of the rising generation; as the precepts and examples are easy, pleasing and engaging, and are calculated to allure, rather than to deter the minds of Youth from the study thereof; which, if this should be the case, my utmost wishes will be answered, and my labour amply rewarded.*

It will appear obvious to every one, that the Want *of such a* Planiſphere, *as an easy and sure Guide by which to demonstrate the Theory of Astronomy, hath always been the grand obstacle, the fatal check to the Study of*

this Science: it is not every Student that can, or that chuses to purchase a Pair of Globes, *and to study Astronomy in bare and dry Authors, hath always been found an hopeless task, which hath deterred many a good genius from attempting this Study at all: but, I presume, and shall venture to affirm, that the encouragement every one will meet with at the first use of this* Planiſphere, *will do away every objection, and will lead them on, by pleasing steps, through this short, pertinent, and useful Introduction, into the wide campaign of the most sublime Science of Astronomy.*

London, July 1, 1802.

THE

PRINCIPLE AND USES

OF THE NEW

CELESTIAL PLANISPHERE.

TAKE any Sector, or Gunter's Rule, (but the Sector is the beſt, becauſe it can be ſet to any Radius) and, with a pair of compaſſes, take the parallel diſtance of 60°, and 60° in the Chords, or the parallel diſtance of 45° in the Semi-Tangents, opening the Sector to any Radius as will beſt ſuit your Plane; with this diſtance ſweep a circle in the middle of your Plane, which is the Equinoctial, and muſt be divided into 360 equal parts, or degrees; and alſo into 24 hours, at the rate of 15° per hour; beginning where the degrees do; this circle is the Right Aſcenſion in time, and degrees—in this caſe, the center of the Sector is the pole of the projection, and the parallel of 45° is the radius of the Equinoctial; and, as the *Tropic of Cancer* is 23° 28′ from the Equinoctial towards the Pole, take the parallel diſtance of theſe degrees (counting them doubly)

and ſweep this circle concentric with the Equinoctial, and this is the parallel of *Cancer*, which will be 66° 32′ from the Pole, or 33° 16′ on the Sector. Then, to find the Tropic of *Capricorn*, you muſt make 45° on theſe lower Tangents a paralliel diſtance of 45° on the upper Tangents, and take 23° 28′ beyond that, for the parallel of *Capricorn*. Then, the Arctic Circle is 23° 30′ from the Pole: and theſe are all the concentric Circles in the Plane, except the Circle of the Months, which is near the outward edge of the *Planiſphere*. The next Circle is the Ecliptic, the apparent annual path of the Sun, and it is drawn thus:—ſet off the Secant of 23° 30′ from *Cancer*, on the Solſtitial Colure towards the Pole, and this ſhall be it's center; and it's Pole is at the interſection of the Arctic Circle, and the Meridian or Solſtitial Colure; in this Circle, the ſigns of the Zodiac are placed; and, in tables of the Right Aſcenſion of the Ecliptic, you will find the proper diviſions of this Circle into ſigns and degrees; then lay a thread, or an Index, from the Pole, through every degree of Right Aſcenſion of the Ecliptic, and it will give points in this Circle where all the Signs and Degrees do fall; the fixed Stars are laid down the ſame way by their right Aſcenſion and Declination as found in the tables of the Stars, and thoſe in my *Planiſphere* are all of the firſt and ſecond Magnitude, and their places computed up to the preſent year 1802, incluſive.—Then through the firſt points of *Cancer* and *Capricorn*, draw a ſtraight line, and this will be the Meridian and Solſtitial Colure; then again through the firſt points of *Aries* and *Libra* draw another line,

which is the Equinoctial Colure and Hour Circle of ſix; theſe two Circles do interſect each other in the Pole of the world, and you will find the ſituation and names of all theſe Circles in the *Planiſphere*; the next is the Circle of Months; and if you look on the horizon of any new Globe, or in any Almanac, you will there ſee the Sun's place to every day of the year; then lay an index from the center of the Plane through every point of the Ecliptic into the Circle of Months, and mark the days accordingly, and it is done: the index conſiſts of an Hour Circle, next to the Circle of Months; and, as you hold the South point from you, the left hand hours are the morning and forenoon hours, and the right hand are the afternoon hours, to twelve at night, which is at the bottom next to you, due North; then the Meridian reaches from 12 to 12 through the Pole, and on the ſouthern part is a ſcale of meridional Altitude from the Horizon up to the Zenith of London; and, on the northern part, is a ſcale of Declination, North and South; the Circle of the Horizon hath the points of the Compaſs, the Azimuth, and the Amplitude; and note, that the inward edge of the Circle is the ſenſible and apparent Horizon; next is the Prime Vertical, or Azimuth of Eaſt and Weſt, and on it is a ſcale of Altitude when due Eaſt or Weſt, up to the Zenith; the next is the Equinoctial Colure and Hour Circle of ſix; and above this is a ſmall index, or director, to be uſed, as will be taught among the Problems. This may ſuffice for a deſcription of the principle and conſtruction of the *Planiſphere*. I muſt now proceed to it's uſes, as it relates to Aſtronomy: and

here I muſt beg, that the more proficient in the ſcience will not think I inſult their judgment, by laying down the firſt rudiments of it. I wiſh firſt to inform, and bring forward young minds, and then I mean to advance, and find amuſement for them, if not inſtruction.

