The description and use of the sphaere devided into three principal parts: whereof the first intreateth especially of the circles of the uppermost moveable sphaere ... the second sheweth the plentifull use of the uppermost sphaere, and of the circles thereof joyntly : the third conteyneth the description of the orbes whereof the sphaeres of the sunne and moone have beene supposed to be made, with their motions and uses / [Edward Wright].


WRIGHT'S DESCRIPTION & USE OF THE SPHÆRE

Scarce 10/6

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THE DESCRIPTION and vse of the Sphære

Deuided into three principal Partes:

WHEREOF

The first intreateth especially of the circles of the vppermost moueable Sphære, and of the manifould vses of euery one of them seuerally.

The second sheweth the plentifull Vse of the vppermost Sphære, and of the circles therof ioyntly:

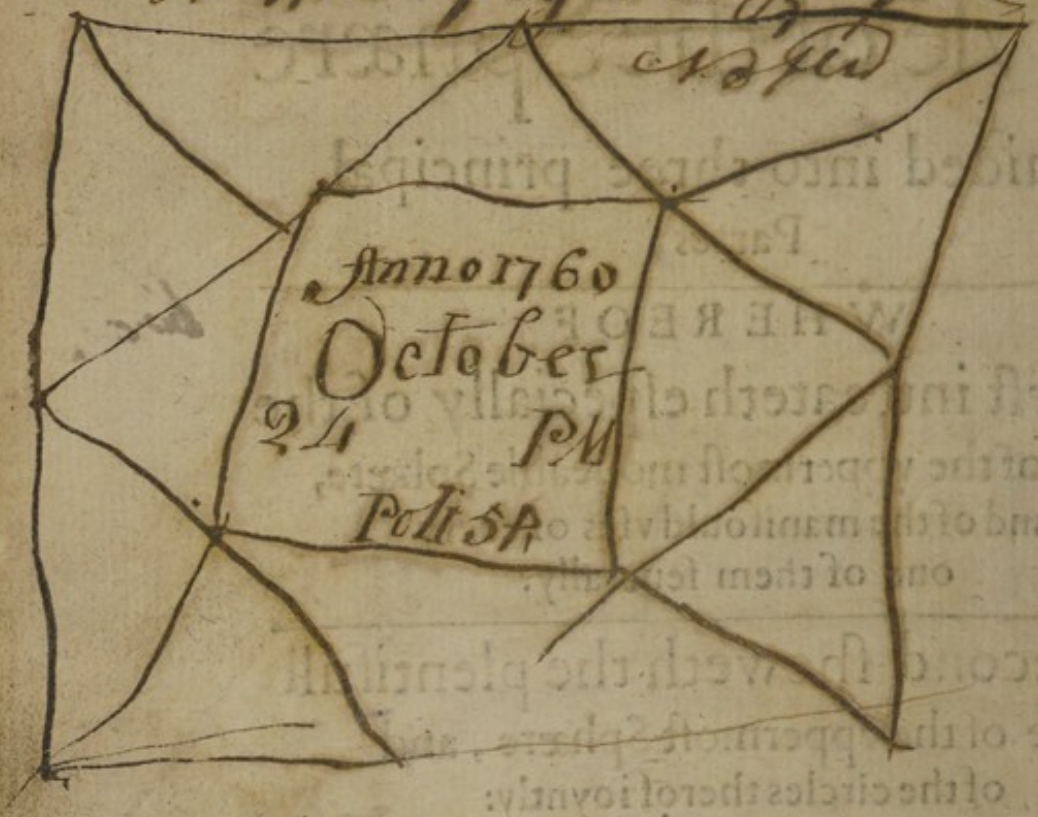
The third conteyneth the Description of the Orbes whereof the Sphæres of the sunne and moone haue beene supposed to be made, with their motions and vses.

By EDWARD WRIGHT.

The contents of each Part are more particularly set downe in the Table.

LONDON
Printed for *Iohn Tap*; dwelling at S. Magnus corner. 1613.

Astrological Judgment
on the Figure Before



A TABLE,
Of the contents of this booke.

The first Part.

Of the circles of the vppermost Sphære and their seuerall vses.

The

A TABLE.

The second part.

Of the vses of the vppermost Sphære, and of the circles thereof ioyntly.

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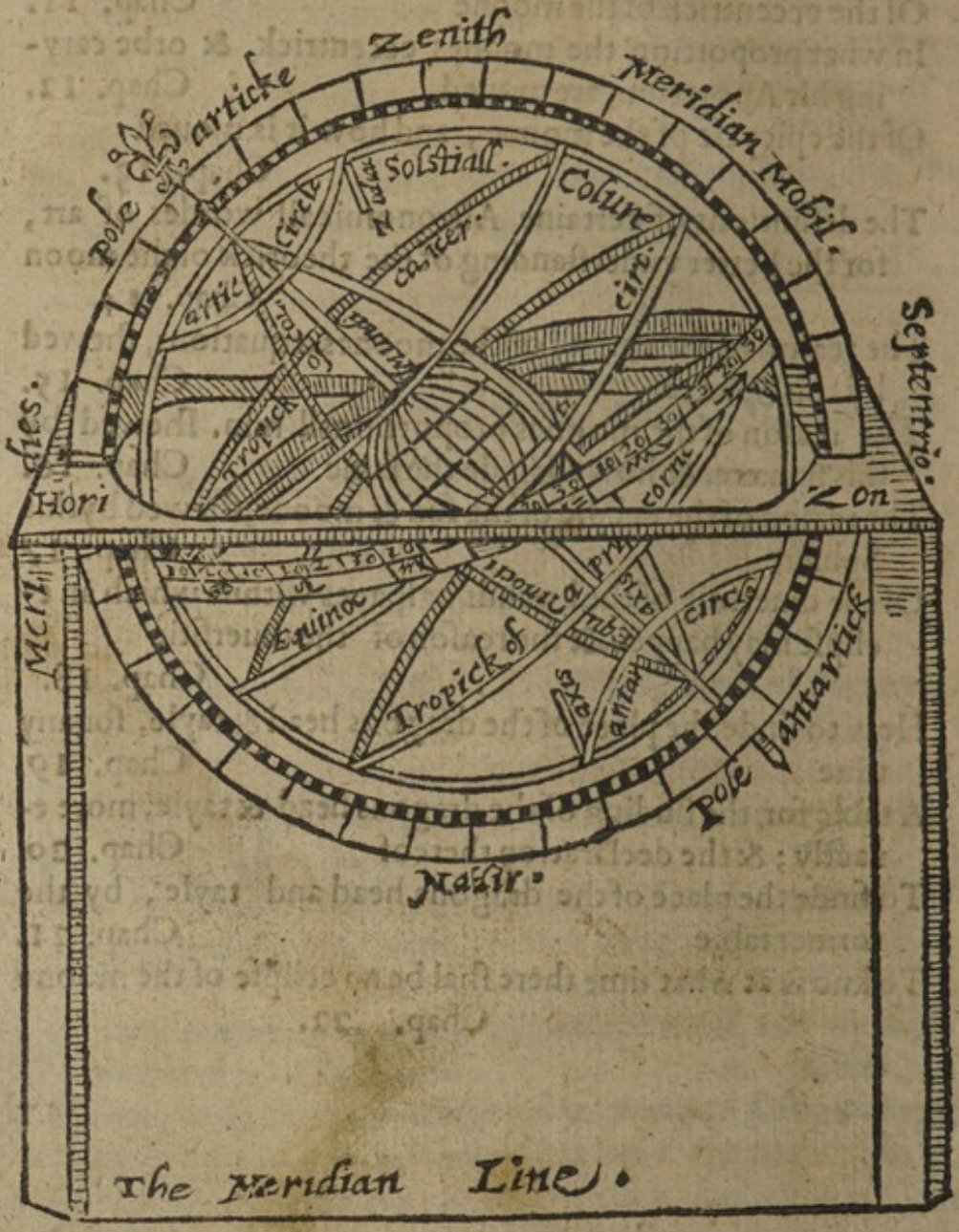
The third Part.

Of the Orbes wherof the Sphæres of the sunne and moone haue beene imagined to be made, and of their motions and vses.

Of

A TABLE



The Meridian Line.

Of the vse of the Sphære and Globe. *Part* 1.

The Description of the SPHÆRE and GLOBE, Divided into three principall parts.

Wherof this first intreateth specially of the circles of the vppermost moueable Sphære and of theyr peculiar vses.

The definition & diuision of this Sphære.

CHAP. I.

THis SPHÆRE, is nothing else but a representation of the Cœlestiall orbes and circles, that haue bene imagined for the easier vnderstanding, expressing, & counting of the motions and apparences, eyther common to the whole heauens, or proper to the Sunne and Moone.

The circles of this Sphære are eyther immoueable, as the two greatest and vtmost circles, the Horizon and Meridian, (whereto is adioyned the lit-

tle howre circle that is fixed to the Meridian) or els moueable; as all the reſt conteyned within theſe.

The Deſcription of the Horizon of this Sphære.

Chap. 2.

THE greateſt and vtmoſt circle of this ſphære that lyeth leuell on all ſides from the ground, is called the Horizon, which is deuided into 7. limbs, or borders. The firſt and vtmoſt of them conteyneth the 32. points of the compaſſe, or the windes (as they are at this day deuided and vſed by ſea-men) with their latine names adioyned vnto them. The ſecond limb conteyneth the names & diuiſions of the 12. windes as they were wont to bee deuided in ould time. The third is deuided into the moneths and dayes of the new Kalendar, firſt eſtabliſhed by Pope Gregory the XIII. & now vſed in many places beyond the ſeas. In the fourth limbe are ſet downe the moneths and dayes of the ordinarie Kalendar vſed in England. Next within this, are placed the 12. ſignes & degrees of the Zodiack, that ſo the place of the Sunne might be preſently knowne for any day of the yeare giuen, or contrariwiſe that the day of the moneth might be readily found by the place of the Sunne. After this, followeth the ſixt limb conteyning the 32. windes or points of the compaſſe, with letters repreſenting the names now in vſe amongſt Engliſh mariners. The ſeauenth & laſt limb next the innermoſt edge of the Horizon, is deuided into 360. degrees, with figures ſet to euery tenth degree, beginning from the points of eaſt and weſt, & ending at north

and

and south, that so the number of any degree of the Horizon might be the easelier knowne: Which circle appeareth most playnly to them that are in a playne Champion countrie, or vpon the sea, close by the water in a cleare calme day.

The vses of the Horizon.

Chap. 3.

1. IT deuideth the vpper and visible part of the heauens from the nether halfe that is hidden out of our sight.

2. It sheweth partly the difference of a right & oblique Sphære, for when this circle and the æquinoctial, crosse each other at right angles, it is said to be a right Sphære; otherwise when they make oblique angles one with another, it is called an oblique Sphære.

3. In an oblique Sphære this circle seuereth those starres which neuer rise nor sett, but are alwayes eyther aboue or beneath the Horizon, from such starres as rise and set in euery 24 howres. For all the northerly starres that are no further distant from the north pole then the north pole is from the Horizon, do neuer set, but are alwayes aboue the Horizon: And contrariwise, those starres that be about the south pole, no further distant from it then it is from the Horizon, do neuer rise, but are alwayes hidden out of sight vnder the Horizon.

4. In respect of this circle, the Sunne, Moone & starres, or any other part or point of the heauens, are sayd to rise or set: For when they come vp from vnder the Horizon, they are said to rise; otherwise

when they goe from aboue the Horizon downe vnderneath the same, they are sayd to sett.

5. And hereof it commeth that the ascendent, & descendent are found by this circle: for that part of the ecliptick that is at the east part of the Horizon arising, is the Ascendent; & the point opposite to this at the West part of the Horizon, may be called the Descendent.

6. This circle partly sheweth the difference of ascension of any part or point of the heauens.

7. In this circle we reckon how farre the Sunne, the Moone, or any starre, or point of heauen, ariseth from the point of due East.

8. The horizon determineth the time of the artificiall day & night: for we call the time wherin the Sun abideth aboue the Horizon, an artificiall day: And the time that he continueth vnder the Horizon, is the artificiall night.

9. This circle sheweth the reason of the æqualitie of artificiall dayes and nights, in a right Sphære: and of the inæqualitie of them in an oblique Sphære. For in a right Sphære, the Horizon deuideth all the paralels of the Sunne or circles of the naturall dayes, into æquall parts: But in an oblique Sphære, it deuideth them into vnæquall parts.

10. By meanes of this circle, we knowe what starres, and what eclipses, coniunctions, or other aspects of the planets may be seene in our hemisphære at any time.

11. From the horizon is measured the twilight: For in the morning the sunne being vnder the horizon about 18. degrees of the vertical circle, the twilight

twilight beginneth: And when the sunne is so much vnder the horizon at ẽuening, the twilight endeth.

12. This circle is of especiall vse in Geography, for from it we beginne to account the eleuation of the pole, and of the æquinoctiall circle, whereby the latitude of any place is knowne.

13. In Astrologie for erecting a figure, this circle sheweth the beginning of the first and seauenth houses.

The description of the Meridian of this Sphære.

Chap. 4.

NExt the horizon, succeeds the Meridian standing vpright on edge, & crossing the horizon at right angles in the points of North and south. This circle is deuided on both sides at the inner edg into 360. degrees, with figures set to euery tenth degree, beginning at the æquinoctiall, & ending at the poles with 90. and beginning also at the poles, & ending at the æquinoctial with 90. The numbers beginning at the pole, serue to set the sphære readily to any eleuation desired. The other numbers beginning at the æquinoctiall, shew presently the declination of any degree of the zodiack, or of any point assigned in the sphære, One quarter of the Meridian on eyther side thereof from the æquinoctiall to both poles, sheweth the climates, and the quantities of the longest dayes.

The vses of the Meridian.

Chap. 5.

1. IT deuideth the world into two halfes or hemiſphæres: that is, the Eaſt and the Weſt hemiſphæres. The eaſterly hemiſphære is all that part of the worlde which is on the Eaſt ſide of the Meridian, And the other halfe may be called the Weſt hemiſphære.

2. It ſheweth the North and ſouth parts of the worlde, for the two interſections of the Meridian with the horizon, ſhew the very points of North & ſouth. The ſouth point is that which is directly vnder the Sunne at noone: And the point right ouer againſt this, is called the North point.

3. It deuideth the arches of the æquinoctial, & of al his paralels, into two æquall parts both aboue and beneath the horizon.

4. And therefore it deuideth the artificial day and night into two æquall parts.

5. And conſequently, it ſheweth midday & midnight.

6. In an oblique ſphære it ſerueth in ſtead of a right horizon (that is) an horizon that maketh right angles with the æquinoctiall.

7. Therefore the Aſtronomers beginne their account of times (which are meaſured by the æqual motion of the æquinoctial) from the Meridian: the principal of which times, is the naturall day which is vſually begunne from midday, or midnight.

8. This circle ſheweth the higheſt and loweſt heights

heights of the sunne and starres, which is most manifest in those starres that are alwayes aboue the horizon. These heights are called the Meridian altitudes of the sunne or stars, which heights are chiefely obserued by Astronomers and Nauigators with great diligence.

9. In this circle, we obserue the distance of the Tropickes, and the greatest obliquity of the Zodiack.

10. In this circle, we obserue and count the latitudes of places, the height of the pole, & of the æquinoctial. For the height of the pole or æquinoctial, is nothing els but the arch of the Meridian conteyned betweene the pole or æquinoctial and the horizon. The height of the pole is alwayes æqual to the latitude of the place. The height of the æquinoctial is æqual to the complement of the latitude, and therfore it being substracted out of 90. there shall remayne the height of the pole.

11. The Meridian sheweth the longitudes of places in Geographie.

12. In the Meridian, are measured the bredth of the zones and Climats.

13. This circle in Astrologie, sheweth the highest & lowest parts of heauen, which are the beginings of two principal howses: that is, the fourth and the tenth howses.

The description of the howre circle, and poles, of this Sphære.

Chap. 6.

THE little circle fastned to the Meridian, is called the howre circle, which is deuided into 24. æqual parts, signifiyng and representing vnto vs so many æqual howrs, wherof both the twelfth howrs are fixed iust vpon the Meridian, because when the sunne commeth to the meridian, it is iust twelue a clock: the vpper XII. serueth for the day; and the other XII. beneath serueth for the night.

The index, or the pointer in forme of an arrow, fastned vpon the pinne that commeth through the midst and center of this circle, is made to shew and point out the sayd howres as neede shall require, in the vse of the sphære.