The Circle of the Zodiac is divided into twelve parts, called Signs, and each ſign into 30°; their names and characters are as follow:

♈	♉	♊	♋	♌	♍
Aries.	*Taurus.*	*Gemini.*	*Cancer.*	*Leo.*	*Virgo.*
♎	♏	♐	♑	♒	♓
Libra.	*Scorpio.*	*Sagittary.*	*Capricorn.*	*Aquarius.*	*Piſces.*

The firſt ſix of theſe are called Northern Signs, and poſſeſs that half of the Ecliptic that is on the north ſide of the Equinoctial, beginning at the firſt point of *Aries*, and ending at the laſt point of *Virgo;* the latter ſix are called Southern Signs, and poſſeſs the Southern half of the Ecliptic, beginning at the firſt point of *Libra*, and end at the laſt degree of *Piſces*, where *Aries* begins again: and note, that theſe ſigns are different from the Conſtellations which bear their names; for, though they were formerly ſituated together, yet now, by a ſlow retrograde motion of the Equinoctial points, at the rate of about 50 ſeconds per year, or one degree in 72 years, the Conſtellation *Aries* is got into the Sign *Taurus*, and ſo of the reſt, till the Stars of *Piſces* are now in *Aries*; this motion is made upon the Poles of the Ecliptic, contrary to the ſucceſſion of the Signs, and is called the Preceſſion of the Equinoxes. The

beginning of the four Quarters of the Ecliptic are called Cardinal Signs, viz. *Aries*, *Cancer*, *Libra*, and *Capricorn*, becauſe the Sun enters them at the beginning of the four Quarters of the year; the four Points of the Compaſs, called Eaſt, Weſt, North, and South, are called Cardinal Points alſo; and if you bring *Cancer* or *Capricorn* to the Meridian, the Cardinal Signs will coincide with, and lay over the Cardinal Points of the Horizon. *Aries* and *Libra* are alſo called Equinoctial Points and Signs, becauſe the days and nights are then equal, as you will ſee by the *Planiſphere;* if you take the Sun's diurnal Arc on thoſe two days that the Sun enters theſe Points, the two Meridians paſſing through theſe Points, are called Colures, and that which paſſeth through the Equinoctial Points is called the Equinoctial Colure; and that which is at right Angles to it, paſſing through the Solſtitial Points, is called the Solſtitial Colure, as you will ſee them named in the *Planiſphere*. The uſe of the Prime Vertical in the *Planiſphere* is very obvious; for when, by the diurnal rotation of the Earth, any celeſtial object comes to this Circle in the eaſtern Hemiſphere, it appears due Eaſt: and if it be in the weſtern Hemiſphere, it is due Weſt, and its Altitude, in both Caſes, is ſeen by inſpection; alſo, when any celeſtial object comes to the ſouthern part of the Meridian, its meridian Altitude is ſeen on the ſcale of Altitude; and when any object is riſing or ſetting, its Azimuth and Amplitude are ſeen on the Horizon, with the Point of the Compaſs on which it riſes or ſets.

When the reader has ſtudied and learnt the Principle and Conſtruction of the *Planiſphere*, which is eaſy to accompliſh, he will find it is adapted, in the moſt eaſy and ready manner, for ſolving all the Problems to which it is applied, and I may venture to ſay, far more ſo than the Celeſtial Globe, it being inconvenient on the Globe to apply, and work the Hour Circle and the days of the months together, and to concentrate the Hour Circle and the Ecliptic is impoſſible; but, on this *Planiſphere*, the Days of the Months and the Degrees of the Ecliptic are adjuſted together, by which means the Day of the Month being given, is the ſame as the Sun's place in the Ecliptic, or the contrary, ſo that theſe may become ſynonymous terms in the *Planiſphere*, and as the Hour Circle on the Index turns concentrical with the Circle of Months, and juſt within it, ſo moſt of the Problems are ſolved at one remove of the Index, and the anſwer appears in an inſtant, by inſpection.

Having now deſcribed, and prepared the *Planiſphere* for uſe, I ſhall next explain the motions of the Terraqueous Globe on which we live: and firſt, according to the true, or *Copernican* Syſtem of the Univerſe, this Globe is a Planet, revolving round the Sun in an orbit ſomewhat elliptical, and in the ſpace of 365 days, 5 hours, and 49 minutes, being accompanied with the Moon, and hath the Sun at reſt in the center of its orb.—Now, conceive at a vaſt diſtance, without this ſyſtem, the ſphere of the fixed Stars; and then imagine that on this, or ſome one day, the Sun appears to a be-

holder on this Earth, to be in a ſtraight line, or in conjunction with ſome one of the Stars; but as the Earth revolves in its orbit, the Sun will apparently leave this Star, and ſeem to paſs from the right to the left, or from Weſt to Eaſt with reſpect to the Stars, 'till it hath paſſed over all the Stars in it's path quite round the Heavens in one year; and here it is evident to the underſtanding of every one, that this apparent motion of the Sun, ariſes from the real motion of the Earth in its orbit round the Sun, and the path, or circle that the Sun appears to deſcribe in the Heavens, is called the Ecliptic; and note, that this ſame path would be traced out by the Earth in its annual motion, to a beholder in the Sun, with only this difference—that when the Sun appears to us to be in *Aries*, the Earth would appear to a ſolar ſpectator to be in *Libra*, and ſo always with ſix ſigns, or 180° difference;—while the Earth is performing its annual courſe round the Sun, it turneth round upon an imaginary axis in every 23 hours, 56 minutes, from Weſt to Eaſt, with its inhabitants, to whoſe ſight, all the celeſtial bodies muſt of courſe appear to move the contrary way, viz. from Eaſt to Weſt; for, the ſenſible Horizon being an opaque, ſolid, and apparently level expanſe, doth always conceal the lower Hemiſphere from our ſight, but as the whole Earth continues to revolve upon the Poles of the Equinoctial, from Weſt to Eaſt, the eaſtern part of the Horizon will be depreſſed below thoſe Stars, or celeſtial bodies, that were before below it, and inviſible, and they will become viſible to our ſight, and are then

ſaid to riſe: the ſame way the Weſtern Horizon doth elevate itſelf above thoſe bodies that are the moſt Weſtern, and they are ſaid to ſet; and ſo thoſe bodies, that are on the eaſtern ſide of the Meridian, will, by this motion of the Earth, culminate, or tranſit the Meridian, and in turn will ſet; as alſo the imaginary Circles of the Sphere, ſuch as the Equinoctial, the Ecliptic with the Sun, and Planets therein, will, by the rotation of the Earth, all appear to riſe, culminate and ſet, cauſing day and night to all; this is called the Diurnal, and Horary Motions of the Spheres; this is the part of Aſtronomy that is peculiarly noticed by, and uſeful to every one; it is theſe motions, that my *Planiſphere* is chiefly intended to illuſtrate, and render familiar to the capacity and practice of every Lover of Aſtronomy; and this leads me to the following Precepts, on the Properties and Uſes of the Circles of the *Planiſphere*.