The vse of this howre circle shal be shewed hereafter when we shal speake of the common vse of many circles of the sphære togither. And these two circles (that is, the Meridian and horizon) are called immoueable, because they keep themselues alwaies, and in all places ouer the same parts of the earth; where as all the rest (conteyned within these two) moue round about al togither with one motion in the space of fowre and twentie howres.

This motion (being common to the whole heauens) is made about two points or poles, represented in this sphære, by the two wyre pinnes about which the sphære is turned; whereof the one that commeth through the middest of the little circle fastned to the meridian (which we call the howre circle)

circle) representeth vnto vs the pole arctick or the north pole: the other because it is opposite to this, is called the antarctic pole, that is the right oppositt, to, or right ouer against the north pole, which is also the south pole.

Of the Aequinoctial circle of this sphære.

Chap. 7.

THAT circle which compasseth about the midst of the sphære, and is euery where of æquall distaunce from both poles, is called the æquinoctiall circle, or the æquator; eyther because it is æqually distant from both poles of the world; or els because the sun comming vnder this circle maketh æqualitie of dayes and nights through-out the world.

Why this circle is called the æquinoctial or æquator.

It is deuided at the vtmost edge, on both sides thereof into 360. degrees, with figures set to euery tenth degree, beginning at the beginning of Aries, and proceeding eastwards, til you be come about to the same point againe.

This circle hath many vses.

1. It is the measure of the first motion. For this only amongst al the circles of the sphære is moued æqually both in a right & oblique sphære, because it alone being perpendicular to the axtree of the world, about which the sphære is æqually turned, is deuided into two halfes by euery horizon in the same points.

2. It is the measure of time; because it measureth the quantitie of the artificial & natural dayes, of which moneths and yeares are made: It measureth also the quantity of howres and of other times

which the sunne maketh going vnder the zodiack. And therefore the degrees of the æquinoctial are called *tempora* (that is) times.

3. It sheweth the two æquinoctial points in the ecliptick, cutting the ecliptick in two places, which are the beginnings of Aries and Libra: and the sunne when he commeth to those two points, is æqually distant from both poles of the world, and maketh æquality of dayes and nights in all places; which hapneth in our time about the 10. or 11. day of March, and the 13. or 14. of September.

4. The irregularity of the zodiack, and of all the signes and degrees therof, is measured by this circle. For seeing the most part of the apparences of the first motiō are referred to the zodiack, which is not turned about his owne poles, but about the poles of the sphære, and therefore must needes be vnæqually turned about; it was needful that this inæquality should be ruled and measured by some other æqual motion.

5. It deuideth the sphære into 2. halfs (which they call hemisphæres) that is into the north half or hemisphære, wherein is the north pole, and into the south hemisphære, wherein is the south pole.

6. So it deuideth the zodiack into the north half, and the south half; or into the north signes, & the south signes.

7. From this circle are numbred the declinations of the starres, and of the degrees and partes of the ecliptick, and of any other point of Heauen.

8. And in this circle are counted the right ascen-

censions of the same degrees and starres &c. For the right ascension of any starre or point of the heauens, is nothing els but the arch of the æquinoctial circle conteyned betweene the beginning of Aries and the Meridian, the same starre or point being first brought vnder the Meridian.

9. In the æquinoctiall is counted the ascentional difference and the oblique ascension & descension of any point of heauen. And from the same circle is rekoned the distance of the sunne rising from the true east point. For the oblique ascension or descension is nothing els but the arch of the æquinoctial, conteyned betweene the beginning of Aries, and that point of the æquinoctial eastwards, which ariseth or setteth together with the starre or point that is giuen, in an oblique sphære. And the difference ascensional or descensional is nought els but the arch of the æquator, whereby the right & oblique ascension or descension of a starre, or any other point in heauen do differ each from other. The distance of the sunnes rising frō the true East point (which in latine is called *amplitudo ortiua*) is the arch of the horizon conteyned betweene the æquinoctial and the parallel of the sunne, or his center when he riseth.

10. In Geographie we count the longitudes of places in this circle; and from it we reckon the latitudes, in the globe of the earth, and in maps, & sea charts. For the longitude of a place is nothing els but the arch of the æquinoctial circle conteined betweene two meridians, whereof one goeth by the Canarie Ilands, and the other by the place that is

giuen. And the latitude of a place is the arch of a meridian conteyned betweene the æquinoctial, & the zenith of the place that was giuen.

11. In dialling this cirle is of especial vse. For by meanes of it the spaces of the howres are deuided in all kindes of dialls, horizontal, erect, direct, declining, inclining, reclining, &c.

12. In Astrologie the twelue houses are set out by the æquall diuisions of this circle into twelue parts, according to the waye deuised by *Regiomontanus*, which way is commonly called rational or reasonable. And this circle gouerneth the directions, whereby things to come are artificially foretould.

The description of the zodiack of this sphære.

Chap. 8.

THe great broad circle that compasseth about the sphære obliquely, comming nearer the pole of the sphære in one place then in another, is called the zodiack.

Round about through the midst of this circle, is drawne the circumference commonly called the ecliptick line, diuiding the whole sphære, and the whole bredth of the zodiack throughout, into two æquall parts.

In this sphære there are represented vnto vs two ecliptick lines. The one may be called the middle, or fixed ecliptick, which keepeth alwayes the same distance or obliquitie from the æquinoctial. The other may be called the true or moueable ecliptick, be-

becauſe it maketh not alwayes the ſame angles of interſection with the æquator, but ſometimes greater, ſometimes leſſe. For the greateſt obliquity of the zodiack, which not long before *Ptolomees* time was obſerued to be 23. degrees and 52. min. in *Copernicus* his time, was hardly found to exceed 23. degrees 28 min. according to his obſeruation, and therefore he thought that the difference betweene the greateſt and leaſt obliquitie of the zodiack, was 24. minutes: and the middle or meane obliquitie between both theſe, to be 23. degrees 40 minutes.

The manner of the variation of this obliquitie may in ſome ſort be ſhewed by this ſphære, if we ſuppoſe the fixed ecliptick drawne round about through the midſt of the zodiack to be 23 degrees 40 minut. diſtant from the æquinoctial at the beginning of Cancer and Capricorne: and the moueable ecliptick (faſtned as it were vpon two poles at the beginning of Aries and Libra, and ſo hauing alwaies the ſame points of interſection with the middle ecliptick and æquinoctial) to be moued vp and downe aboue and beneath the middle ecliptick, by the ſpace of 12. minutes at the beginning of Cancer and Capricorne: and this motion to finiſh his reuolution once in 3432 Iulian yeares.

The bredth of the zodiack is bounded by the greateſt latitudes of the planetes, eſpecially of Venus and Mars, which ſometimes hath almoſt 7 degrees of latitude.

The zodiack is deuided by the æquinoctial into two ſemicircles.

The one aboue the æquinoctial is called the northerly ſemicircle the other half beneath the æquinoctial is the ſouthern ſemicircle of the zodiak.

So long as the ſunne moueth vnder the firſt of theſe ſemicircles, the dayes are longer then the nights, otherwiſe they are ſhorter.

Each of theſe ſemicircles is againe deuided into two parts, and ſo the whole zodiack into fowre quarters: the firſt from Aries to Cancer may be called the vernal or ſpring quarter, which in this Sphære is alſo ſhewed by the word *Ver* (ſignifiyng the ſpring:) The next from Cancer to Libra, the ſummer quarter, wherein is written the word *Aeſtas* ſignifiyng the ſummer. The 3. from Libra to Capricorne is the Harueſt quarter, wherin you ſhal finde in this ſphære the worde *Autumnus* which ſignifieth Autumne or Harueſt. The fourth and the laſt from the beginning of Capricorne to Aries is called the winter quarter, which in this ſphære is ſhewed by this worde *Hiems* which ſignifieth the winter. And theſe foure quarters of the zodiack are thus called by the names of the quarters of the yeare, becauſe the ſunne mouing vnder thoſe quarters of the zodiacke, maketh thoſe fowre quarters of the yeare. Euery one of theſe quarters of the zodiack is againe deuided into three parts, and ſo the whole compaſſe of the zodiack into 12. which are called the 12. ſignes, whereof euery one conteyneth 30. degrees in length from Weſt to Eaſt, & is in bredth æqual to the breadth of the zodiack. Theſe ſignes, &

the

the zodiack it selfhaue theyr beginning from that common meeting, or crossing of the ecliptick, and the æquinoctial, where the ecliptick beginneth to arise aboue the æquinoctial towardes the north pole: and they are called by these names; *Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagitrie, Capricorne, Aquarie, Pisces.* That is to say, The Ramme, The Bull, The Twinnes, The Crabb, the Lion, the Virgin, the Ballance, the Scorpion, the Shooter, the Goate, the Water-pourer, the Fishes. And they are signified by these characters ♈, ♉, ♊, ♋, ♌, ♍, ♎, ♏, ♐, ♑, ♒, ♓. This diuision of the zodiack into 12. signes and of euery signe into 30. degrees, nature it selfe seemeth to haue shewed by the motions of the sunne and moone. For in what time the sunne moueth once about the whole compasse of the zodiack, the moone maketh 12. reuolutions through the same. Therefore as the time of a yeare is deuided into twelue moones, so the zodiacke is deuided into twelue signes: And as euery moneth conteyneth 30. dayes, so euery signe is deuided into 30. parts, which they call degrees, which signifieth as much as steps, because the Sun steppeth, or goeth forwards almost so much as a degree in euery day, from the West Eastwards vnder the Zodiack.

The Zodiack is otherwise also deuided into two semicircles, the one (from Capricorne to Cancer) ascending, because that so long as the sunne or any of the plantes are in that semicircle, they still ascend and rise higher and higher aboue the Horizon. The other semicircle of the zodiack, from Cancer to

Ca-

Capricorne, is called descending, because the sun or planetes being in that semicircle, come downe euery day lower then other.

The twelue signes are by the Astrologians diuersely diuided, first into chiefe, meane, and common signes. The chief signes (which are also called Cardinall, that is the principal signes) are Aries, Cancer, Libra & Capricorne, because they come next after the principal points of the zodiack that is the two æquinoctiall points at the beginnings of Aries, and Libra; and the two solstitial points of Cancer and Capricorne. The meane signes (which are also called fixed) are Taurus, Leo, Scorpio, and Aquarius. They are called meane, because they are placed betweene the chiefe or principall, and the common signes. They are called fixed signes, because that when the sun is in those signes, we finde a more perfect temperature of the aire, then when he is in the other signes.

The common signes (which are also called double bodyed) are Gemini, Virgo, Sagittarie, and Pisces. They are called common, because they take part of the nature of the fixed signes going before them, & of the Cardinal signes following after thē. They are called double bodied, by reason of theyr images, as they are imagined in the eight sphære, which are compounded of two bodies: For there be two twinnes; and the virgin houldeth an eare of corne in her hand; Sagittarie is made of a man and an horse; and there are two fishes. The placing, and nature of these signes brought in this diuision.

The Astrologians also deuide the twelue signes into

into fowre trigons or triplicities, so called because they are distant the third part of a circle, one from another. The first triplicity contayneth Aries, Leo, and Sagittarius; & is called the fierye trigon, or triplicity: The second triplicitie conteyneth Taurus, Virgo, and Capricorne; and is called the earthly trigon. The third triplicity conteyneth Gemini Libra and Aquarius; & is called the ayrie trigon. The fourth triplicitie conteyning, Cancer, Scorpio, & Pisces; is called the watrie trigon. Nature it self is the cause of this diuision of the signes also. For into these trigons of the signes she hath distributed the coniunctions of the three superiour planets: especially the coniunctions of Saturne and Iupiter, which the Astrologians cal great coniunctions. For examples sake, if there be a great coniunction in Aries, the same shal be twenty yeares after in Sagittarie, and other twenty yeares after in Leo; & after as many more yeares, it returneth againe into Aries. The reuolution of one trigon conteyneth almost 200. yeares, after which time the same great coniunctions remoue into the next trigon.

The vses of the zodiack.

Chap. 9.

1. The zodiack is the measure of the second motions, as the æquinoctiall is the measure of the first motion.

2. For in this circle we reckon the longitudes, and from it we count the latitudes of al the starres. For the longitude of a starre is nothing els but the arch of the ecliptick conteyned betweene the be-

ginning of Aries, and the circle of the ſtarres latitude. And the latitude is the Arch of a great circle, drawne by the poles of the ecliptyck, conteyned betweene the ſtarre, and the ecliptick.

3. According to this circle, the whole Heauen, yea the whole world is deuided into twelue ſignes. Whereof it commeth that becauſe of this circle, aſwell the fixed, as the wandring ſtarres which we cal planetes, yea and thoſe ſtarres alſo that appeare of a ſuddaine, as blaſing ſtarres or comets, and other meteors, are ſayd to be in this or that ſigne; and that three manner of wayes.

Firſt to be in a ſigne is to be vnder ſome one of the 12. parts of the ecliptick. Thus the ſtarres which are vnder the ecliptick, but eſpecially the ſunne which runneth always vnder it, are ſayd to be in the ſignes.

Secondly becauſe the zodiack hath latitude, thoſe ſtarres are ſayd to be in a ſigne, which although they be beſide the Ecliptick, yet are vnder the zodiack, and ſo any of the other planets, which for the moſt part wander beſide the ecliptick, may be ſayd to be in ſome ſigne.

Thirdly, if we vnderſtand ſix great circles to be drawne by the beginnings of the twelue ſignes, and by the poles of the ecliptick; by theſe circles the whole heauen (or rather the whole world) is deuided into twelue parts, which with a general name are called ſignes: Thus all the ſtarres aſwel fixed as planets and comets, which are without the zodiack in any of theſe parts, may be ſayd to be in ſome ſigne.

4. In this circle are noted the degrees of the

ſignes,

signes, with which the starres do rise & set, as well in a right as in an oblique sphære. For because this circle is the chiefest, all cælestial apparences (or at least the most part of them) are referred vnto it, & not vnto the æquinoctiall. But the æquinoctiall measureth the times of their risings and settings.

5. The obliquitie of the ecliptick is the cause of the inæqualitie, aswell of naturall dayes in both Sphæres, as of artificial days in an oblique sphære. For seeing it is moued vnæqually because it is moued vpon other poles then his owne, the Sun which is the author, and maker of times mouing vnder it, must needes make vnæquall dayes.

6. The chiefe times are defined by this circle, as the time of a yeare, by the motion of the Sunne; the time of a moneth by the motion of the Moone, through the whole compasse of this circle. Also the 4. quarters of the yeare, Spring, Sommer, Autumne, and Winter, whereto may be added *Plato* his great yeare, which is the time wherin the fixed starres make one reuolution about the axtree and poles of the zodiack, if God would haue the world to last so long.

7. The Eclipticke line sheweth the places, and times of the Eclipses: For the Sunne and Moone, are Eclipsed onely vnder it, or neare vnto it.

8. As the description of the Tropickes dependeth on the obliquitie of the Ecliptycke, so the polar circles are described by the poles thereof.

9. Hereof it commeth, that by reason of the

same obliquitie, the zones & climates are set forth and bounded.

10. This circle is of especial vse in Astrologie, for it distinguisheth the points of the 12. howses, and in it the aspects and configurations of the planets are obserued: The chiefest iudgement aswel in casting figures as in reuolutions and directions is taken from this circle.

The description of the two Colures, togither with the vses common to them both.

Chap. 10.

THE two circles crossing each other at right angles in the poles of the Sphære, are called the Colures: whereof the one that passeth by the common meeting of the Ecliptick and æquinoctiall, is called *Colurus æquinoctiorum*, that is the æquinoctial colure, or the colure of æqual dayes & nights. The other passing by the poles of the ecliptyck, and the Solstitial points, is called *Colurus solstitiorum*, the Solstitiall colure, or colure of the Sunne-standinges.

Vses common to both colures.

1. By meanes of these two colures, all the moueable circles of the materiall sphære are framed togither, that so they might be turned about, like as the whole heauens are moued.

2. The poles are fastned in the common meeting of these two circles: and the poles are also shewed by the same common meetings.

3. They

3. They shew the 4. principal points of the Ecliptick; that is, the two æquinoctial, & the two Solstitial points.

4. These circles shew those pointes of the Ecliptick, wherin the sunne is eyther æqually distant from both poles of the sphære, or commeth neareſt to eyther of them: In which pointes the Sunne maketh the dayes longeſt or shorteſt, or of a meane length betweene both these in an oblique sphære.