Precept 1. DECLINATION of the CELESTIAL BODIES, is an Arc of the Meridian, beginning at the Equinoctial, and counting it North and South to the Poles, ſo any celeſtial object, while it is ſituated on the North ſide of the Equinoctial, is ſaid to have North Declination; but, while they are on the South ſide of the Equinoctial, are ſaid to have South Declination: and note! on my *Planiſphere*, a Scale of Declination, North and South, is laid down upon the Meridian of the Index with 0° degrees, revolving in the Equinoctial.

Precept 2. RIGHT ASCENSION IN TIME, AND DEGREES, is an Arc of the Equinoctial, beginning at the firſt

point of *Aries*, and counting Eaſtward round the *Planiſphere*, and, with the celeſtial bodies, it is that degree of the Equinoctial that comes to the Meridian with any of them reſpectively; and the Right Aſcenſion of every ſign, degree, and point of the Ecliptic, is to be found the ſame way, by bringing thoſe points reſpectively to the Meridian, and the degree of the Equinoctial cut thereby, is the Right Aſcenſion of that ſign, or point required; and note! that 15° of this circle revolves through the Meridian in every hour, it being the 24th part of 360°, which the whole Circle contains.

Precept 3. OBLIQUE ASCENSION, and DESCENSION, is the degree of the Equinoctial cut by the Horizon, at the time of the riſing, and ſetting of any of the celeſtial bodies, or of any part of the Ecliptic, as may be required.

Precept 4. ASCENSIONAL DIFFERENCE, is the difference between the Right, and Oblique Aſcenſion; and with the Sun, it ſhows how much it riſes and ſets, before, and after ſix o'clock.

Precept 5. CELESTIAL LONGITUDE is an Arc of the Ecliptic, beginning at the firſt point of *Aries*; and if the Sun, or any celeſtial object, be in any particular ſign, degree, and minute, as if in 24 degrees, 35 minutes, and 49 ſeconds of *Leo*—we write it's Longitude thus—4ˢ 24° 35′ 49″. Obſerve the ſame rule in all other caſes, as required.

Precept 6. LATITUDE OF A STAR, OR PLANET, is an Arc of a great Circle, interſecting the Ecliptic at right angles, and paſſing through the Poles thereof; that on the North ſide of the Ecliptic is called North Latitude, and the other ſide South.

Precept 7. AZIMUTHS are Vertical Circles, paſſing through the Zenith and Nadir, interſecting the Horizon at right Angles, and counted from the South, and North, towards the Eaſt and Weſt, or it is an Arc of the Horizon, intercepted between the North, or South Points, and the place where any celeſtial body riſes or ſets.

Precept 8. AMPLITUDE OF THE SUN, OR A STAR, is an Arc of the Horizon, intercepted between the Eaſt or Weſt Points, and that Point where the object riſes or ſets; and note! you will find the degrees of the Azimuths, and Amplitudes on the Horizon of the Index to the *Planiſphere*; the degree of Amplitude at riſing, is called Amplitude Ortive, and Occaſive at ſetting, which muſt be denominated, whether it be North, or South.

Precept 9. COSMICAL RISING, or SETTING, is when a Star or Planet riſes or ſets when the Sun doth.

Precept 10. ACHRONICAL RISING, and SETTING, is when a Star, or other object riſes, when the Sun ſets, or ſets when the Sun riſes.

Precept 11. CIRCLES OF PERPETUAL APPARITION,

and PERPETUAL OCCULTATION, are different parts, or portions of the celeſtial ſphere in all the different Latitudes upon this Globe; and in this parallel, the Circle of Perpetual Apparition is all that part of the celeſtial ſphere round the North Pole, that never ſets below the Horizon, being from the parallel of 38° 28′ declination Northward, and is always equal to the compliment of the Latitude; all the Stars within this Parallel revolve round and round the Pole, but never diſappear, nor deſcend lower than the Northern part of the Horizon, and theſe are ſometimes called Circum-Polar Stars, and you will ſee them, with their names in the *Planiſphere*, by turning the Index round about;—by the ſame cauſe, the Circles of Perpetual Occultation, is, all thoſe Stars, near, and round the South Pole, which never riſe above the Southern part of our Horizon, from 38° 28′ Declination Southward, to the South Pole.

But, this ſubject will be better illuſtrated, and rendered apparent, by the ſolution of the following Problems with the *Planiſphere*.

Problem 1. The day of the month, and hour of the day given, to rectify the *Planiſphere* for uſe, ſuppoſe July 5th, at 4 hours, 36 minutes, P. M.?

Find the day of the month in the outermoſt circle, and bring the hour and minute on the index thereto, and it is done. This Problem is very ſhort, and ſolved in an inſtant; but its effects are very extenſive and

great; for it preſents to our view the true and perfect ſituation of the celeſtial ſphere, together with all the Stars, and other celeſtial bodies, in their true poſitions with reſpect to each other, and to the Horizon, and Meridian, and all the other Circles of the Spheres: this effect cannot fail to delight and gratify every beholder, who will make their various uſes of it accordingly, and by continuing to turn the Index by a good regulated clock, or watch, as often as we chuſe to take an obſervation, we ſhall moſt beautifully diſcern and comprehend the diurnal rotation of the Earth upon its axis, from Weſt to Eaſt, cauſing the apparent diurnal motion of the Heavens from Eaſt to Weſt.

Problem 2. To find the Sun's place in the Ecliptic, ſuppoſe on Auguſt 14th, and November 29th, at noon. Turn the director to the days propoſed, and you will find it points to 22° of *Leo* on Auguſt 14th, and 7° of *Sagittary* on November 29th, for anſwer.

Problem 3. To find the Sun's Declination on June 4th, and December 1ſt. Find the Sun's place by the ſecond Problem, for each day, and bring theſe points of the Ecliptic to the Meridian of the Index North, and it gives 22° 30′ North, on June 4th, and 21° 40′ South, on December 1ſt.