5. They deuide the Ecliptick into 4. quarters, in which the sunne maketh fowre quarters of the yeare, the Spring, the Summer, Autumne, and Winter.

6. They deuide the Ecliptick & æquinoctial into such fowre quarters, as in a right sphære doe rise togither in æqual time.

Vses of the Eequinoctiall Colure.

Chap. II.

1. The section of this circle with the ecliptick, sheweth the æquinoctial points, wherin the æquinoctial & the ecliptick do deuide and crosse each other. In which points the sunne maketh æquality of dayes and nights throughout the whole world: whereof this circle is also called *Colurus Aequinoctiorum*; that, is the colure of æqual dayes and nights, or the æquinoctiall colure.

2. It deuideth the Ecliptick into the north and south halfes.

3. It deuideth the signes wherein the sunne maketh the days longer then the nights, from those signes wherein the dayes are made shorter then the nights.

4. It sheweth which halfes of the Ecliptick and æquator, do rise together in æqual time in an oblique sphære.

5. It sheweth the two high sunn-standings in a right sphære, in the time of which sun-standings, the sun passeth by the zenith.

Vses of the Solstitial Colure.

Chap. 12.

1. THe common meetings of this circle with the ecliptick, shew the solstitial or tropical points; in which points the sunne seemeth to stand, and then returneth back againe: for which cause this circle is called the Colure of the sun-standings. These points are called tropical (which is as much to say as turne-points, or points of returne) because that when the sunne going alwayes vnder the Ecliptick commeth to these points, which are furthest distant from the æquinoctiall circle, it returneth againe towards the same circle. But they were called Solstitial or Sun-standing points, because that whilest the Sunne is about those points, the difference of the sunnes returning is (for certayne dayes) insensible. Hereof the sunne is said to make his station, or to stand, when he commeth to eyther of those points. They that dwell without the

the tropicks, haue two sunnestandings, that is the summer sunnstanding, or high sunstanding (when the sun in summer time is at the higheſt, & next vnto our zenith being in the beginning of Cancer) and the winterly, or low sunstanding, when the sun in winter time is loweſt in the Meridian, and furtheſt from our zenith. But they that dwell within the tropickes (by a certayne similitude taken from our sunstandings, wherein the sunne is eyther higheſt or loweſt) are sayd to haue fowre sunstandings; that is two high sunstandings, when the sunne passeth by their zenith (the higheſt point in the heauens) which hapneth twice euery yeare in two places, æqually distant from the beginnings of Cancer and Capricorne: and two low sunstandings, when the sunne is in the beginning of Cancer, and Capricorne.

2. In this circle by the arch conteyned between the æquator and Ecliptick, we measure the greateſt declination of the sunne, or obliquity of the ecliptick, which in *Ptolemees* time was 23. degr. 51. min. and one third part of a minute. But euer since that time it hath beene found by obseruation to decreaſe; ſo as in this our age, it is no more then 23. degrees and one half, or little more: Notwithstanding *Copernicus* thought that the greateſt obliquity was 23. degr. 28. minutes.

3. It sheweth the places of the Eclipticke, in which the sunne (comming neareſt to our Zenith) maketh the artificial day longeſt; or going furtheſt from the same point, maketh the same shorteſt.

4. It

4. It deuideth the zodiack into two halfes, the one ascending, and the other descending.

5. Hereby also the signes are distinguished, which doe rise rightly, and which rise obliquely in an oblique Sphære. For the descending half riseth rightly, and the ascending halfe riseth obliquely.

6. So the points of the ecliptick are shewed by this circle, wherein the greatest difference of right & oblique ascensions happeneth. It distinguisheth those signes in which when the sunne moueth, the artificial dayes are increased and the nightes decrease; from those signes wherein the dayes are diminished, and the nights increase.

7. In this circle are the bredths of the zones bouded; for the obliquity of the eliptick doubled, sheweth the bredth of the torride or burnt zone: the distance of the poles of the ecliptick, and of the poles of the æquator, shew the bredth of the could or frozen zones; and the other two arches remayning, shewe the bredthes of the temperate zones.

The Description of the two Tropicks.

Chap. 13.

THe two smaller circles æquidistant in all places from the æquinoctial, & comming vnder these solstitial points of the eliptick on both sides, are called the tropicks, that is circles of returne.

And they are so called, because that when the sunne commeth to them, it beginneth to returne backe

back againe towards the æquinoctial circle. Or els they may be so called, because they are described by the turning about of the Tropical points of Cancer and Capricorne. They are also called solstitial cirles; that is circles of the sunstandinges; because that by reason of the insensible alteration of the declination of the ecliptick, for some space both before, and after the tropical points, the sunne (in respect of his Meridian altitudes, or in respect of the motion he hath towards the north or south, by reason of the obliquity of the Ecliptick) seemeth to stand (as it were) for certaine dayes in those places.

There be two tropicks, the tropick of Cancer, & the tropick of Capricorne.

The tropick of Cancer, toucheth the Ecliptick in the beginning of Cancer, which is the most northerly point of the Ecliptick: or it is the tropick described in the first moueable sphære, by the summer solstitial point.

This circle is called the tropick of Cancer, because it toucheth the ecliptick in the beginning of Cancer.

It is also called the summer Tropick, and the tropick of the summer sunstanding, because that when the sunne commeth to it, the summer beginneth. It is called the north tropick, because it is in the north part of the world: and the circle of the high sunnestanding, because the sunne comming to it, is highest in the meridian, and next vnto our zenith which dwell in the north part of the world, without the Tropicks. The Tropick of Capricorne is the Tropick which toucheth the Ecliptick in the

first point of Capricorne. It is called the tropick of Capricorne, becauſe it toucheth the Ecliptick in the beginning of Capricorne. It is called the winter tropick and tropick of the winter ſunſtanding, becauſe the ſunne commeth to it in winter.

It is alſo called the circle of the loweſt ſun-ſtanding, becauſe that when the Sunne commeth to this Tropicke, it is furtheſt diſtant from our zenith, and hath his loweſt height in the Meridian.

Vſes of the Tropickes.

Chap. 14.

1. THe tropicks ſhew the tropical, or ſolſtiall points of the Ecliptick: that is, the points wherein the ſun ſeemeth to ſtand, & beginneth to returne backagaine.

2. They bound out the greateſt declinations of the ſun, which in our time is about 23. degrees and an halfe.

3. Therfore they do alſo bound out the obliquity of the Ecliptick, for they are the boundes of the ſunnes way, beyond which the ſun goeth not at any tyme.

4. The ſun comming to eyther of theſe circles, is eyther neareſt, or furtheſt diſtant from our vertical point.

5. In an oblique ſphære, they meaſure out the ſhorteſt, and longeſt artificiall day and night.

6. The tropicks (aſwell in heauen as in earth, con-

conteyne betwixt them the Torride zone, & separate it from the temperate.

The Polar Circles.

Chap. 15.

THe two smalleſt circles that are next about the poles of the ſphære, are called the polar circles.

They are drawne by the poles of the Ecliptick, and are euery where æquidiſtant from the æquinoctial, and from the poles of the ſphære.

They are called polar circles, either becauſe they are neare the poles of the ſphære, or els becauſe they are deſcribed by the motion of the poles of the ecliptick.

And therefore there be two polar circles, that is, ſo many as there are poles of the Ecliptick: the Polar circle Arctick, and the Polar Antartick.

The arctick polar circle, is that which paſſeth by the North pole of the ecliptick, or which is deſcribed by the North pole of the Ecliptick being caried about with the motion of the firſt mouable ſphære.

The antarctick polar circle, is that which goeth by the South pole of the ecliptick, being deſcribed with the firſt motion by the antarctick pole of the Ecliptick.

The diſtance of theſe polar circles from the poles of the ſphære, is æqual to the diſtãce of the tropicks from the æquinoctiall, which in our time is about 23. degr. and an half: for ſo much as is the obliquity of the zodiack (wherto the diſtance of the tropicks from the æquinoctial is alwayes æqual) ſo much are

the poles of the ecliptick distant from the poles of the world.

Vses of the Polar Circles.

Chap. 16.

1. The polar circles shew the poles of the zodiack, and shew theyr distance from the poles of the æquinoctiall.

2. The temperate zones are bounded by these polar circles; for the arctick circle boundeth the North side of the North temperate zone; and the antarctick circle boundeth out the South side of the south temperate zone.

3. The polar circles separate the temperate zones, from the could zones which they compasse round about, and inclose within them.

Therfore the 4. lesser circles, that is the two polar circles, and the tropickes, deuide heauen & earth, into fiue zones.

Of the Zones.

Ch. 17.

A Zone is a space of heauen, or earth, conteyned betweene two of the smaller Circles; or incloased within the compasse of eyther polar circle.

They are called zones (that is as much to say as girdles) because they compasse about heauen, or earth like a girdle.

The zones are deuided by auncient writers into two

two kindes; that is into temperate, & vntemperate zones.

A temperate zone is the space of heauen or earth, conteyned betweene eyther of the tropicks, & the next polar circle.

There be two temperate zones; the one North, the other South.

The North temperate zone is conteyned betweene the tropicke of Cancer, & the arctick polar circle.

The south temperate zone is that which is conteyned betweene the tropick of Capricorne, & the antarctick polar circle.

They are called temperate zones, because they haue a better temperature of the ayre for the most part, and more meet for habitation, then the vntemperate zones. The bredth of eyther temperate zone is alwayes æqual to the complement of the distance of the tropicks, & therfore in this age is about 43 degrees, that is 2580. english miles.

60
47
2580

There be two kinde of vntemperate zones, the one exceeding in heat, the other in could, for the most part.

The hot vntemperate zone, (called also the Torride; that is, the burnt or broyled zone) is that space of heauen or earth, which is conteyned betweene the tropicks.

It is called the burnt zone, because that by reason of the sunnes continual going ouer that zone, and casting his beams directly downe thereupon, it is scorched with ouermuch heat, & is not so meete to be inhabited as the temperate zones.

The bredth of this zone is alwayes æqual to the obliquitie of the zodiack, or greateſt declination of the ſun, doubled; which in our time is about 47. degrees, that is 2820. engliſh miles.

The could or frozen zones, are the ſpaces of heauen or earth, conteyned within the polar circles.

There be two could zones, the one North, conteyned within the compaſſe of the Arctick circle: the other ſouth, conteyned within the compaſſe of the antarctik polar circle.

Theſe zones exceed in could, becauſe they want the ſight of the ſun for a great part of the yeare, & when the ſunne appeareth vnto them, his beams fal ſo obliquely vpon them, that they can (in al likely hood) receyue but ſmal heat thereby for the moſt part.

The bredth of theſe zones is meaſured from the poles of the world to the polar circles, and therefore muſt alwaies be ſo much as the polar circles are diſtant from the poles: that is, in our age about 23. degrees and an half, which make 1410. Engliſh miles.

The difference of shadowes that the sunne maketh in these zones.

Chap. 18.

THey that dwel in the torride zone, doe cast theyr shadowes which the sunne maketh at noone (which we may therefore call theyr noone shadowes) both towards the North, & towards the South: towards the North, when the sunne is betwixt theyr zenith and the south point of the Horizon; and towards the South, where the sun is betweene theyr zenith and the North.

For seeing the zenith of them that dwel in that zone is betweene the tropicks, the Sun must needs be sometime North-wards from their zenith, and so make a south shadowe: and sometime South-wards, and then make a north shadow. For which cause they that inhabite this zone are called *Amphiscij*; that is, such as cast theyr noone shadowes on both sides.

But they that dwell in the temperate zones, are called *Heteroscij*; that is, such as cast theyr shadowes at noone, one way onely. For they that dwell in the North temperate zone, haue the sunne allwayes at noone from theyr zenith South-wardes, and therefore must needes allwayes cast theyr noone shadowes North-wardes. Whereas contrariwyse they that inhabit the south temperate zone, hauing the sunne at noone alwayes north-wardes from theyr zenith,

must

muſt needes haue their ſhadowes at noone, alwayes towards the ſouth.

And they that are in the could zones, are called *Periſcij*; that is, ſuch as caſt theyr ſhadowes round about them. For ſeeing the ſunne continueth euery yeare for certayne dayes togither, alwayes aboue theyr Horizon, and therefore moueth round about them without ſetting: it muſt needes be that theyr ſhadowes alſo are caried round about them, falling towards al parts of the world in the ſpace of 24. howres.

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The second Part.

Of the vses of the vppermost SPHAERE, and of the circles thereof ioyntly.

To rectifie the sphære; that is, to sett the sphære to the latitude of that place for which you would vse it.

PROP. I.

FIRST finde by obseruation, or otherwise the height of the pole, or latitude of that place for which you would rectify the sphære. Then (by turning about the Meridian of the sphære, lift vp or put downe the north pole of the sphære (about which the howre circle is fastned) til the arch of the Meridian from the north part of the Horizon vpwards vnto the pole, be iust so many degrees as the eleuation

of the pole or latitude of the place was founde to be: for so haue you the sphære duely rectified.

As for example, the latitude of the Citty of London is 51. degrees and 32. minutes, therefore if you lift vp the North pole of the sphære, aboue the North part of the Horizon, so many degrees & minutes you shal haue your sphære rectified for that place.

To know the place of the Sunne (that is, the point of the Ecliptick in which the center of the Sunne is) any time by this Sphære.

PROP. 2.

LOoke the day of the moneth (for which you desire to know the place of the sunne) in the Horizon, and see what signe and degree of the zodiack vpon the Horizon answereth therto; for there haue you the place of the sunne.

Take for example the 25. of December: looke this day therefore in the Horizon, and you shal find aunswerable thereto 13. degrees, and about 40. min. of Capricorne, which is the place of the sunne at that time.

The

To know the declination of the Sunne, or of any point of the Eclipticke.

PROP. 3.

BRing the point whose declination you desire to know, vnto the Meridian of the Sphære; & look what number of degrees & minutes of the meridian is conteyned betweene that point and the æquinoctial, for so much is the declination.

As if you would know the declination of the 10 degree of Taurus, bring that degree to the Meridian & you shall finde the arch of the meridian betweene that degree & the æquinoctial, to be 14. degrees and about 51. min.

To know the right ascension of the Sunne or of any point of the zodiack.

PROP. 4.

BRing that point (as before) to the Meridian, & see then how many degrees and minutes of the æquinoctial are conteyned betweene the beginning of Aries and the Meridian: for that is the right ascension of that point. So you shal finde the right ascension of the 10. degr. of Taurus to be 37. degr. 35 min: for if you bring that degree of Taurus to the Meridian, you shal finde so many degrees and min. betweene the beginning of Aries, and the meridian.

To know the oblique ascension of the Sunne or of any starre or point in the zodiack.

PROP. 5.

SEtt the sphære to the eleuation of the place for which you desire to know the oblique ascension; then bring the sunne, starre, or point whose oblique ascension you would know, vnto the east semicircle of the Horizon, and looke how many degrees and minutes of the æquinoctial circle, are conteyned betweene the East point of the Horizon, and the beginning of Aries; for so much is the oblique ascension desired: As for exãple, if you set the sphære to the latitude of London 51. deg. 32. min. and then bring the 10. degree of Taurus to the East part of the Horizon, you shal finde about 19. degrees & an half of the æquinoctial, at the same East part of the Horizon; which is the oblique ascension of that degree of Taurus, for the latitude of the cittie of London.

To finde the differrence of Ascension.

PROP. 6.

COmpare the right and oblique ascensions of the sunne, (or of any point of the zodiack) togither, and subtract the lesse from the greater, for the remainder shal be the difference of ascension. As for example, the right ascension of the 10. degr. of *Taurus*, being found by the 4. prop. to be 37. degree 35. min. and the oblique ascension of the same degr.

degree at London, by the 5. Prop. 19. degree 30. min. by subtraction of the lesse out of the greater, the difference shalbe found to be 18. degr. and 5. min. which is the difference of ascension sought for.

To finde at what time the Sunne riseth or setteth.

Prop. 7.

REduce the difference of Ascension into howres and minutes (taking for euery 15. degrees 1. howre, and for euery one degree that remayneth 4. minutes, and for euery minute of a degree 4. seconds) for these howres, minuts & seconds, being added to 6. howres, if the sunne be in any of the South signes; or subtracted, if he be in the North signes, sheweth the tyme of the sun-rising. And contrariwyse, the same howres and minutes subtracted from six howres when the sunne is in the South-signes, or added when he is in the North signes, sheweth the time of the sun-setting.