Problem 4. To find the Sun's right Aſcenſion in time, and degrees, on April 9th, and on September 2d. Lay the director to each day, and it interſects the Sun's place in the Ecliptic, and his right Aſcenſion in the

Equinoctial 18°, or, 1 hour, 12 minutes in time, on April 9th—and 161° 30′, or 10 hours, 46 minutes, in time, on September 2d.

Problem 5. To find the Declination, and right Aſcenſion of the fixed Stars, ſuppoſe *Cor-Scorpio*, and the *Virgin Spike*, and *Cor Leo*—Bring each ſtar to the Meridian of the Index, North, and it gives the right Aſcenſion of *Cor-Scorpio* 244° 20′, or 16 hours, 17 minutes, 20 ſeconds, in time, with 26° South Declination.—Obſerve the ſame rule with all the other Stars.

Problem 6. To find the Right Aſcenſion and Declination of the Moon, or a Planet, depends on two caſes, thus—Seek the Planet's Longitude and Latitude in the Nautical Ephemeris, for the time given.—So, Auguſt 7th, at noon, the Moon's Longitude is 22° 39′ of *Scorpio*, or 7 ſigns, 22° 39′, with 4° 57′ South Latitude; then find this Point in the Zodiac on the *Planiſphere*, and take the Right Aſcenſion and Declination of it, as in the laſt Problem by the Stars, and you will find the Moon's Right Aſcenſion 261° 40′, or 17 hours, 27 minutes in time, and 27° 45′ South Declination, as was required.

Problem 7. To find the Sun's Oblique Aſcenſion and Aſcenſional Difference on April 14th. Find his place in the Ecliptic 25° of *Aries*, bring it to the eaſtern Horizon, and you will ſee 11° of the Equinoctial riſe with it, which is the Oblique Aſcenſion required; then find the Sun's Right Aſcenſion as before, 23° 40′ and ſub-

tract the Oblique Aſcenſion from it, and it leaves 12° 40′, which is the Aſcenſional Difference required.—Obſerve the ſame rule with the Moon, Planet, or any Star.

Problem 8. To find the time of Sun-riſing, and length of the day and night, on February 4th and Auguſt 9th. Bring the Sun's place to the Horizon, Eaſtward, and lay the director through it into the Hour Circle, and it points to 25 minutes paſt 7. For riſing on February 4th, ſubtract this from 12 hours, and the remainder is the Sun's Semi-diurnal Arc, 4 hours, 35 minutes, which doubled, is 9 hours, 10 minutes, for the length of the day; but ſubtract this 9 hours, 10 minutes, from 24 hours, and the remainder is the Nocturnal Arc, or the length of the night, 14 hours, 50 minutes, as required; but, on Auguſt 9th, the Sun riſes 25 minutes before 5; therefore, the Semi-diurnal Arc is 7 hours, 25 minutes, which doubled, makes 14 hours, 50 minutes, for the length of the day, which, ſubtracted from 24 hours, leaves 9 hours, 10 minutes, for the length of the night required.

Problem 9. To find the length of the longeſt and ſhorteſt days at London. Bring the firſt point of *Cancer* to the eaſtern Horizon, lay the director through it, and it points to 3 hours, 47 minutes, A. M. or 13 minutes before 4 in the morning, ſubtract this from 12 hours, and it leaves 8 hours, 13 minutes for the Semi-diurnal Arc, which doubled, gives 16 hours, 26 minutes for the length of the day; but, ſubtract this

from 24 hours, and it leaves 7 hours, 34 minutes for the ſhorteſt night under *Cancer*; by the ſame rule, you will find this 7 hours, 34 minutes, to be the length of the day under *Capricorn*, and the 16 hours, 26 minutes, the length of the night as was ſought.

Problem 10. To find the Meridional Altitude of the Sun on the 3d of October. Bring the Sun's place for that day, found by Problem 2d. to the Meridian, viz. 10° of *Libra*, and you will find 34° 40′ Altitude, by the ſcale of Meridional Altitude, as required.

Problem 11. To find the Meridional Altitude of the fixed Stars, *Fomahaut* and *Lyra*. Bring them reſpectively to the Meridian, and you will find *Fomahaut* hath 7° 39′ Altitude, and *Lyra* 77° 4′, and *Canis Minor* hath 44° 37′ Meridional Altitude.

Problem 12. What is the Zenith diſtance of the Sun on May 13th, at noon? Find the Sun's place 22° of *Taurus*, bring it to the Meridian, and it hath 56° 30′ Meridional Altitude; ſubtract this from 90°, and the remainder 33° 30′, is the Zenith diſtance required.

Problem 13. To find the Sun's Amplitude at riſing, on the 15th of February. Bring the Sun's place 10° 27° to the Eaſtern part of the Horizon, and you will ſee it interſect the Amplitude of 21° towards the South, the ſame with any Star or Planet.

Problem 14. To find the Right Aſcenſion and Decli-

nation of any Point in the Ecliptic; ſuppoſe 20° of *Leo*. Bring that Point to the Meridian, and it hath 142° Right Aſcenſion, and 14° North Declination.

Problem 15. To find what Point of the Ecliptic doth riſe, culminate, and ſet, at any day, hour, and minute propoſed; as September 4th, 3 hours, 42 minutes, P. M.—*Rule*.—Bring the day of the month to the hour and minute given, and you will find 5° of *Capricorn* riſing, and 11° of *Scorpio* tranſiting the Meridian, Southward; and, of courſe, 5° of *Cancer* ſetting, and 11° of *Taurus* on the Meridian, North.

Problem 16. May 24th, in the morning, the Sun was obſerved due Eaſt; What is his Altitude, and the Hour of the Day?——Find the Sun's place, 2ˢ 3°. Bring it to the Prime Vertical, Eaſtward; lay the director through it into the Hour-Circle, and it ſhews the Time of the Morning to be 16ᵐ paſt 7, with 27° of Altitude, as was required.