As for example the Sunne being in the 10. deg. of *Taurus* (which happeneth abont the 20. or 21. day of April) I would know at what howre & minute the Sunne riseth, and setteth at London: Hauing therefore found by the former proposition the difference of ascension to be 18. degr. and 5. minutes I take for 15. degrees therof one howre, & for the three degr. remayning, 12. minutes of an howre, & for the 5. minutes, 20 seconds of an howre. Which howre, minutes and seconds being subtracted out

of 6. howres, becauſe the ſunne is in a North ſigne, there remayneth the time of the ſunnes riſing at 4 a clock 47. minutes, 40 ſeconds. And adding the ſame howre, min. and ſeconds to 6 howres, you haue the time of the ſun ſetting that day at 7. a clock 12 min. & 20 ſeconds.

To finde the length of the artificiall day or night.

PROP. 8.

The artificial day, is the time conteyned between the ſunne-riſing and the ſunne-ſetting: and the artificiall night is the time betweene ſun-ſetting & ſun-riſing. The length of both theſe is found after this manner: hauing found the difference of aſcenſion, and reduced it into howres and minutes (as in the former propoſition) double thoſe howres & minutes, and add them to 12 howres if the ſunne be in the North ſignes, or ſubtract them from 12. howres if the ſunne be in the ſouth ſignes, for ſo ſhal you haue the length of the day: But (contrariwyſe) ſubtract the ſame howres & minutes (being doubled) from 12. howres, the ſun being in the north ſignes; and add them to 12. howres when he is in the ſouth-ſignes; ſo haue you the length of the night.

Or els, double the time of the ſun ſetting, ſo haue you the length of the day. And double the time of the ſunne-riſing, ſo haue you the length of the night.

As

As the time of the sun-rising being found by the former proposition to be 4 howres 48 minutes after midnight at London, the sunne being in the 10 degr. of *Taurus*, by doubling the time of the sun-rising, the length of the night shal be found to be 9 howres and 36 minutes. And doubling the time of the sun-setting, that is 7 howres, twelue minutes, you haue the length of the day 14 howres, & 24. minutes.

To know the time of the sunne-rising and sun-setting otherwise by the Sphære.

PROP. 5.

THE place of the figure being found by the 2. proposition, bring the same to the Meridian, and withall set the point of the index of the howre circle, to the 12 howre in the same circle: Then bring the place of the sunne to the Horizon east-wardes; and the point of the howre index shall shew you in the howre circle, the time of the sun-rising. But if you bring the place of the Sun to the horizon west-wards, the point of the index wil shew in the howre circle the time of the sunne-setting.

As for example, the sunne being in the 10 degr. of *Taurus*, bring the same degree to the Meridian, and bring the point of the howre index also to the meridian: then (the Sphære being set to the latitude of London) bring the same 10 degr. of *Taurus* to the east part of the horizon, for then the howre index will shew you in the howre circle, that the sunne

sunne riseth at 4 of the clock and 48 minutes.

And bringing the same degree to the West semicircle of the Horizon, the same Index will shew the time of the Sun-setting to be 7 howres and 12. min. after noone.

To finde the length of the artificiall day or night otherwyse by the Sphære.

PROP. 10.

BRing the place of the sun (being found as before to the East semicircle of the Horizon: sett the howre index to 12 a clock in the howre circle: turne about the sphære from the East, Westwards, till the place of the sun come to the Horizon, & mark how many howres the index hath runne ouer vpon the howre circle in the meane time, for so much is the length of the day.

And to finde the length of the night: Bring the place of the sunne to the West semi-circle of the Horizon, and set the index to 12 a clock as before; Then turning forwards the sphære from East West-warde til the place of the sunne come to the East semicircle of the Horizon; see how many howres the index passeth ouer in the howre circle, for so many howres long is the night.

As for example; supposing the sunne to be as before in the 10 degr. of *Taurus*, bring the same degree to the East part of the Horizon, and the point of the index to the meridian; then turning about the sphære, till the same degree come to the West part of the horizon; you shall finde that in the meane

meane time, the point of the Index ſhall paſſe ouer 14 howres and 24 min. which is the length of the day. Likewiſe, if you bring the ſame 10 degree of *Taurus* to the weſt part of the horizon, and the index to the meridian, and turne about the ſphære, til that degree come to the eaſt ſemicirle of the horizon, the number of howres that the index runneth ouer in the meane time vpon the howre circle, ſhall be founde to be nine degrees, and 36. minutes.

To know the meridian altitude, or the height of the Sunne at noone for any time and place (whoſe latitude is knowne)

Prop. 11.

SEt the ſphære to the latitude of the place where you deſire to know the ſunnes height at noone: bring the place of the ſunne (being found as before by the 2 Prop.) to the meridian, then ſee how many degrees of the meridian, are conteyned betweene the horizon, and the place of the ſun, for ſo much is the height of the Sunne at noone.

In like ſorte it may be knowne how much the ſunne is vnder the horizon at midnight, after this manner: Bring the place of the ſunne in the zodiack to the meridian vnder the horizon, and ſee how many degrees of the meridian, are conteyned betweene the vpper ſide of the horizon, and the place of the ſunne downwards: and ſo ſhal you haue that you ſought for.

Or els if you cannot well come to the Meridian vnder the horizon: Bring that point of the ecliptick which is oppoſite to the place of the ſun, vnto the Meridian aboue the horizon; for the arch of the meridian, or the number of degrees and minutes of the meridian, betweene that point and the horizon ſheweth how much the ſunne is vnder the horizon at midnight.

After this manner, the ſunne being in the 10. of *Taurus*, you ſhall finde that his Meridian altitude at London is fifty three degrees, and about one halfe.

As alſo that he is vnder the horizon at midnight about 23 degrees and a halfe at London.

To know how high the Sunne is aboue the Horizon at any time of the day.

Prop. 12.

BRing the place of the ſun (found by the 2 Prop.) to the Meridian: ſet the howre index to 12. a clock vpon the howre circle: turne the ſphære about till the index come to the howre at which you deſire to know the height of the ſunne aboue the horizon; take the diſtance of the place of the ſun from the horizon with a large payre of compaſſes: then ſet both feet of the compaſſes in the ecliptick, and looke how many degrees are conteyned betweene them, for ſo much is the height of the ſun.

Thus may you find by the Sphære, that when the ſunne is in the tenth degree, of *Taurus*, his height at 10. of the clock in the fore-noone (the

Sphære

Sphære being duely rectified by the firſt propoſition) ſhall be about 45. degrees and an halfe at London.

To finde the howre of the day by the height of the ſunne; the place of the ſunne, & the height of the pole being giuen.

SEt the pole arctick of the Sphære to his eleuation for that place where you deſire to know the howre of the day: bring the place of the ſunne in the zodiack to the meridian, and the howre index to 12. a clock of the howre circle: take ſo many degrees of the ecliptick betweene the feet of your compaſſes, as the height of the ſunne amounteth vnto.

Then ſet one foot of your compaſſes in the place of the Sunne, and turne the ſphære about, Eaſtwards, if it be in the fore-noone, or Weſt-wards, if in the after noone, till you can but only touch the horizon with the other foote of your compaſſes; for then the index pointeth out the howre of the day in the howre circle.

As ſuppoſe you obſerue the height of the ſun being in the 10 degr. of *Taurus*, and finde him to be 30 degr. high in the fore-noone: you ſhal finde (following the directions præſcribed in this propoſition) that it ſhall then be about 8. of the clock in the morning.

To finde the amplitude or bredth of the sunnes rising, or setting: that is how farre he riseth or setteth from the point of true East, or West at any time.

PROP. 14.

THe pole of the Sphære being set to his eleuation, and the place of the sunne to the East semicircle of the horizon: see how many degrees of the horizon, are conteyned betweene the place of the sun, & the true East point, for so you shall haue the bredth of the sunnes rising.

Thus the sunne being in the 10. degr. of *Taurus*, you shal finde by the sphære, that (for the latitude of London) he riseth about 23 degr. and an halfe North-wards, from the true East point, and that he setteth as many degrees towards the North, from the true West point.

To finde the place of the sunne: his declination and the quarter of the yeare being first knowne.

PROP. 15.

THe quarter of the yeare being knowne, bring the quarter of the Ecliptick that is aunswerable thereto, vnder the Meridian; and turne the sphære to or fro, till there be so many degrees & minutes of the Meridian, conteyned betweene the ecliptick and the æquator, as the declination commeth to: then

then looke what degree of the Ecliptick is vnder the Meridian, for that is the place of the Sunne.

As suppose the declination of the sun in some day of the spring time of the yeare be found to be 14 degr. 51. min. (turning therefore the sphære to and fro, till some part of the spring quarter of the Ecliptick, come right vnder that degree & minute of declination in the Meridian) you may finde that the sunne is then in the tenth degree of *Taurus*.

To finde what day of the moneth it is, by knowledge of the Sunnes declination.

Prop. 16.

THe place of the sunne being found by his declination (as is already shewed) seeke the place of the sunne in the horizon of the sphære, & looke what day is aunswereable thereto, for that is the day of the moneth which was sought for.

As the place of the sunne being found by his declination (as is shewed in the former proposition) to be in the 10. degree of *Taurus*, the day of the moneth shall thus be found to be the 21. of April.

The day of the moneth being knowne, to finde at what time the day breaketh.

PROP. 17.

FInde the place of the sunne (by the 2. prop.) & bring it to the Meridian, then bring the howre index to 12. a clock vpon the howre circle.

Finde out also the point of the Ecliptick that is right ouer against the place of the sunne: then take betweene the feet of your compasses 17 degr. of the ecliptick, and setting one foote of the compasses in the point opposite to the place of the sunn, turne the Sphære West-wards, til you can but only touch the horizon with the other foote, for then the index sheweth in the howre circle at what time the day breaketh.

So the 21. of April, the sun being in the 10 degr. of *Taurus*, you shal finde that the day breaketh about halfe an howre past two of the clocke in the morning.

To finde how long the twylight continueth:

PROP. 18.

FInde out by the former Prop. at what time the day breaketh, and learne also at what time the sunne riseth by the 7. or 9. prop.

Then subtract the lesser from the greater, and there shall remayne the length of the twylyght.

Or els thus: hauing brought the point that is oppo-

oppoſite to the place of the ſunne to be 17 degrees aboue the horizon Weſt-wards, in ſuch ſorte as is ſhewed in the former propoſition; and keeping the ſphære in that poſition, bring about the point of the howre index vnto 12 a clock vpon the howre circle; then turne the ſphære Weſt-wards vntil the degree or point of the ecliptick that is oppoſite to the place of the ſunne come to the Horizon: and ſee how many howres the point of the index hath run ouer in the meane time vpon the hower-circle: for ſo many howres continueth the twylight.

By eyther of theſe wayes, the ſunne being in the 10. deg. of *Taurus*, you ſhal finde that the twylight (that is the time from the breake of the day till Sun riſe) is about 2. howres and 20 minutes.

To finde how much the declination of the ſunne muſt alter at any time of the yeare, to make the day an howre longer or ſhorter.

Prop. 19.

BRing the place of the ſunne (found by the ſecõd Prop.) to the Eaſt ſemicircle of the horizon, & marke what degree or point of the horizon it falleth vpon; bring one of the Colures to the ſame degree or point, and there make a prick in that colure; and (houlding the ſphære immoueable,) marke withall what degree of the æquinoctiall, or of eyther of the tropicks is then at the horizon: Then turne the ſphære 7 degr. and an halfe forwards, towards the Weſt, if the dayes ſhorten: but contrariwiſe

wise if the dayes lengthen; & houlding the sphære there immoueable, make another prick in the colure at the horizon: for the distance of these two pricks in the colure taken with the compasses and brought to the ecliptick, or æquinoctial, sheweth how much the sunnes declination must alter to make the day an howre longer, if the dayes increase; or shorter, if they decrease.

After this manner you shall finde that the sun being in the 10. degree of *Taurus*, his declination must increase about 5 degrees, (or little more) to make the day an howre longer; but when the sunne is in the 20 degr. of *Pisces*, his declination, or rather his meridian altitude, must increase about 6 degr. to make the day an howre longer: and when he is in the beginning of Capricorne, his declination decreaseth scarce 5 degrees to make the day an howre longer.

To finde how many dayes it is ere the day lengthen or shorten an howre.

PROP. 20.

BRing the foresayd pricks (made in the colure by the former proposition) vnto the meridian, and there make two markes iustly aunswereable vnto those pricks in the colure: turne about the sphære till the eliptick line come iust vnder one of those markes, & there make a prick in the ecliptick: then againe turne the sphære til the ecliptick come iust vnder the other marke made in the meridian, and there make another prick in the ecliptick: (But here

here it is to be noted, that wheras the ecliptick may be brought vnder that marke whether way soeuer you turne the Sphære, it must (I say be noted that the sphære must be turned that way which may sooneſt bring the ecliptick vnder that marke. (Laſtly, finde out amongſt the ſignes and degrees deſcribed vpon the Horizon, the like arch to this, that is conteyned betweene theſe pricks in the ecliptick: For the number of dayes anſwerable to this arch in the horizon, is the time wherein the day groweth an howre longer or ſhorter.

Thus ſhal you finde, that when the ſunne is in the beginning of Aries, it will be about 18. dayes after, ere the day be one howre longer. But when the ſunne is in the beginning of Capricorne, you ſhall finde that it will be almoſt twice ſo much, that is neare 34. dayes before the day will be an howre longer.

Hereby therfore the error of them manifeſtly appeareth, which think that in euery 15. dayes the day is lengthned or ſhortned an howre, wheras indeede the lengthning or ſhortning of the dayes, keepeth no ſuch rule. For when the ſunne is about the æquinoctial points, the dayes lengthen or ſhorten very faſt: but when he is neere the tropical points, they grow longer or ſhorter very ſlowely.

To make an horizontal Diall by the Sphære.

Prop. 21.

SEt the ſphære to the eleuation of the place for which you would make the Dial turne about the ſphære, til the ſolſtitial colure be 15 degrees (meaſured in the æquinoctial) from the meridian; and where the colure croſſeth the horizon, there make a prick; then turne the colure yet 15 degr. further, that is 30 degr. from the meridian; and where the colure croſſeth the horizon, there make an other prick: againe turne the colure forwards yet 15 deg. more, (that is 45 degrees from the Meridian) and at the common meeting of the colure and horizon, make the third prick in the horizon; and ſo proceed with the reſt, till you haue made ſo many pricks on that ſide of the horizon as there are howres in half the longeſt day. Then looke how many degrees the firſt, ſecond, third, fourth pricks, &c. are from the Meridian, for ſo many degrees muſt the howre lines of 11 a clock and one a clock; of 10. and 2, of 9. and 3. of 8. and 4. &c. be from the 12. a clock line in the horizontal dyal.

After this manner in an horizontal dial made for the latitude of London, (which is 51 degr. and 32 minutes) you ſhal finde the diſtaunces of all the reſt of the howre lines from the 12. a clock line as followeth: Betwixt twelue and 11. and 12. and 1. are conteyned 12 degrees almoſt: Betweene 12. and 10. and 12. and 2. there are conteyned 24 degr. and

an

an halfe: Betweene 12. and 9. and 12. and 3. 38 deg. Betweene 12 and 8, and 12. & 4. 53 degr. Betweene 12. and 7. and 12. and 5. 70 degr. and an half.

Betweene 12 and 6. both before and after noone, 90 degr. The other howre-ſpaces before 6. in the morning, and after 6 in the euening, are æqual to the hower-ſpaces after 6 in the morning, & before 6 in the after noone.

How to make a direct mural diall by the Sphære.

PROP. 22.

SEt the pole arctick of the Sphære ſo much vnder the Horizon as is the complement of the poles eleuation: the Horizon therefore being thus ſet as it were to the zenith of the ſphære, and ſo repreſenting the verticall circle of Eaſt and Weſt (that is the plaine ſuperficies of a direct mural dial) you ſhall finde the diſtaunces of all howre lines, (both before and after noone) from the 12 a clock line, in ſuch ſorte as you did before for the Horizontal dial.

So you ſhal finde the diſtaunces of the howre lines in an erect direct mural dial made for the latitude of London to be as followeth: Betweene the twelue a clock line and the lines of 11 and 1, 9 degr. and about one third part of a degree: Betweene 12. and 10. and 12. and 2, 19 degrees and one quarter; Betweene 12 and 9, and 12 and 3, 32 degr. or little more: Betweene 12 and 8, and 12 and 4, 48 degrees: betweene 12 and 7, and 12 and 5, 67 degr. or little

more: betweene 12 and 6. both before and after noone 90. degrees.