Problem 17. To find the Diurnal Arc of any Star, or Planet, ſuppoſe the Virgin's Spike, (being the Star to the eaſtern Horizon). Lay the director through it into the Hour-Circle, and it points to 5 minutes before 7, which is 5 hours, 5 minutes, A. M. this is its Semi diurnal Arc, which, doubled, makes 10 hours, 10 minutes, for the Diurnal Arc, or time of this Star's duration above our Horizon; which, ſubtracted from 24 hours, leaves 13 hours, 50 minutes, for the Nocturnal Arc, or time of its ſtay below our

Horizon. Mind the ſame rule with all the fixed Stars, (but the Moon), and the ſwifteſt of the Planets will require a reduction in their places in this Problem.

Problem 18. To find at what hour a Star riſes on any day, ſuppoſe Oct. 14th. What time doth the *Bull's Eye* riſe?——Bring the Star to the Horizon, and ſee what hour and minute points to the day propoſed, and it is found to be 12 minutes before Eight at night, and ſets 12 minutes before Ten in the morning.

Problem 19. To learn to know the Stars by ſight, at any hour, by the help of the *Planiſphere*. Suppoſe July 20th. at 10h &c. P. M. you are out of doors, and rectify the *Planiſphere* to that hour; then ſuppoſe yourſelf to ſtand under that part of the heavens where is marked the Zenith of London in the *Planiſphere*, and you will ſee the *Dragon's Head* in the Vertex, *Lyra* South by Eaſt, the Stars of *Pegaſus* nearly Eaſt, with from ten to twenty degrees of Altitude, the *Great Bear* Weſt North Weſt; *Arcturus* Weſt South Weſt; the *Virgin's Spike* nearly ſetting Weſt-South-Weſt; *Cor-Scorpio* South-South-Weſt; *Atair in the Eagle* South-South-Eaſt; *Perſeus* and *Capella* near the northern Horizon; and you may ſee the names of the reſt in the *Planiſphere*, that are then above the Horizon; and by varying the time of the year in your obſervation, you will eaſily ſee, and learn the names of them all.—This is a uſeful Problem, and ſhould often be repeated.

Problem 20. To find the time of night. Being out from home, on January 20, I ſaw the great Dog Star, *Sirius*, on the ſouthern Meridian, by a quadrant, or compaſs, then bring the Star to the meridian of the *Planisphere*, and lay the director to the day of the month, and it points to half paſt 10 at night, as was ſought.

Problem. 21. To find the time of night on the 15th of May. Being out from home, I obſerve the Star *Atair*, due Eaſt, with 11° Altitude.—What is the hour?—Bring the Star to the Prime Vertical, Eaſt, and turn the director to the day of the month, and it points to the hour, 20 minutes before 11 o'clock at night, which is the time required.

Problem 22. Auguſt 1ſt. being out, I obſerved the Sun was due Weſt by the compaſs—What is the hour?—Find the Sun's Place, and bring it to the Prime Vertical, Weſt; then lay the director through it, and it ſhows the time to be 4 minutes before 5, in the afternoon, as was ſought.

Problem 23. What time of day or night, will *Cor Leo* appear due Eaſt on October 9th? Bring the Star to the Prime Vertical, Eaſtward; lay the director to the day of the month, and it ſhows the time to be 20 minutes before 4, in the morning, for anſwer.

Note! That if, on the contrary of this Problem, the hour be given, then the *Planisphere* will diſcover

what point the Star is upon: *Example*, obſerving the Stars in the *Great Dog's* hind part, above the Horizon, and having no compaſs, I refer to my watch, and find it 3 in the morning of the 15th of October, then rectify the *Planiſphere* to the day and hour, and we find the Star in the *Dog's* flank, South-Eaſt by South, and that in the tail a quarter Eaſt; *Aldebaran* is on the Meridian, and the large Star in the *Lion's* tail, juſt riſing on the Eaſt-North-Eaſt; thus, the points are gained by the *Planiſphere*, without any other inſtrument, not only by land, but on the ſea, between London and Holland, or in the Iriſh ſea, or the Weſtern Ocean to Newfoundland, or any other part, in or near this parallel, with uſeful and pleaſing effects both to the landſman and mariner.

Problem 24. To find when the Sun riſes or ſets coſmically with any Star, ſuppoſe the Great Dog, *Sirius*. Bring the center of the Star to the eaſtern Horizon; lay the director through the interſection of the Horizon and the Ecliptic, and it points out the 11th of Auguſt for the day required; but to know when they ſet coſmically, or together, bring the Star to the weſtern Horizon, and the director through the interſection of the Ecliptic and the weſtern Horizon, and it points out the 15th of May to be the day ſought.

Problem 25. To find when the Sun riſes or ſets achronically, ſuppoſe with the right ſhoulder of *Orion*. Bring the Star to the weſtern Horizon, and lay the di-

rector through the interſection of the Ecliptic and the eaſtern Horizon, and it points to the 28th of November, for the day of Achronical riſing; but, if you bring the Star to riſe, and turn the director through the interſection of the Ecliptic and the weſtern Horizon, it points out the 8th of January to be the day on which the Sun ſets achronically with that Star.

Problem 26. To find what days of the year the Sun enters into each ſign of the Zodiac? *Rule*—Begin at *Aries*, and lay the director through it into the circle of months, and it cuts the 20th of March, when the Sun enters that ſign; then lay it through 0° of *Taurus*, and it points out the 20th of April; and ſo, whatever day is pointed to, when the director is laid through any point of the Ecliptic, that is the day in which the Sun will be in that ſign and degree.

Problem 27. To find what time of the year the *Little Dog Star* will be on the Meridian at eleven o'clock at night?—Turn the Index, till the Star is on the Meridian; then look for eleven at night, and it points to the 28th of January, for the day ſought; at which time of the year, and hour of the night, we may ſee *Procyon, Caſtor and Pollux*, tranſit the ſouthern Meridian.

Problem 28. To find a true Meridian line by the preciſe time of the Tranſit of any Star found by the *Planiſphere*, thus: Drop a perpendicular line between the eye and the Star down to any fixed object before

you on the Horizon, and a line drawn from the eye to that object is a true Meridian line.