How to make any direct inclining, or direct reclining diall by the Sphere.

PROP. 23.

REckon from the æquinoctial vpwards in the Meridian, so many degrees as the height of the pole commeth to at that place where you would make your diall; for there is the verticall point or zenith of that place: from this zenith reckon southwards in the meridian, the inclination of south dials and the reclination of North dialls; but contrarywise, reckon from the zenith North-wards the inclination of North dials and the reclination of South Dials. Then bring that degree of the meridian where this reckoning endeth to the Horizon, for so the Horizon representeth vnto you the plaine or the flat superficies of the dial which you would make. Therefore you shal finde how many degrees euery one of the howre lines should be distant from the 12. a clock line, in such sort as you did before in making the Horizontal dial.

Thus in a South direct dial inclining 30 deg. or in a North direct reclining 30 degr. made for the latitude or eleuation of the pole at London, you may finde the distances of the eleuen a clock line & of the one a clock line, from the 12 a clock line, to be about 14. degrees.

But the howre lines of 10. in the forenoone and of 2 in the afternoone, are distant from the 12 a clock line 28 degr. and on half; From 12 to 9. and to 3, you shal finde 43 degr. From 12 to 8 in the fore noone, and 4 in the after noone, you shall haue 58 degr. & an halfe: also from 12 to 7, and to 5. shal be about 74 degr. And from 12 to 6 in the morning, & 6. after noone 90 degrees.

Likewise in a South direct reclining, or North direct inclining 20 degr. for the elevation of London; the spaces betweene 12 & 11 & 12 & 1, shal be about 5 deg. or little lesse: Betweene 12 & 10, & 12. & 2, about 10 deg. & 2 third parts. From 12 to 9 in the forenoone, & 3 in the afternoone, 18 almost: Frō 12 to 8, & 4, 29 degr. or little more. From the 12. a clock line, to the line of 7 a clock in the forenoone, & 5 in the afternoone, 50 degr. or there abouts. Frō 12 to 6 both before & after noone, 90 deg. as in the former kindes of dials. In al which it is to be noted, that there is alwayes the same distance between the howre lines of 5 & 6, & 4 & 6 that there is between 7 and 6 and 8. & 6 in the forenoone, and betweene 5 & 6, & 4 & 6 & 7 & 6, & 8, & 6. in the after noone. So as the distances of al the howre lines from the 12 a clock line being found from 6 in the morning, till 6 at night, the distances of the other howre lines before 6 in the morning, and after 6 at night shall easely be had.

To know at what time the moone, or any other of the planetes or fixed ſtarres, that are within the bredth of the zodiack; riſe, or ſet, or come to the meridian; as alſo with what degree of the ecliptick they riſe or ſet or midd heauen, togither with their declinations, and their right and oblique aſcenſions, and deſcenſions; and theyr bredths or amplitudes of riſing, or ſetting.

PROP. 24.

FInde the place of the moone, or any other of the planetes, both in longitude and latitude, by the Ephemerides: and finde the place (that is, the longitude and latitude) of any of the fixed ſtarres in the zodiack by ſome table of the fixed ſtarres, or otherwiſe; and marke the ſame place of the moone, planete or ſtarre, in the zodiack of the ſphære: and hauing ſet the ſphære to the latitude of the place, bring the place of the ſunne (found by the 2. propoſition) to the meridian, and the howre-index to 12 a clock vpon the howre-circle; then turne the Sphære till the place of the moone, planet or ſtarre marked in the zodiack, come to the eaſt ſemicircle of the horizon; for then the index ſheweth the time when the moone, or that planet or fixed ſtarre, riſeth.

Alſo the number of degrees in the Horizon, conteyned betweene the point of the moones, planetes, or ſtarres, riſing, and the point of true Eaſt, ſhew

ſheweth the bredth, widenes or amplitude of riſing; And you may at the ſame inſtant ſee, what degr. of the ecliptick riſeth with any of them, and what the oblique aſcenſion of any of them is: For if you tell how many degrees of the æquinoctial are conteyned betweene the beginning of Aries and the Horizon, proceeding Eaſt-wards, or according to the order of the ſignes: you ſhall haue the oblique aſcenſion of the moone, planete, or ſtarre that you ſought for.

But bring the ſame place of the moone, planete or ſtarre to the meridian, and the index ſheweth in the howre circle at what time they come to the meridian: where you may alſo ſee, firſt what degree of the zodiack middeth heauen (that is, commeth to the meridian) with any of them; ſecondly you may ſee how much the declination of any of them is; for count how many degrees of the meridian are conteyned betweene the æquinoctial and the place of the moone, planete, or fixed ſtarre, and ſo much is the declination. Thirdly you may there ſee what the right aſcenſion of any of them is: for the place of any of them being brought to the meridian and there ſtayed, reckon Eaſt-wards how many degrees of the æquinoctial are conteyned betweene the beginning of Aries and the Meridian, ſo haue you the right aſcenſiō: Laſtly bring the place of the moone, planete, or ſtarre, to the Weſt ſemicircle of the Horizon; for then the index ſheweth the time of theyr ſetting; and the number of the degrees of the Horizon betweene the point where any of them ſetteth, and the æquinoctial, or true Weſt point

where

(where the æquinoctial, and Horizon crosse each other) is the amplitude or bredth of the setting of any of them, shewing how much they set from the true West point.

You may there also see what degree, eyther of the ecliptick, or of the æquinoctial, setteth with any of them: and consequently you may know the oblique descension of any of them, by reckoning how many degr. of the æquinoctial there are from the beginning of Aries Eastwards, till you come about to the West part of the Horizon.

Take for example the great starre called the Bulles eye, whose place in longitude is about the 4. deg. of Taurus, and his latitude about 5 degr. and an half Southwards.

Following therefore the directions præscribed in this proposition, you shal find that vpon the first day of April this present yeare 1600. the same starre ryseth here at London about half an howre past 7. of the clock in the morning, and setteth about a quarter of an howre past 10 at night, and commeth to the meridian about 3 a clock afternoone: Also you shal find that it riseth with the 15 degree of Gemini, and setteth with the last deg. of Taurus, and commeth to the meridian, or middeth heauen, with the 5. deg. of Gemini: Thirdly you shal find his declinatiõ to be about 15 deg. & 2 third parts, his right ascension 63 degr. and a quarter, his oblique ascension 43 degr. and his oblique descension about 84. deg. and an half: and lastly his amplitude or bredth of rising, or setting about 25 degr. & an halfe from the true East & West points towards the North.

To know how long the moone or any of the planets or fixed ſtarres do ſhine or continue aboue the Horizon.

PROP. 25.

THe Sphære being ſet to the latitude of the place, and the place of the moone, planete, or fixed ſtarre, being found, & marked in the zodiack, both in longitude, and latitude, (as in the former prop.) bring the place of the moone, planete, or ſtar, to the Eaſt ſemicircle of the Horizon, and the index of howres to 12. a clock: Then turne about the Sphære Weſt-wards, till the ſame place of the Moone, or of the ſame planete, or ſtarre, come to the Weſt ſemicircle of the Horizon, and marke withall how many howres the index runneth ouer in the meane time vpon the howre circle, for ſo many howres continueth the moone, planete, or ſtarre aboue the Horizon.

Thus ſhall you finde that the foreſayd ſtarre (called The Bulles eye) continueth, or ſhineth aboue the horizon at London, about 14. howres & 3. quarters.

To finde which of the planetes or fixed ſtarres are aboue or vnder the Horizon at any time of the day or night.

PROP. 26.

THe places of the planetes or fixed ſtarres being marked in the zodiack of the Sphære, as in the former propoſitions, and the place of the ſunne brought to the Meridian, and then the index to 12 a clock; turne the ſphære til the index come to that howre vpon the howre circle at which you deſire to know what planetes are aboue or vnder the Horizon, and then hould ſtil the ſphære, and marke what planetes or ſtarres are aboue, or vnder the horizon in the ſphære, for the ſame planetes or ſtarres are aboue or vnder the horizon in the heauens.

As for example: the 1. of April 1600. at 9. of the clock at night, you may by this propoſition finde, that the moſt part of the fixed ſtarres, that are in the conſtellations of *Taurus*, *Gemini*, *Cancer*, *Leo*, *Virgo*, and *Libra*, togither with the three ſuperiour planetes, *Saturne*, *Iupiter* & *Mars*, are at that howre to be ſeene aboue the Horizon; & that the reſt of the planetes and fixed ſtarres, that are within the compaſſe of the zodiack, are vnder the horizon, and cannot then be ſeene.

To finde in what time any signe or part of the ecliptick riseth or setteth.

PROP. 27.

BRing the beginning of the signe, or part of the ecliptick, to the East semicircle of the horizon, if you would knowe in how long time it riseth, or to the west part of the horizon, if you would know in what time it setteth; then set the index to 12 a clock and turne forwardes the sphære, til the whole signe or part of the zodiack be risen, or set: For then the index sheweth vpon the howre circle in how long time, that signe or part of the zodiack riseth or setteth.

Thus you may finde (for example) that the whole signe of Aries here at London riseth in one howre or somewhat lesse, and setteth in two howres & three quarters, or somthing more: And that the whole quarter of the zodiack, from the beginning of Aries to the beginning of Cancer, riseth in lesse then 4 howres, but setteth in more then 8 howres.

To finde the howre of the night by any of the planettes or fixed starres in the zodiack, that appeare aboue the Horizon.

PROP. 28.

THe place (that is to say the longitude & latitude) of any planete, or fixed starre in the zodiacke,

that is aboue the horizon, being first found, and marked in the zodiack of the sphære; bring the place of the sunne (found by the 2 proposition) to the meridian, & the index to 12 a clock vpon the howre circle: Then hauing found the height of the starre, or planete by obseruation, and the sphære also being set to the latitude of the place of obseruatiõ, take betweene the feet of your compasses, so many degrees of the ecliptick, or æquinoctiall, as the height of the planete, or starre obserued, commeth to; and setting one foote of your compasses in the place of the planete, or fixed starre that you obserued in the zodiack, turne the sphære forwards, or backwards, till you can but onely touch the horizon with the other foote: for then the index in the howre circle, shall shew you the howre of the night.

Suppose (for example) I should obserue the height of the foresayd Bulles eye, and should finde the same to be 29. degrees the first day of March at euening: finding therfore the place of that starre in the zodiack of the Sphære, and bringing it (with help of the compasses) to the height obserued (hauing first set the place of the sunne and howre-index both togither to the meridian) the index of the howres will shewe, that when that starre hath that height of 29 degrees, it is about 9 of the clock at night.

To know at any time of the yeare, what ſtarres in the zodiack, ariſe, or ſett, Coſmically, Achronycally, or Heliacally.

PROP. 14.

SVch ſtarres as riſe togither with the ſunne, are ſayd to riſe coſmically: and ſuch ſtarres as ſett when the ſunne riſeth, are ſaid to ſet coſmically; But thoſe ſtarres which ſet togither with the ſunne, ſet achronycally; and thoſe ſtarres that riſe when the ſunne ſetteth, are ſayd to riſe achronycally. Laſtly thoſe ſtarres that riſe a little before the ſunne, riſe heliacally: and thoſe that ſet a little after the ſunne, ſet heliacally.

All which may thus be found: Bring the place of the ſunne to the Eaſt ſemicircle of the Horizon: for the ſtarres that are then a litle aboue the horizō riſe heliacally: but thoſe that are in the horizon in the Eaſt, riſe coſmically; and they that are in the Weſt ſemicircle of the horizon ſet coſmically: But bring the place of the ſunne to the Weſt ſemicircle of the horizon, for thoſe ſtarres that are at the Weſt part of the horizon at the ſame time, ſet achronycally; but thoſe that are then in the Eaſt ſemicircle of the horizon, riſe achronycally: & they which are a little aboue the Weſt ſemicircle of the horizon ſet heliacally.

Thus you may know that vpon the ſix or ſeuen & twentith day of May (in our latitude of London) the Bulles eye riſeth coſmically, and the ſtarres in Serpentarius his right foote, ſet coſmically, you

may see also that the same day the starre in the Buls South horne setteth achronycally: and the northermost starre in Serpentarius his right foote, riseth achronycally: and lastly you may finde that about the same time the Pleiades & the starre in the Bulles north horne, rise heliacally, & that the same starre also, and the former Twinnes feete set heliacally.

To finde the fowre principall or Cardinall points of Heauen (as the astrologians call them) at any time.

PROP. 30.

THese fowre cardinal points are nothing els but 4 points of the ecliptick, whereof one is at the East part of the horizon, ascending, and is therefore called the ascendent: another is at the vpper part of the meridian aboue the horizon, and is called the midst of heauen, and the hart of heauen: the third is at the West part of the horizon descending, and may be therfore called the descendent: the forth point is that which is at the nether part of the meridian vnder the horizon. Which fowre points are the beginnings of the first, tenth, seauenth, and fowrth howses. Therefore to finde these points at any time by the sphære, bring the place of the sun (being found for that time by the 2 proposition) to the meridian, and the index to 12 a clocke: then turne the sphære till the index come to that howre at which you desire to know those fowre points, & there hould the sphære that it moue not: and looke withall,

withall, what points of the ecliptick are at the East and West semicircle of the horizon; and at the vpper and nether parts of the Meridian: for those be the fowre principall or Cardinall pointes you sought for.

Take for example the time of the Sunnes entrance into Aries this present yeare 1600. which was vpon the tenth day of March about eight of the clock in the morning, or little after with vs heere at London. Hauing therefore brought the beginning of Aries togither with the howre index to the meridian, and then turned back the whole sphære till the index come to 8 of the clock vpon the howre circle: you shall finde the ascendent at that time, to be the 27 degree of Taurus; the midest or hart of heauen, the 27 of Capricorne: the descendent, the 27 deg. of Scorpio; and the lowest part of heauen, the 27 deg. of Cancer.

To finde out the bredth of any climate; that is, how much the pole must be eleuated, or depressed, to make the longest day half an howre longer or shorter.

Prop. 31.

LIft vp, or put downe the pole of the Sphære, til you finde that there are 7 deg. and an half of the tropick of Cancer, more or lesse aboue the horizon, then there were before; and mark withal how much the pole of the sphære is raysed, or let fall in the meane

meane time, more then it was before; for so much is the bredth of that climate.

As for example: hauing set the sphære to our latitude of London of 51. deg. and an halfe, with the point of your compasses, houlding and guiding some point of the tropick of Cancer right vnder the horizon; then lifting vp the pole till you finde 7. degrees and an halfe more aboue the horizon then were before, you shal finde the pole eleuated about 2 deg. and an halfe more then it was before.

Likewise, if you put downe the pole till there be 7 degrees and an halfe of the tropicke of Cancer, fewer aboue the horizon then was before; you shal finde the eleuation of the pole to be about 3 degrees lesse then before.

The reason of the inæqualitite of naturall-dayes; that is, why the space of 24 howres, is longer at one time of the yeare then at another time.

Prop. 32.

THe reason hereof is shewed partly by the inæqualitie of the differences of right ascensions aunswerable to æqual arcks of the zodiacke, and partly by the vnæqual apparent motion of the sun. For the first: the differences of right ascensions answerable to the parts of the cliptick, about the tropicall points of Cancer and Capricorne, are much greater then about the æquinoctial points of Aries and Libra.

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In so much that whereas the difference of right ascension aunswerable to one signe, or 30 degrees taken about those tropicall points, is more then 32 deg. and an halfe: about the æquinoctial points it is little more then 27 deg. and an halfe; as it may appeare by the Sphære. So as you may hereby gather, that the difference of ascension answerable to one degree, which about the beginning of Capricorne is one deg. and about six minutes; about the beginning of Aries, or Libra, is only 55 minutes. Secondly the apparent motion of the sunne is much swifter about his *Perigæum*, in the signe of Capricorne, then about his *Apogæum* in Cancer, or in other parts of the zodiack: so that whereas the sun being in Capricorne moueth 61 minutes and something more in a day: in Aries or Libra he moueth but 59 minutes or very little more in the same time. Therefore seeing the natural day is nothing els, but the time wherein the sunne moueth from the Meridian about, til it returne againe to the same part of the meridian; it must needes be that alwayes in one natural day, there is made one whole reuolution of the æquinoctial circle, and so much more as is the difference of right ascension aunswerable to the apparent motion of the sunne in the meane time: which differences of ascension because they be vnæquall, for the two causes before alleaged; the natural dayes must needs also be vnæquall, the motion of the æquinoctiall circle about his owne center being (as it hath beene alwayes supposed to be) æqual, that is mouing alwayes an æquall space in æqual time.

Which by this example may most playnely appeare: The Sunne being in Capricorne moueth 61. minutes in a natural day: the difference of ascension agreable thereto is 67. minutes, or something more. Therefore at that time, in the space of one natural day, the æquinoctiall circle must make one full reuolution, and 67 minutes more. But when the sun is in Aries, mouing onely 59 minutes in a day, and the difference of right ascension aunswerable therto, scarce 54 minutes more then one reuolution of the æquinoctiall circle; there shal passe onely 54. minutes more in a natural day; so as here the æquinoctiall circle moueth not about so much in one day as before by 13. minutes. Seeing then that 15. degrees or little more of the æquinoctial circle doe passe the meridian in euery howre, & consequently one degree of the æquinoctiall passeth the Meridian in fowre minutes of an howre, and one minute of a degree in fowre seconds of an howre; therefore 13 minutes of the æquinoctiall shall passe the meridian in 52 seconds: that is almost in one minute of an howre: Whereby it manifestly appeareth that the natural day, that is to say the space of 24 howres, which is the time wherein the sunne moueth from the noone-stead to the same noone-stead againe, is in our age greater almost by one minute of an howre, when the sunne is in Capricorne, then when he is in Aries or Libra.

To finde by the Sphære how much the naturall dayes are longer at one time of the yeare then at another:

PROP. 33.

FOr this purpose it will be best to take a good number of dayes togither; as for example, take the whole moneth of December, and the whole moneth of March: both which moneths consist of the same number of 31 natural dayes: finde the place of the sunne for the beginning, and ending of both moneths, which you may finde by the second proposition to be for the beginning of March this present yeare 1600, about 20 degrees and thirteen minutes of Pisces; and for the ending about 20. degr. 48 minutes of Aries: Also for the beginning of December the same yeare 18 deg. 46 minutes of Sagittarie; and for the ending, twenty degrees 24. minutes of Capricorne: Then seeke out the right ascensions of the same places of the sunne for the beginnings and endings of both those moneths by the 4 proposition, and the differences of ascension aunswerable to the motion of the sunne in each moneth, by the sixt proposition; which you may finde by the Sphære to be about 33 degrees, 24 minutes for December, and 28 degrees 39 minutes for March. Lastly finde out the difference of these differences of ascension by subtracting the lesser out of the greater; which in this exãple is 4 degrees 45 minutes; which resolued into minutes of an howre, by taking for euery degree 4 minutes of an howre,

and for euery fifteen minutes of a degree, one minute of an howre; shall amount to 19 minutes of an howre, that is a quarter of an howre and fower minutes. And so much is the moneth of December longer then the moneth of March; Notwithstanding both of them consist of the same nnmber of 31 naturall dayes.

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THE

The third Part.

Of the Orbes whereof the Sphæres of the Sunne and Moone haue been imagined to be made, and of thoyr motions & vses.

Of the Orbes whereof the Sphære of the sunne is made.

Chap. I.

WIthin the Sphære or Orbe containening all the circles that we haue hetherto spoken of, and representing vnto vs the *Primum mobile*; that is, the first & highest moueable heauen, that hath beene imagined by the Astronomers, to shew the reason of that dayly motion, which appeareth to be in all the heauens, and of all the apparences that follow thereupon, are included the sphæres & Orbes of the sunne and moone.

The sphære of the sun conteyneth three orbes: The vppermost of them (which in this Sphære is signified by the yealow circle that commeth next within the compasse of the zodiack) is called *Deferens apogæum Solis*; that is, the Orbe which carieth about that point, wherein the sunne is furthest distant from the earth.

Next within this Orbe is placed the eccentricke carying about the body of the Sunne; which in this Sphære is represented by the grene coloured circle that commeth next vnder the *Deferens Apogæum*.

Againe, within this Eccentrick is included the third Orbe of the Sphære of the sun called *Deferens Perigæum Solis*; that is, the Orbe carying about that point wherein the sunne is neareſt to the earth. This is the nethermost of the three Orbes of the sunne, and in this sphære is represented vnto you by the yealow coloured circle next vnder the sunnes Eccentrick.

Of the vppermost and nethermost Orbes of the Sphære of the Sunne, more particularly.

Chap. 2.

IN the vppermost and nethermost of these three Orbes, there be 4 points especially to be considered: That is, the points where they be narrowest and where they be broadest, and where they are of a meane bredth betwixt the narrowest and broadest For at the narrowest part of the vppermost Orbe, where

where you may see written *Aux solis*, and the broadest part of the nethermost Orbe, is the place of the sunnes *Apogæum*: so that whensoeuer the sunne commeth there, he is furthest distant from the earth. As you may easely trye, if (with a payre of compasses, or otherwyse) you take the distance betwixt the earth and the sunne being brought about to that place, and compare the same with the distances that the sunne hath from the earth in other places. This point is called *Aux Solis*, and *longitudo longior*, that is, the point of the sunnes furthest distaunce from the earth. But vnder the broadest part of the vppermost and vttermost Orbe, where you see printed *PERIGAEVM*, and right aboue the narrowest part of the nethermost Orbe, is the place where the sun commeth neerest to the earth, as you may easely finde (with your compasses, or otherwyse) in like sort as before was shewed. The point where the sun commeth neareſt to the earth, is called *oppositum Augis*, and *longitudo propior*, that is, the point opposite to the *Apogæum*, and the neareſt distance. And at those parts of this Orbe, which are in the middest betweene the former; the sunne hath a meane distance from the earth: a meane (I say) betweene the least, and greatest distance. The very point wherein this meane or middle distance hapneth, is shewed by the points that are iust in the midst betweene the short lines AB, and IK, which are drawne ouerthwart on eyther side of this Orbe. These points are called *longitudines mediæ*; that is, the meane distances of the sunne, because the sunn comming to these points, hath a meane distaunce

be-

betweene the least and the greatest. About these points also, the true motion of the sunne, is as it were in a meane betweene the slowest, which hapneth the sunne being about the *Apogæum*; and the swiftest, which hapneth about his *Perigæum*.

Moreouer the lines A, and K, shew the places wherein there is the greatest *Prosthaphæresis*, or æquation of the sun: that is, the greatest difference betweene the true, and middle, or meane place of the sunne.

Lastly the distaunce betweene the lines I, and K, or A & B, shew how much the eccentricitie of the sunnes eccentrick is, that is how farre the center of the eccentrick, is distant from the center of earth.

To finde how much the sunne is nearer or further from the earth, at one time then at another.

Chap. 3.

BY meanes of this circle, you may easily finde with your compasses, how much the sunne is nearer to, or further from the earth at one time, the at another: for hauing set one foot of the compasses vpon the vtmost edge of the *Deferens Apogæum*, vnder the place of the sunne in the zodiack, found by the second propostreteh out the other foote, to the innermost edge of the same Orbe; for then, if you set one foote of your compasses, vpon the vtmost edge of this Orbe, at the *Apogæum*, the other foote turned inwards, towards the center of the

Sphære,

Sphære, will shew you how much the sunne is nearer to the earth, at that time, then when he is in his *Apogæum*: for so much as that foote reacheth within the inner edge of the Orbe, so much is the sunne nearer. Likewise if you set one foot of your compasses, vpon the vttermost edge of this orbe, at the *Perigæum*, and turne the other foote towardes the center of the sphære, so much at this foote of the compasse, is from the inner edge of the *Deferens Perigæum*, so much is the sunne further distant from the earth, at that time, then when he is in his *Perigæum*.

Of the situation and motion of the vppermost, and nethermost Orbes of the Sunne.

Chap. 4.

THe vppermost, and nethermost of these three Orbes, called *Deferens Apogæum*, and *Perigæum solis*, do alwayes answere each to other, in such sort that the broadest part of the one, is alwayes against the narrowest part of the other: And therefore both of them are moued togither, with one motion about the axtree and poles of the ecliptick, making one reuolution vnder the zodiack, in the space of 17000. yeares almost. For in *Ptolemee* his time (that is about the yeare of our Lord 134.) the place of the Sunnes *Apogæum*, was about the middest of the 6 deg. of *Gemini*; as it may appeare by the 4. Chapter of the 3. booke of his Almagest. But in our time we finde that it cannot exceede the 7 degr. of *Cancer*, although after the account of *Copernicus*, &

of the Prutenicke tables, it should be in the 9 degr. of *Cancer*. So as, if the rest of the motion of the sunnes *Apogæum*, that is to come hereafter, be proportionable to that is past, the whole reuolution thereof shalbe finished in 16990. yeares vnder the zodiack. For in 1463. yeares betwixt *Ptolemee* his time and ours, it hath moued about 31 degr. therefore it shall moue 360. degr. (that is, the compasse of the whole circle) in 16990. yeares.

Which number of yeares being deuided by 360. it shall appeare that the *Apogæum* of the sunne moueth one degr. in little more then 47 yeares, wherby the yearely motion thereof may be found to be little more then one minute and a quarter.

How to finde the place of the sunnes Aux *or* Apogæum: *and of the vses of the two foresaid Orbes of the Sunne.*

Chap. 5.

THerefore the place of the sunnes *Apogæum*, being founde for the yeare 1600. to be about 7 degr. in *Cancer*, the place thereof for any other yeare before or after, may easely be found in our age, onely by subtracting, or adding for euery fowre yeares 5 minutes, & for euery single yeare 1 minute and a quarter, Although indede we neede not stand so præcisely neyther vpon quarters of minutes, neither yet vpon whole minutes, in the place of the sunnes *Apogæum*, which cannot be by any art so exactly found, but that the diligentest man that is, may erre many minutes therein.

Take

Take for example the yeare of our Lord 1558. (in which our gracious Queene *Elizabeth* beganne her happie reigne, which is now 42. yeares since) taking therefore for euery 4 yeares 5 minutes, that is for 40. yeares 50 minutes, and for the two years remayning 2 minutes and one halfe; that is in all 52. minutes and an halfe, and subtracting the same out of 7 deg. of *Cancer*, there shall remaine the place of the sunnes *Apogæum* at the beginning of her Ma^ties, reigne, in 6. degr. and about 8 min. of *Cancer*.

The vses of these two Orbes are these.

1. First to make the sphære of the sunne concentricall; for these Orbes be so framed togither, that the narrowest part of the one, aunswereth alwayes to the broadest part of the other: it commeth to passe by this meanes, that both the out-side, and in-side of the Sphære of the sunne, haue alwayes the same center, that the world it self hath.

2. The second vse is to shew the reason, and manner of the motion of the sunnes *Apogæum* and *Perigæum*.

Of the eccentrick of the Sunne, and how it hath beene proued that the Sunne is moued in an eccentrical Orbe.

Chap. 6.

THe Orbe conteyned betweene the two former, and carying about the body of the sun it selfe, is called the eccentricke of the sunne; because it hath another center, then the center of the world.

The especiall reason, that moued the skilfull in this celestial science, to make this Orbe (wherein the body of the sunne is carryed) eccentrical, was because they found the apparent motion of the sunne vnder the ecliptick line to be vnæquall, that is swifter in the southerly signes: and slower in the northerly.

For *Hipparchus*, and *Ptolemee* found in their times, that the sunne continued in the Northerne semicircle of the ecliptick, from *Aries* to *Libra*, 187. dayes: and in the other half of the zodiack, that is Southward from *Libra* to *Aries*, 178. dayes and a quarter onely. But in our time by diligent obseruation it is found, that the time of the sunnes continuance in the first of those semicircles from *Aries* to *Libra*, is 186 dayes 14 howres and an half: and consequently in the other semicircle, from *Libra* to *Aries*, 178 dayes 15 howres and an half. Taking it therefore for a ground, according to the doctrine of *Aristotle*, that the motion of the cælestiall bodies is circular and æqual; it must needs follow, that a greater part of the circle described by the proper motion of the sunne, must be conteyned vnder the northerly semicircle of the ecliptick, then vnder the Southerly: and consequently that the circle or orbe that caryeth about the body of the sunne vnder the ecliptick, hath another center then the center of the ecliptick.

2. An other reason to proue that the sunne is caried in an accentricall circle, is the vnæquall apparent bignes of the sunnes diameter, the Sunne being of the same height aboue the horizon & the

ayre

ayre alike affected, and alike cleare; so as if there were any refraction by reason of the thicknes of the ayre, it must needs be the same in both places. For in sommer, when the sunne is at, or neare his *Apogæum*, his apparent diameter hath beene found by exquisit obseruation to be 13 minutes 48 secõds. But in winter being about his *Perigæum* 33. min. 54. seconds, as it may appeare in *Copernicus* his reuolutions 4 booke 21 Chapter.

Therefore seeing euery visible obiect appeareth greater when it is neare, and lesse when it is further remoued from vs, it is manifest that the sunne appearing greater in winter, then in summer, must needes be nearer to the earth in winter, then in sommer.

The reason of which apparaunce is most easely shewed, by supposing the sunne to be moued, in an eccentricall Orbe.

3. A third reason may be the vnæquall greatnesse and continuance of the eclipses of the moone, euen at those times when she hath had the same latitude, or distaunce from the ecliptick, and the same distance from the center of the earth: which argueth that the conicall sharp pointed shadow of the earth, in the place where the moone in time of the eclipse passeth through that shadow, at the same distance from the earth, is som times greater, and somtimes lesser: wherof ther cã no cause be shewed more reasonable then this, that the sunne is sometimes further distant from the earth, and then maketh the shadow greater, and sometimes nearer, & so maketh it lesser. Whereby it is also manifestly

proued, that the sun is moued about another center then the center of the earth, and therefor that the circle or Orbe, wherein the sunne is moued, is an Eccentricke.

Of the vses of the Sunnes eccentricall Orbe.

Chap. 7.

THerefore the vses of the sunnes eccentrick may be these:

1. First to shew the reason of that apparent inæqualitie, which seemeth to be in the motion of the sunne: for although the sunne moue æqually in his owne Orbe, and about his owne center; yet to them that are at the center of the world, or vpon the earth, he shall seeme to moue vnæqually; that is, swiftly when he is in that part of his eccentricke which is neareſt vnto the earth; and slowly when he is fartheſt from the earth. And therefore in sommer, when the sunne is about his *Apogæum*, and in his greateſt distaunce from the earth, he seemeth to moue little aboue 57 minutes in one day. But in winter, being about his *Perigæum*, and neareſt vnto the earth, he seemeth to moue more then 61 minutes: whereas notwithstanding he moueth æqually in his Eccentrick, euery day about nine and fifty minutes and 8 seconds; and so finisheth his reuolution in 365. dayes, and six howres almoſt.

2. The second vse of the sunnes Excentricke, may be to shew the reason why the sun appeareth greater at one time then at another; for the sunne being in those parts of the eccentrick that are neareſt vnto vs, seemeth greateſt, & when he is in those

parts

parts of his eccentrick that are furtheſt from vs, he appeareth to be leaſt.

3. And laſtly the inæquality of the ſunnes diſtaunce from the earth, cauſed by his eccentrick, is one eſpeciall cauſe of the inæqualitie of the Eclipſes, both of the ſunne and Moone.

The definitions of certaine Aſtronomical wordes of art, for the better vnderſtanding of the Theorick of the ſunne.

Chap. 8.

1. WHat the *Aux* or *Apogæum* of the ſunne is, it hath beene partly ſhewed already: that namely it is that part, or rather point of the Orbe carying the ſunnes *Apogæum*, wherein the ſaid Orbe is thinneſt, or narroweſt: Or it is that point of the eccentrick which is furtheſt diſtant from the earth, and is alwayes ſhewed by a right line vnderſtood to be drawn from the center of the world, by the center of the eccentrick, vnto the Orbe carying the ſunnes *Apogæum*. Which line is therefore called the line of the ſun his *Aux* or the line of the ſunnes *Apogæum*.

2. The motion of the *Aux*, or of the *Apogæum* of the ſunne (which is alſo called the ſunnes *Aux* in the ſecond ſignification) is nothing els but the arch of the Ecliptick, conteyned betwene the beginning of Aries, and the line of the ſuns *Apogæum*, drawne forth to the zodiack; where this line alſo ſheweth the place of the ſunnes *Apogæum*.

3. The middle or meane place of the ſunne in the

the zodiack, is ſhewed by a line drawne from the center of the world vnto the zodiack, æquidiſtant from the center of the Eccentricke, and of the ſunne.