Problem 29. To find what two days of the year, the days will be of any given length leſs than ſixteen hours, ſuppoſe 10 hours, 20 minutes long?—*Rule:* Find the Semidiurnal Arc on the index, viz. 5 hours, 10 minutes, both Eaſt and Weſt; lay the director to theſe hours and minutes, on both ſides of the Meridian alternately; then turn the director and the Horizon together, till ſome point in the Ecliptic interſects them both, and the director will then lay over the day of the month required, viz. the 22d of February, and October 19, for anſwer. Again, what two days will be 13 hours, 30 minutes long each? Turn the director to 45 minutes after ſix Weſtward, and move it and the the Horizon together, till ſome point in the Ecliptic exactly interſects them both, and it points out September 1ſt. for one of the days; and, when brought to 15 minutes paſt 5, in the morning hours, or Eaſtern ſide of the Meridian, the director points out April 10th. for the other.

Problem 30. To find what two days in the year the Sun will have 50° Meridian Altitude at London? Turn the Meridian of the Index on each ſide of the Tropic of *Cancer*, till ſome point of the Ecliptic interſects it in the given Altitude, and in one caſe it points out Auguſt 23d. and in the other, April 21ſt. for anſwer.

Problem 31. To find the Longitude and Latitude of

the Moon, Planets, or fixed Stars, refer to the 5th and 6th Precepts for a Rule. *Example:* Required to find the Moon's place in the Zodiac, on Auguſt 9th at noon? Look in the Nautical, or any good Ephemeris, for the Moon's Longitude, and we find it 8ˢ 19° 32′, ſeek this place in the Ecliptic of the *Planiſphere*, viz. 19° of *Sagittary*, but this is not her true place, for if you look in the next column in the Ephemeris, to the right hand, you find 5° 12′ South Latitude; then bring the Longitude to the Scale of Declination, and with the compaſſes take 5°. 12′. Southward from this point, and ſet it off at right angles with the Ecliptic, with one foot in the Moon's Longitude, and the other will ſtand in the Moon's true place in the Zodiac; but if ſhe had had North Latitude, then you muſt have taken the Latitude Northward on the Scale, and projected that diſtance on the North ſide of the Ecliptic, and that would be the Moon's true place in the Zodiac, where, if you make a point with a pencil, you may take the right Aſcenſion, or Declination of the Moon, or a Planet at that time—the reaſon why the Scale of Declination will ſolve this Problem of celeſtial Latitude, is, the Radius of the Equinoctial and the Ecliptic being ſimilar, and both on a tangent ſcale, the error, if any, is wholly imperceptible; and note! if the place of the Moon, or a Planet be required for any certain number of hours after noon, a reduction muſt be made in their Longitude and Latitude for that hour, and that Arc added to the place at noon, (if it be the Moon, or a Planet direct in motion), and that point ſought in the Zodiac as before directed.

Problem 32. There are many ſecret ways by which Aſtronomers may date their letters to each other, ſome of them as follow. ☉ ♍ 5° 51′—if you receive a letter from your friend in the country thus dated, you look in the Nautical Almanac, and correct the Sun's motion the day in which it is in that ſign and degree, and find it was on the 29th of Auguſt, at midnight, in which he wrote it.—Again, ♄ 13° 10′ ♍—This anſwers to September 22, at ſix in the afternoon—Again, the *Dragon's Head* in ♓ 8° 8′, this will direct you to the 7th November, at noon—or, ☽ ♎ 2° 17′—☿ 8ˢ 2° 12′ this can be no other time than Decem. 10th, at noon; and many other ways you may invent from theſe examples, according to your fancy.

Problem 33. To find the Jewiſh hours by the *Planiſphere*, viz. they divide the day, and night, be it long or ſhort, into twelve equal parts, from Sun-riſing to Sun ſetting, for the day, and from Sun-ſetting to its riſing for the night; thus, in the Equinoctial, the Jewiſh hours, and the common hours are alike in length, viz. 60 minutes; but, it is evident, when the Sun is in *Cancer*, the twelfth part of the day will be more than 60 minutes, and the night hours leſs, and they continually vary between the Tropics: thus, ſuppoſe at London the longeſt day is 16 hours, 26 minutes—multiply this by 60, and divide the product 986^m by 12, and the quotient is $82^m\frac{1}{12}$ for the length of a Jewiſh hour by day under *Cancer*, and this is the length of the night hours under *Capricorn*; by this rule, we find a night hour under *Cancer* is 37 minutes,

which is the length of a day hour under *Capricorn*; but, to find the length of these hours at all times of the year by night and day, by the *Planisphere*, do thus: suppose, for *Example*, on the first of August, at 10 hours, 12 minutes in the forenoon; I wish to know the exact time of day, according to the Jews?—Take the Semi-diurnal Arc, by Problem 8, which is 7 hours, 37 minutes, multiply this by 60, and divide the product, 457 minutes by 6, and the quotient is $76^{m}\frac{1}{2}$, for the length of a Jewish hour that day; then rectify the *Planisphere* to the hour and minute given, 10 hours, 12 minutes, A. M. and steady it there; then bring the director to the time of Sun-rising before found, 23 minutes past 4, and carry it warily over 76 minutes, or 1 hour, 16 minutes, and it will then lay over 21 minutes before 6, and call this the first Jewish hour; then move it on 1 hour, 16 minutes more, to 5 minutes before 7, and call it the second hour; then to 11 minutes after 8, and it ends the 3d hour; then proceed to 27 minutes past 9, for the 4th hour; so now, as the director lays, you will plainly see there is not another whole hour, before you come to our 12 minutes past 10; so count the odd minutes, till the director comes in a straight line with the 1st of August, the hour and minute given, and the Sun's place, and you find 45 minutes towards the 5th Jewish hour, with 31 minutes to come to finish that hour: by this rule, you will come at the true Chronological time mostly made use of in the Scriptures, and may reduce it, by this last Problem, to our time of the day; so we find, at the Crucifixion of our Saviour, there was darkness