4 This line is therefore called the line of the meane or middle place of the ſun.

5 The middle or meane motion of the ſunne is the arch of the ecliptick betweene the beginning of Aries, and the middle place of the ſun.

6 The true place of the ſunne is ſhewed by a ſtreight line drawne from the center of the earth by the center of the ſunne vnto the zodiack, which line is therefor called the line of the true place of the ſun.

7 The true motion of the ſun is the arke of the eclipticke from the beginning of Aries, vnto the true place of the ſun.

8. The argument of the ſun (as the *Alphonſines* terme it) or the motion of the Sunnes Anomalie, (as *Copernicus* calleth it) is the arke of the ecliptick conteyned betweene the place of the ſunnes *Apogæum* and the middle place of the ſunne according to the order and ſucceſſion of the ſignes. This arch is called the argument, or motion of the ſunnes Anomalie, or irregularitie, becauſe that by it is alwayes found how much the ſuns true motion which (is vnæqual & irregular) differeth from his middle motion; which difference they call the ſuns æquation, or proſtaphæreſis.

9 The æqnation, or proſthaphæreſis of the ſun is nothing els but the arch of the ecliptick conteyned betwene the true, & middle places of the ſun.

This

This arch is called the sunnes æquation, because it maketh the suns middle motion æqual to his true motion, being added to it or subtracted from it, as occasion requireth: for which cause it is more significantly and fitly called *Prosthaphæresis*, that is as much to say, as that which is to be added to or subtracted from the middle motion, that so we might haue the true motion. For so long as the sunne is in the semicircle of his excentrick, descending from his *Apogæum* to his *Perigæum*, so long this *Prosthaphæresis* is to be subtracted from the midle motion: but the sunne being in the other halfe of his eccentrick ascending, the *Prosthaphæresis* or æquation of the sun must be added to the middle motion, that so the true motion and place of the sunne may be found. Because that in the first semicircle of the eccentricke descending, the middle place of the sunne goeth before the true place, and the middle motion is allwayes greater then the true motion of the sun, and therefore the difference of these two motions, (that is to say, the æquation or *Prosthaphæresis*) must be subtracted, to finde the true motion.

But in the other halfe ascending, it falleth out contrarywise; for the true place of the sunne goeth alwaies before the middle place, and so the true motion is greater then the middle motion, and therefore the æquation must be added to the middle motion for the finding out of the true motion and place of the same.

Of the vppermoſt Orbe of the Sphære of the moone, caryng the Dragons head and tayle.

Chap. 9.

NExt within the Orbes of the ſun in this Sphære are conteyned the Orbes of the Sphære of the moone: which are fiue in number.

The vppermoſt of them (which in this Sphære is next vnder the Orbe that caryeth the Sunnes *Perigæum* and is coloured with red) is called the Caryer of the Dragons head and tayle, or *Deferens nodos*, which is as much to ſay as the Caryer of the knots, that is of the two interſections, or pointes wherein the reſt of the Orbes of the Moone, doe croſſe ouer-thwart this Orbe. This Orbe is deuided into fowre ninetyes of degrees, for the eaſier reckoning of the motion & place of the dragons head or tayle in this ſphære. And it is moued about in 18 Iulian yeares 224 dayes 3 howres and 5 minutes almoſt, from the Eaſt Weſt-wards, vnder the Ecliptick. By reaſon of this motion it commeth to paſſe, that the eclipſes, or rather the places wherein the eclipſes of the ſunne or moone do happen in the heauens, are remoued continually, more backwards in the zodiack, contrary to the order and ſucceſſion of the ſignes.

As for example; the eclipſe of the moone happning this preſent yeare 1600. the 20 of Ianuarie neare vnto the Dragons tayle about the 9 degree & 40 minutes of *Leo*; the next eclipſe that ſhall happen neare the ſame interſection of the dragõs tayle, in the

in the yeare 1601, the 29 of Nouember, shall be in 17 degr. and an half of *Gemini*: And that eclipse which shal be the next yeare after neare the same intersection the 19 of Nouember in the morning, shal be about the 6. degree and 40 minutes of Gemini &c.

Al this remouing of the eclipses backwards cõmeth to passe, by reason of the motion of this Orbe carying the dragons head and tayle, contrary to the course and order of the signes.

The scituation of the Orbe carying the Dragons head and tayle.

This Orbe continueth alwayes right vnder, & euen with the Orbes of the sphære of the sunne, which abide alwayes in al parts iust vnder the ecliptick line, and hath his center agreeing, and all one with the center of the world, and of the ecliptick: And therefore the poles and axtree, about which this orbe is turned, agree iustly with the axtree of the Ecliptick.

The scituation of the rest of the Orbes.

The rest of the Orbes of the moone, that are conteyned within this, haue all theyr playnes agreeing in one, and lying euen one with another. But the one halfe of all their playnes, ariseth aboue the playne of the former orbe, and of the Ecliptick, towards the North pole of the zodiack: and the other half descendeth beneath the playne of the ecliptick, toward the South pole: euen as the one half of the zodiack ariseth aboue the æquinoctiall circle towards the North: and the other halfe descendeth towards the south. And as the angle of intersection, or obliquitie of the ecliptick with the æquinoctiall circle, is 23 degr. and an half or little more: so the angle of intersection, or obli-

quity of the playnes of these Orbes of the moone, from the plaine of the Ecliptick, and of the former Orbe carying the Dragons head and tayle, is 5. degrees, or (according to *Tigho Brahe* his obseruation) 5 degr. and a quarter almost sometimes, & sometimes lesse then 5 degr.

That point or intersection of these Orbs with the former, from which they begin to arise about the playne of the ecliptick towards the North, proceeding East-wards, is called the Dragons head; and is signified by this character ☊: and the other point or intersection diametrally opposite vnto this, is called the Dragons tayle, which is also signified by the former character turned vpside downe after this manner, ☋.

The two points of these orbes that are furthest distant from the plaine of the ecliptick, are called the bounds or limites of the moones latitude, and they are 90 deg. from the dragons head & tayle, & 5 deg. & a quarter almost from the playne of the Ecliptick, according to the obliquity, or greatest declination of the plaines of these orbes, frō the playn of the ecliptick: Of these two points, that which is in the north side of the ecliptick, is called the north limit, or bound of the moones latitude; and contrariwise, the other point opposit to this on the south side of the Ecliptick, is called the South limite of the moones latitude. And when the moone commeth to eyther of these two points, she hath hir greatest latitude.

Of the

Of the Orbes carying the moones Apogæum *and* Perigæum.

Chap. 10.

NExt within the orbe carying the dragons head and tayle, is contayned the orbe called *Deferens Apogæum lunæ* which is the point wherein the moon is furtheſt diſtant from the earth.

And vnder this orbe is placed the moones Eccentrick, which is alſo called *Deferens epiciclum Lunæ*, that is the orbe carying the moones Epicycle.

Againe within this eccentrick of the moone, is conteyned the leaſt and loweſt Orbe, of all that are in this Sphære, Which they call *Deferens Perigæum Lunæ*: that is, the orbe carying the moones *Perigæum*, which is the point wherein the moone commeth neareſt to the earth.

The vppermoſt and nethermoſt of theſe three orbes, that is to ſay, the orbes carying the moones *Apogæum* and *Perigæum* (both which orbes in this Sphære are coloured with blewe) are alwayes placed in ſuch ſort, that the narroweſt part of the one, is continually aunſwerable to the broadeſt part of the other; whereby it commeth to paſſe, that the ſphære of the moone is made concentricall, that is to ſay, to haue the ſame center with the world: which alſo is one eſpeciall vſe, why theſe orbes were deuided.

Another vſe of theſe Orbes, is to ſhew the reaſon of the motion of the moones *Apogæum* and *Perigæum*: Therefore both theſe orbes are moued

togither with one motion æqually, about the center of the world, in the same time from the East Westwards, in the space of 32 dayes 3 howres & 5 min. almost: So mouing in one day 11 deg. 12 min. and 1 third part almost. The axtree, about which these orbes are moued æqually, passeth through the center of the world and of the ecliptick: but the poles of these orbes differ from the poles of the Ecliptick and of the orbe carying the dragons head and tayle, by the space of 5 degr. and a quarter, or there; abouts which poles are caryed about the pols of the orbe carying the Dragons head and tayle, with the motion of the same orbe, in the space of 19 yeares almost.

Whereby it commeth to passe, that the poles of the orbe carying the *Apogæum* and *Perigæum* of the moone, describe certaine little circles about the poles of the Orbe that caryeth the Dragons head and tayle, euen as the Arcticke, and Antarcticke circle in the ordinary sphære, are described by the motion of the poles of the Eclipticke, caryed about daylie with the motion of the first and highest moueable sphære, in the space of fowre & twenty howres almost.

Of the eccentrick of the moone.

Chap. II.

THe Eccentrick of the moone conteyned betweene the two former orbes, and coloured with a sad yealow colour in this sphære, is moued æqually about the center of the same orbes, from the

the West towards the East, finiſhing his motion vnder the zodiack, in the ſpace of 27 dayes. and 8. howres almoſt: and with this motion, it carieth about the moones Epicycle æqually, vnder the zodiack.

Therefore the motion of this orbe, about his owne center, muſt needes be vnæquall: that is to ſay, ſwifter in thoſe parts that are about the *Apogæum*, and ſlower in the lower parts about the *Perigæum*: Becauſe that greater arches of the eccentrick, do aunſwere to æqual arches of the zodiack about the *Apogæum*, then about the *Perigæum* of the Eccentrick.

The axtree about which this orbe is moued, is alwayes in all places æquidiſtant from the axtree of the orbe carying the *Apogæum* of the moone: & the poles of the axtree of the moones eccentricke, are faſtned in the orbe carying the moones *Apogæum*, æquidiſtantly from the poles of the ſame orbe: therfore theſe poles togither with the whole axtree of the eccentrick, are caryed and æqually moued about the poles and axtree of the orbe carying the *Apogæum* from the East, towards the West. With this motion therfore, the poles and center of the eccentrick, deſcribe certaine little circles of æqual bignes, about the poles, and center of the Orbe carying the *Apogæum*, from the East West-wards. And therfore alſo the *Apogæum* of the eccentrick, is moued about æqually, vnder the ecliptick, contrary to the order of the ſignes frō the East West-wards. Whereby it commeth to paſſe, that both the *Apogæum*, and center of the eccentrick, are ſometimes

vnder

vnder the Ecliptick, that is, when they are vnder the Dragons head or tayle: but for the most part they are beside the plaine of the Ecliptick, either towardes the North, or els towards the South.

Hereby also it appeareth, that the plaine of the Ecliptick doth not alwayes deuide the plaine of the eccentrick into æquall parts or halfs; but then onely, when the center and *Apogæum* of the Eccentrick, is right vnder the Dragons head or tayle; for then onely the playne of the ecliptick deuideth the playne of the Eccentrick, by the center thereof; and consequently deuideth it præcisely into two halfes. Otherwyse, if the *Apogæum* of the eccentrick, be not vnder the dragōs head or tayle, looke on which side of the plaine of the ecliptick the *Apogæum* is, for on the same side of the Ecliptick is the greater part of the eccentrick.

In what proportion the the moones eccentrick, and orbe, carying her Apogæum *are moued.*

Chap. 12.

NOw the Eccentrick of the moone, & the orbe carying her *Apogæum*, are moued in such sort, that the middle place of the sunne, is alwayes right in the midst betweene the center of the Epicyle caried in the eccentrick, and the *Apogæum* of the Eccentrick; except it be when the center of the epicycle is in coniunction, or opposition to the middle place of the sunne. For in euery middle coniunction and opposition of the sunne and moone, the center

of

of the epicycle, and the *Apogæum* of the eccentrick are vnited togither; But in the coniunction they are both conioyned with the middle place of the sun; & in the oppositon they are both togither opposite to the same. Wherof it followeth, that in the first & last quarters of the moone, the center of hir epicycle is diametrally opposite to the *Apogæum* of her eccentrick.

Hereof it commeth to passe, that although the moone haue the same position in her epicycle at the time of the new and full moone, and of the first and last quarters; yet the æquation, or prosthaphæresis of the moones Argument (as they call it) that is the difference betweene the true, and middle places of the moone, is alwayes greater in the first and last quarter, then in the full and new moone. Hereby likewyse it appeareth that in the time contayned betweene new moone and new moone (which they cal *mensem synodicũ*, that is the moneth coniunctional, or the time from coniunction to coniunction) the center of the epicycle maketh two complete reuolutions, vnder the orbe carying the *Apogæum* of the moones eccentrick.

And therefor in euery moneth, the center of the epicycle commeth twise to the *Apogæum* & twise to the *Perigæum* of the eccentrick; and so the monthly motion of the center of the Epicycle, describeth an oual figure: the endes whereof are alwayes towards the place of the ful & new moone, & the sides towards the places of the first & last quarter.

By this that hath beene spoken, it is also manifest, that if the middle motion of the sunne be, sub-

tracted out of the middle motion of the moone, there remaineth the middle motion of the moones longitude from the sunne, and that if this longitude againe be doubled, you shall haue the motion of the center of the moones Epicycle from the *Apogæum* of her eccentrick, which motion they call the center of the moone.

Of the Epicycle of the moone, and how it is moued.

Chap. 13.

THe little orbe placed in the Eccentrick, is called the Epicycle of the moone; in the circumference whereof is also placed the bodye of the moone, represented by the round beade, set into the moones epicycle in this sphære.

The plaine superficies of this epicycle, agreeth euen with the plaine of the eccentrick: and the axtree about which it is moued, is perpendicular to the plaine of the eccentrick. This Epicycle is moued æqually from his middle *Apogæum*, about his owne center and axtree from the East West-wards, contrary to the motion of the eccentrick, carying forwards the body of the moone with this motion 13 deg. and almost 4 min. euery day, and finishing his reuolution in 27 dayes 13 howres and 19 minut. almost.

The middle *Apogæum* of the Epicycle is shewed by a right line, imagined to be drawne, from that point of the little circle (described by the motion of the center of the moones eccentrick) which is oppo-

oppoſite to the center of the eccentrick, by the center of the epicycle vnto the vpper part of the Epicycle.

But the true *Apogæum* of the epicycle, is ſhewed by a right line, vnderſtood to be drawne from the center of the earth, by the center of the Epicycle, vnto the vppper part of the circumference therereof.

By the motion of this epicycle it may eaſely be conceyued why the moone ſeemeth to moue ſometimes ſwifter & ſometimes ſlower: For ſeeing that the vpper part of the Epicycle, moueth contrarye to the motion of the eccentrick from the East weſtwards, when the moone commeth in that part, ſhe muſt needs ſeeme to moue more ſlowely, to them that are at the center of the world. Why the moone ſeemeth ſometimes to moue ſwifter, ſometimes ſlower.

But when the moone commeth in the nether part of the Epicycle, the eccentrick caryeth the epicycle, and the epicycle carieth the body of the moone both one way; that is, from the weſt Eaſtwards, and therefore at that time the moone ſeemeth to moue more ſwiftly. According as you may ſee in the Ephemerides, the diurne motion of the moone to be ſometimes little more then 11 degr. and ſometimes againe little leſſe then 15 deg. The true motion of the moone ſeemeth then to be ſwifter, when the moone is in the *Perigæum* of her Epicycle, and the epicycle in the *Perigæum* of the eccentrick; becauſe then ſhe is not onely caryed forwards the ſame way both by her epicycle and eccentrick, but ſhe is alſo at that time neareſt vnto vs:

for which cause her motion shall seeme swifter, then when the epicycle is in other parts of the Eccentrick.

The definitions of certaine astronomicall wordes of art, for the better vnderstanding of the theorick of the Moone.

Chap. 14.

1. THe line of the moones middle motion, is a line vnderstood to be drawne from the center of the earth, by the center of the moones Epicycle, vnto the zodiack.

2. This line sheweth the middle place of the moone in the zodiack.

3. And the middle motion of the moone, is the arch of the zodiack, from the beginning of Aries, vnto the same line.

4. So likewise the line of the true motion, or of the true place of the moone, is drawne from the center of the world, by the center of the moone, to the zodiack.

5. This line therefore sheweth the true place of the moone in the zodiack.

6. And the true motion of the moone, is the arch of the zodiack, from the beginning of Aries, vnto the true place of the moone.

7. The middle longitude of the moone from the Sunne, is the arch of the zodiack, from the middle place of the Sun eastwards vnto the middle place of moone.