from the 6th hour until the 9th hour; now, by this Problem, we learn, that the 6th hour ended at the Semidiurnal Arc, or when the Sun was on the Meridian at noon; and the 9th hour was a few minutes after 3, by an equal Hour Clock; inasmuch as it was near the Vernal Equinox. But, the Arithmetical way to find the Jewish hour and minute, is thus—find how many of our hours and minutes the day consists of; then say, as these hours and minutes are to 12 hours, so is the hours and minutes since Sun-rising, to a fourth proportional, the Judaical hour required; but observe, the time gained as above, is only that shewed by a clock or watch that goes equal hours at the place where the occurrence happened; but to find the real time of day at another place, (suppose London), we must find the difference of Longitude of the two places, and turn it into time, at the rate of 15° per hour; so, Jerusalem, being 35° 20′ East of London, or $2^h\ 21^m\ 20^s$ in time earlier, this must be subtracted from the time given by their equal hour clock, and the remainder will be the time at London, as though their ninth hour, at that time of the year, ended at 8^m after 3 in the afternoon, subtract $2^h\ 21^m\ 20^s$ from $3^h\ 8^m$, and the remainder is $46^m\ 40^s$ after 12 at noon at London.

Problem 34. To find the Horary Angle, or the apparent time from noon by a single Altitude of the Sun; for which purpose, Mr. Syed's Patent Quadrant is the best instrument by land, as well as by sea, it having an artificial Horizon, which the common Hadley's Quadrants have not; but if one should have a Collins's, or

a Sutton's Quadrant in hand, it will do in this caſe; but, if neither are in your poſſeſſion, then the *Planiſphere* will be ſufficient for this work. Thus, hang a ſmall plummet by a fine hair to the center-pin, then ſtick a fine pin in the morning hour line of 6, and another in the ſame line near the center, both perpendicular to the Plane, then hold the *Planiſphere* up with the Southern 12 to the Vertex, and the Eaſt ſide next the Sun, and elevate the index, till the ſhadow of the outermoſt pin falls on the other, and then the hair will ſhow the Altitude on the lower limb of the index, counting each diviſion for a degree from the Northern 12 to the right hand.—Thus, for *Example*, on Auguſt the 13th, 1802, I find the Sun's Altitude in the forenoon 43°. Required the Horary Angle, or apparent time from noon? Take the Secant of the Latitude rejecting the index, - 51° 31′ — 0,20601

And the Secant of the Declination, - 14° 53′ — 0,01482

Subtract the Declination from the Latitude, and the difference is, - - 36° 38′

To which add the Complement of the Altitude, - 47°

And it makes - 83° 38′

And their difference is, - 10° 22′

Then take the half of - 83° 38′

Which is, - - 41° 49′ = ſine, 9,82396

And take half the difference, 5° 11′ = ſine, 8,95590

Now add the Secants of the Latitude and the Declination to theſe two ſines all into one ſum, which makes - - 19,00069
The half of which will be, - 9,50034
Which is the ſine of — 18° 27′
Which double, or multiply it by 2, and the product is, 36° 54′
Which, convert into time, at 15° per hour, and it gives 2h 27m 36s
Which is the Horary Angle, or the time the Sun wants of being on the Meridian—or it is 32m 24s paſt 9 o'clock in the morning, for anſwer. And note! the beſt tables for theſe and the Lunar Obſervations, are the Requiſite tables; yet, if they are not at hand, any tables of artificial Sines, Tangent, and Secants will do to ſolve this laſt Problem; but to illuſtrate this Problem ſtill more, and render it perfect in its uſe, both to ſeamen, and others who have no Quadrant, I will ſhew how to take an Altitude by the *Planiſphere* to the neareſt minute, by which the Horary Angle, or time from noon, will come out correct to a ſecond, as thus: on the director is a line called Perpendicular, divided into four equal parts—and a ſimilar line of equal parts, up to ten, on the Hour Circle of ſix, Weſtward; hang the plummet on the center, and let the hair hang over the 12, at night, and then the line of ſix is an Horizon; put a fine pin in the 2, 3, or 4, of the perpendicular lines, and bring this Scale to the Meridian, South, and form a right Angle with the line of ſix, and ſee what diviſion the ſhadow of the

pin falls on, in the horizontal line; as ſuppoſe, if the Sun is near the Horizon, you put the pin in 2, or 3, on account of the obliquity of the ſhadow; but, if the Sun hath greater altitude, then place it in 4: and ſuppoſe the ſhadow falls on 5, ſo have you a Rectangular Triangle, the Legs being formed by the Scales of equal parts, and the Sun's Rays is the Hypothenuſe; then work by this analogy, as the Log. of the length of the ſhadow, 5, ——— — 0,69897
Is to the Log. of the Perpendicular, 4, — 0,60206
So is Radius, ——— — 10,00000
To the Tangent of the Sun's Alt. 38° 39′ 9,90309
and, note! if the ſhadow falls between the diviſions, then take the proportional part of the logarithms, and work as before, as if the ſhadow falls on 5¼ parts, then take a quarter of the difference of the next leſs, and greater Arcs, and add it to the logarithm of the leſſer Arc, and work with it as in the laſt Example; by which Rule you can never err a minute, either in the altitude or the time; and you may ſafely ſet the watch thereby. This Problem is univerſal, and is of the utmoſt utility to the practical Navigator, as well as for the exerciſe and amuſement of every private ſtudent, by land.

Problem 35. To regulate and adjuſt the motions of the Planets from noon, or midnight, as found in the Nautical Almanac, to any other intermediate hour and minute of the day or night required, and conſequently to find their true places in the Zodiac, in the *Planiſphere*, and their ſituations, at all times, with reſpect to, and their progreſſive motion among the fixed

Stars, &c. their names and characters are as follow:— ☉, the *Sun*, is in the center, and ☿, *Mercury*, is nearest to the Sun of all the Planets, and performs its courſe round the Sun in about three months, or 87 days, 23 hours. ♀, *Venus*, whoſe Orb is next to *Mercury*, revolves round the Sun in 224 days, and 17 hours, or about eight months. The Planet, which is the third in order from the Sun, is our *Earth*, performing its annual orbit in 365 days, 5 hours, and 49 minutes: the next is ♂ *Mars*, which moves round his Orb in 686 days and 23 hours. Then ♃ *Jupiter*, performs his circuit in 4332 days and 12 hours, or about 12 years. Then ♄ *Saturn*, completes his revolution in 10759 days, and 7 hours, or a little leſs than 30 years. Then the Georgian Planet, whoſe Orb is exceeding remote, and motion very ſlow, as may be ſeen in the Nautical Almanac. Thoſe Planets, whoſe Orbs are beyond the Orb of the Earth, are called Superior Planets; but *Venus* and *Mercury*, whoſe Orbs are between the Earth's Orb and the Sun, are called Inferior Planets. The *Georgian*, *Saturn*, *Jupiter*, and the *Earth*, have their ſecondary Planets, or Satellites accompanying them round the Sun; and moving round them alſo, in certain periods. *Jupiter* hath four, and the *Earth* one; which is the *Moon*, revolving round it in 27 days, 7 hours, and 43 minutes, which is alſo the exact time of her rotation round her axis, ſo that ſhe always turneth the ſame ſide, or part of her Surface towards us; her Orbit is an Ellipſis, whoſe mean Radius is about 244258 miles, and whoſe Plane is inclined to the Plane

of the Ecliptic, at an Angle of 5° 18′ at the moſt; the Moon never remains in the Ecliptic, but interſects it twice in a month, in the points called her Nodes, or the Head and Tail of the Dragon; or, theſe are the points in which the Moon's Orbit biſects the Plane of the Ecliptic, and while ſhe is in that half of her Orbit, which is on the South ſide of the Ecliptic, ſhe is ſaid to have South Latitude; and the point of the Ecliptic where the Moon paſſeth out of South, into North Latitude, is called her North Node, or Head of the *Dragon*, and then ſhe hath North Latitude, till ſhe arrives at her South Node, or, to the *Dragon's* Tail. The Nodes of the other Planets, according to Geocentric Viſion, are, in thoſe points of the Ecliptic where they have no Latitude, which are ſeen in the Nautical Almanac. I need not premiſe farther, in order to this Problem.

Required the Moon's true place on Sept. 15th, 1802, at 7ʰ 24ᵐ, P. M. Find in the Nautical, or in any good Ephemeris, her Longitude at noon on the 15th, 1ˢ 10° 49′, and ſubtract it from her Longitude on the 16th, at noon, 1ˢ 24° 41′, and the difference is, 0ˢ 13° 52′; then ſay, by the rule of proportion, if 24ʰ give this Arc 0ˢ 13° 52′, what will the time from noon, 7ʰ 24ᵐ give?—Anſwer, 4° 16′, which, added to her Longitude the 15th, at noon, makes it 1ˢ 15° 5′, her true and corrected Longitude at the hour and minute required. But note! this is not the moon's true place in the Zodiac; for, againſt the 15th at noon, ſhe hath 4° 33″ North Latitude, which, ſubtract from her Latitude the

16th at noon, viz. 5° 4′, and the difference is 31′; then ſay, if 24 hours, give this Arc 31′, what will 7^{h} 24^{m} give?—Anſwer, 9′: which, as her Latitude is increaſing, muſt be added to the Latitude at noon, the 15th, 4° 33′, and it makes 4° 42′, the true Latitude ſought; then ſeek the Longitude found, 1^{s} 15° 5′, in the Ecliptic, in the *Planiſphere*, and point off the Latitude 4° 42′, at right Angles thereto Northward, as per Problem 31, for noon, and this point will be the true place of the Moon at the hour and minute required, ſituated in the Heavens, in the Angle between the *Whale's Jaw*, the *Pleiades*, and the *Ram's North Horn;* and you may now take her right Aſcenſion and Declination with the utmoſt eaſe in an inſtant, by Problems 3 and 4; and, if you rectify the *Planiſphere* for the day and hour given, you will find the Moon riſing between thoſe Stars on the Eaſt-North-Eaſt. The ſame rule muſt be uſed with all the Planets: and note! that when any Planet is direct in motion, or increaſing in Latitude, then ſuch increaſed Arcs, in any number of hours and minutes given, muſt be added to their place the preceeding noon, and the ſum is the true place at the time required; but if the Planet be retrograde, or decreaſing in Latitude, then ſuch Arcs of motion muſt be ſubtracted from their place the preceeding noon, and the remainder is the true place of the Planet required. *Example*, in the Planet *Mercury*, November 2d, 1802, at 6^{h} 30^{m}, P. M. his Longitude at noon, 7^{s} 23° 49′, and the third day at noon, 7^{s} 23° 7′, which is leſs than the ſecond day, and conſequently he is retrograde, ſubtract, and take the difference, which is 42′; then ſay,

if 24^h give 42′, what will 6^h 30^m give?—Anſwer, 11″ 20‴: ſubtract this from 7^s 23° 49′, the Longitude at noon on the ſecond day, and the remainder is, 7^s 23° 37′ 40″, the true Longitude of *Mercury* at the time required; then for the Latitude of the Planet, obſerve, on the firſt day it is 2° 16′ South; and on the ſeventh day, 0° 38′ South, and of courſe decreaſing: ſubtract, and the difference is 1° 38′: then ſay, if ſix days give 1° 38′, what will 1 day, 6^h 30^m give?—Anſwer, 20′ 21′, to be ſubtracted from the Latitude on the firſt day, 2° 16′, and it leaves 1° 55′ 39″ for the true South Latitude of the Planet at the day and hour propoſed; ſeek theſe points in Longitude and Latitude in the *Zodiac* of the *Planiſphere*, and that is the true and corrected place of *Mercury* for the time required, viz. in 7^s 23° 37′ 40″, and between the Stars in the Scales, and the Claws of the *Scorpion*, and you may take the right Aſcenſion and Declination of the Planet at the time, as before taught; by this rule, we have the ſituation of all the Planets among the Stars at any time required, and by which, any perſon may learn to diſtinguiſh, and know them by ſight from the fixed Stars, and to trace their progreſſive motions continually.

FINIS.

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