8. And this arch doubled, is called the doubled

bled longitude of the moone from the Sunne, or the center of the Moone (as the *Alphonsines* cal it) which is nothing els but the arch of the zodiacke, betwene the place of the *Apogæum* of the eccentrick and the middle place of the moone. It is called the doubled longitude of the moone from the sun, because it is alwayes twice so much, as is the middle longitude of the Moone from the sun.

9. And it is called the center of the moone, because it sheweth the distaunce of the center of the Moones Epicycle from the *Apogæum*.

10 The æqnation, or *Prostaphæresis* of the center, is the arch of the epicycle, betweene the middle & true *Apogæum* of the epicycle.

This æquation or *Prosthaphæresis*, is nothing at all, when the center of the epicycle is in the *Apogæum*, or *Perigæum* of the eccentrick. But the epicycle being in any other part of the Eccentricke there is alwayes some æquation of the center; yea in some parts thereof, where it groweth greatest, it is 13 deg. 9 minutes: and so long as the center of the epicycle, is in the half of the eccentrick descending from the *Apogæum* to the *Perigæum*, that æquation is to be added to the motion of the epicycle; but in the other halfe of the Eccentrick ascending, it must be subtracted; that so the true Argument or Anomalie of the Epicycle may be had.

11 The Argument, or Anomalie of the Moone is nothing els, but the motion of the Moones Epicycle.

12. The true or middle argument, or Anomalye, is the arch of the Epicycle from the true or

middle *Apogæum* of the Epicycle, vnto the center of the body of the moon, reckoned that way, which the epicycle moueth.

13 The æquation of the argument, or *Prosthaphæresis* of the epicycle, is the arch of the zodiack, betweene the middle, & true place of the Moone. This æquation is nothing, when the moone is in the true *Apogæum*, or *Perigæum* of her epicycle. But it is greateſt, when the center of the moone commeth to the line, drawne out of the center of the world, and touching the epicycle, when it is in the *Perigæum* of the eccentrick.

And the moone being in the firſt, that is in the Weſterly half of the Epicycle, counted from the true *Apogæum* therof, the middle place of the moon goeth before the true place, and the æquation of the argument muſt therefore be ſubtracted: but when the moone is in the other latter, and eaſterly ſemicircle of the Epicycle, the true place goeth before the middle place, & ſo that æquation muſt be added to the moones middle motion, that the true motion and place of the moone may be found.

The reaſon of the variety of the Moones æquation ſhewed by this ſphære.

Chap. 15.

THis æquation becommeth leſſer or greater, according as the epicycle is further of, or nearer to the center of the world. The leaſt æquations are, when the epicycle is in the *Apogæum* of the eccentrick,

trick, & contrarywise, the greatest must happen, the epicycle being in the *Perigæum* of the eccentrick.

The difference betweene these greatest, & least æquations, *Ptolemee* and *Copernicus* call the excesse: but *Purbachius*, and the *Alphonsines*, call it the diuersitie of the diameter; because that difference of the æquations, ariseth by reason of the diuerse apparent bignesse of the diameter of the Epicycle, according as it is nearer to vs, or further from vs.

Therefore in the Astronomicall tables, they vse to set downe those æquations only, which happen when the Epicycle is in the *Apogæum* of the eccentrick, which are the least æquations, whereto they also adioyne the excesse, or diuersity of diameter, shewing how much those æquations, which happen when the Epicycle is in the *Perigæum* of the Eccentrick, exceede those which happen, the epicycle being in the *Apogæum* of the eccentrick. Moreouer, there are annexed certaine min. which they call *Scrupula*, or *minuta proportionalia*: that is, proportionall minutes: whereby is found, how much of the sayd excesse, is to be added to the foresayd æquations, when the epicycle is in any other part of the eccentrick, then in the *Apogæum*: that so the true æquation of the argument, for the same part of the eccentrick might at any time be found. For then onely is that whole excesse to be added, when the epicycle is in the *Perigæum* of the eccentrick. But if the epicicle be in any other part of the eccentrick; then looke what proportion 60 hath to the whole excesse, the same proportion haue the proportionall minutes, answerable to that part of the

eccen-

centrick, wherein the epicycle is, vnto the part proportional of the exceſſe, which (part proportionall) being added to the æquation before found, ſhall giue you the true æquation.

The reaſon of the moones proportionall minutes ſhewed by this Sphære, and how to finde the ſame.

Chap. 16.

THe reaſon of thoſe proportional minutes, may in ſome ſort be ſhewed, by thoſe concentricall arches of circles, which you ſee drawne vpon the moones eccentricall orbe, in this ſphære: but indeede all thoſe arches muſt be vnderſtood, to haue alwayes the ſame center with the world, and not to be moued about togither with the eccentrick. The vppermoſt of them is to be drawne by the center of the epicycle being in the *Apogæum* of the eccentrik, and the nethermoſt is drawne by the ſame center when it is in the *Perigæum* of the eccentrick: ſo as the diſtaunce of theſe two arches, or peripheryes, is iuſt twiſe ſo much as the eccentricitie; that is the diſtaunce of the center of the eccentrick, from the center of the world, ſhewed by the diſtaunce of the ſhort lines NO, or FF, vpon the orbe carying the *Apogæum*; or of PQ, or GH, vpon the caryer of the *Perigæum* of the moone.

The whole diſtance, betwene theſe two peripheryes, from the vttermoſt to the innermoſt, is vnderſtood to be deuided into 60 æqual parts, imagining euery one of theſe to conteyn 10: as may appeare by the figures ſet to euery one of them, from the vppermoſt

most to the nethermost in this order 10 20 30 40 50 60.

Now the intersections of these *Peripheries* with the eccentrick (that is, with the vppermost of the two deuided *peripheries*, which are drawne round about through the midst of the moons eccentrical orbe) do shew what proportionall, min. answere to any part of the eccentrick, after this manner: In the vppermost of the two foresayd graduated *peripheries*, looke that distance of the center of the moones epicicle from the *Apogæum* of the eccentrick, (that is to say) that doubled longitude of the moone as the *Alphonsines* cal it) which you desire Then looke which of the concentricall arches before mentioned passeth by the terme, or end of that distãce, or doubled longitude: And thirdly, looke about in the same arch, what number is set therupon for that sheweth you the number of the proportionall minutes, aunswereable to the situation of the epicicle, at that distaunce from the *Apogæum* of the eccentrick.

These proportional min. therfore may be defined to be nothingels, but the sixtyth parts of the diuersityes of diameters, of the excesse where with the æquations of the argument, or *prosthaphæreses* of the Epicycle: are to be augmented, when the epicyle is any other part of the Eccentrick, then in the *Apogæum*.

Otherwyse also, these proportional min. may be defined, to be sixtieth parts of the excesse, wherewith the line drawn from the center of the earth, to the *Apogæum* of the moones eccentrick, exceedeth the line drawne from the same center to the *Perigæum* of the eccentrick For these sixtieth parts also may not vnfitly be called propotional minutes, because that alwayes, looke how many of these parts there are left without the circumference of the eccentrick, or beyond the center of the

epicycle; so many of the former sixtyeth parts of the diuersity of diameter, or of the excesse of the *prostaphæresis* of the Epicycle, must be added to the æquation of the argument, that the true æquation of the argument may be had, for that position, or situation of the Epicycle, in the eccentrick.

The reason of the eclipses of the Sunne and moone, shewed by this Sphere. Chap. 17.

NOw by this sphære, it may easely be conceyued, why there is not an eclipse, in euery coniunction or oppositon of the sun & moone. For seeing that the moone hath for the most part a greater apparent latitude, then the visible or apparent conioyned semidiameters of the sun & moone in the coniunction: & because the true latitude of the moone, is also for the most part greater then the apparent semidiameters of the moone and shadow of the earth (at that place where the moone should passe through that shadow) in the opposition, to make an eclipse: it commeth to passe, that in most coniunctions & oppositions of the sun & moone, there is no eclipse. And the reason hereof is this, because that the moone commeth vnder the way of the sun (which we called the ecliptick line) onely twise in a moneth, and those two points (wherein the wayes of the sun & moon crosse each other) only twise in a synodical month, which two points we called the dragons head & tayle; (wherof we haue also spoken before.) Wherfore, seeing the sun (going but once onely through the compasse of the eliptick in a yeare) can come but once in a yeare to eyther of those points; the moone for the most part, when she commeth to be in oppositon, or coniunction with the sun, must needes

be so

be so farre wide from the ecliptick line, or way of the sun, either towards the north or south: that she can neither come betwixt vs and the sunne in the coniunction, nor yet within the compasse of the shadow of the earth in the opposition.

But when the sun commeth neare eyther of those points (which hapneth once in six months) there must needs for the most part be some eclipse, eyther of the sunne, or moone, or both.

Of the diuersitie of the bounds or spaces, within which an eclipse may happen: and the reason of that diuersitie. CHAP. 18.

THe bounds or distances from the Dragons head or taile, within which there may happen an eclipse of the moone, are sometimes greater, and sometimes lesse, by reason of the diuerse distances of the sunne, or moone, or both of them, from the earth. For seing the body of the sun is greater then the globe of the whole earth (as it is manifestly demonstrated by *Ptolemy* and *Copernicus*) it must needs be, that the greater distaunce the sunne hath from the earth, the greater shadowe must the earth haue; and the nearer the sunne is to the earth, the lesse shadow shal the earth haue, at the place of the moones passage through the shadow, at æquall distances from the earth.

Contrariwyse, the further that the moone is from the earth, the lesse shall the shadow of the earth be, & the nearer the moon is to the earth, the greater shal the shadow be, at the place where the moone is to passe through the shadow.

The greatest distaunce therefore from the dragons head or taile, wherin there can at any time happen any

eclipse of the moone, is about 13 degr. And the least distaunce at which it is possible for the moon to auoid an eclipse, is about 10 degr. and one third part of a degree; which hapneth when the moone is in the *Apogæum* of her epicicle, in her greateſt distaunce from the earth, and the sun in his *Perigæum*, in the time of his greateſt eccentricity, for then the sunne commeth neareſt to the earth and maketh the least shadow: as contrariwise at the same time of his greateſt eccentricitie, being in his *Apogæum*, he hath his greateſt distance frō the earth, and so maketh the earth cast forth hir greateſt shadow. At which time, if the moone also chance to be in the *Perigæum* of hir epicycle, and so in hir neareſt distance from the earth, she may be somethinge eclipsed, although she be full 13 deg. or somthing more from the Dragons head or tayle.

How to finde the place of the Dragons head or tayle for any time. Chap. 19.

NOw the place, and time of the full moone, being easely knowne, by some almanack, or Prognostication; it shall not be hard, to giue a reasonable neare estimate, and to foretell both the time, and quantitye of the eclipse of the moone, the place of the Dragons head & tayle, being first knowne after this manner.

The place of the dragons head, being first giuen for any time, for euery yeare before the same time, adde to the same place: & for euery yeare after the same time subtract 19 degr. & one third part of a deg & for euery moneth a deg. & an half & a tenth part of a deg. & for euery day 3 min. & the remainder shall shew you the place of the dragons head after the same time: or the same before that time, without any great errour.

As

As for example, the 30 of Iune this present yeare 1600, suppose you would know the place of the Dragons head: The place therefore of the Dragons head being first giuen, for the beginning of the same yeare, in 0 degr. 45 min, of *Aquarius*: and six moneths onely of that yeare being passed, I take for those six moneths 6 deg. and 6 half deg. that is 9 deg. and six tenth parts of a deg. that is 36 min. the summe of al which is 9 deg. and 36 minutes.

Which being subtracted out of 0 deg, 45 min. of *Aquarius*, there remaine 21 deg. 9 min. of Capricorne, for the place of the Dragons head at that time.

A table for finding the place of the dragons head and taile more exactly and the declaration thereof.

Chap. 20.

BVt if you would haue the place of the Dragons head more exactly, you may finde the same most easely, by meanes of the table following, for any time within the space of these 20 yeares yet to come.

This table conteyneth 3 principal parts, or columns the first part sheweth you in what signe, degr. and min. the dragons head is, at the beginning of any yeare; frō this present yeare 1600 till the yeare 1620. The second part sheweth, how much the Dragons head moueth, in any number of moneths of the yeare: the third part giueth you the motion of the dragons head, in any number of dayes of the moneth.

At the beginning of the yeares of our Lord.

The place of the Dragons head.				Moneths			Day	Day	
Yeare	Sign.	Deg.	Mi.	Complete.	De.	Mi.		De.	Mi.
1600	Aquarius	0	45	Ianuar.	1.	38	1	0.	3
1601	Capricorne	11	21	Februar.	3.	8	2	0.	6
1602	Sagittari.	22	2	March	4.	46	3	0.	10
1603	Sagittari.	2	42	April	6.	22	4	0.	13
1604	Scorpio	13	22	Maye	8.	0	5	0.	16
1605	Libra.	23	59	Iune	9.	36	6	0.	19
1606	Libra.	4	39	Iulie	11,	14	7	0.	22
1607	Virgo	15	19	Augvst.	12.	53	8	0.	25
1608	Leo	25	59	Septemb.	14	28	9	0.	29
1609	Leo	6	35	October	16.	7	10	0.	32
1610	Cancer	17	15	Novemb.	17.	42	11	0.	35
1611	Gemini	27	55	Decemb.	19.	23	12	0.	38
1612	Gemini	8	35				13	0.	41
1613	Taurus	19	12				14	0.	44
1614	Aries	29	52				15	0.	48
1615	Aries	10	32				16	0.	51
1616	Pisces	21	12				17	0.	54
1617	Pisces	1	49				18	0.	57
1618	Aquarius	12	29				19	1.	0
1619	Capricor.	23	9				20	1.	4
1620	Capricor.	3	49				21	1.	7
							22	1.	10
							23	1.	13
							24	1.	16
							25	1.	19
							26	1.	13
							27	1.	26
							28	1.	29
							29	1.	32
							30	1.	35

To finde the place of the Dragons head or tayle, by the former table.

Chap. 21.

FInde out in the former table, the moneth next going before the moneth giuen; finde out also the day of the moneth, Adde togither the numbers of degrees and minutes answerable to that moneth and day of the moneth, & subtract the same out of the place of the Dragons head at the beginning of the yeare, adding thereto 30 degr. (that is the whole signe next going before resolued into degr.) if the sunne aforesayd be greater then the number of degr. shewing the place of the dragons head at the beginning of the yeare: so shall you haue the place of the Dragons head for the time giuen And the point of the zodiack opposite to this, is the place of the Dragons taile.

Take for example, the 29. of Nouember 1601. I finde therfore against October (the moneth going next before Nouember) 16 deg. 7 min. & against the 29 day 1 deg. 32 min. the summ of both these added togither is 17 deg. 39 min. The place of the dragons head for the beginning of the yeare 1601 is 11 deg. 21 min. of of Capric. which because they be lesse then 17 deg. 39. min. I add vnto them 30 degr. that is the whole signe of Sagittarie, and the summe of both is 41 degrees 12 minutes, out of which subtract 17 degrees 39 minutes and there shal remaine 23 degrees 42 minutes of Sagittarie; the place of the dragons head at that time. And the point of the zodiack which is opposite hereto (that is the 23 deg. 42 min. of Gemini) is the place of the Dragon: tayle.

To know at what time there shal be an eclipse of the moone. Chap. 22.

THe place of the dragons head being thus knowne, finde out the same place vpon the horizon of the sphære, and see what day and moneth answereth thereto: finde out also the place of the full moone, which hapneth next before or after that day, which

which place if it chaunce to be within 11 or 12 degr eyther before or after that point of the zodiack which is oppoſite to the dragons head, there muſt needes be for the moſt part an eclipſe of the moone.

Likewyſe if you finde what day and moneth is aunſwerable to the place of the dragons tayle vpon the horizon of the ſphære if the place of the full moone which happeneth next before or after that day chaunce to be within 11 or 12 degr. of the dragons head, for the moſt part there ſhall be an eclipſe of the moone.

As for example The 20 day of Ianuarie laſt this preſent yeare 1600 the place of the dragons head was fownd (by the former Chap.) to haue beene in 29 deg. 41 min. of Capricorne; where to ther anſwereth in the horizon the 10 day of Ianuary the place of the full moone happning next after, vpon the 20 of the ſame moneth in the morning muſt needs be in the place oppoſite to the place of the ſunne the ſame 20 day: Therefore becauſe the ſunne that day is in 9 degr. and about on half of Aquarius, therfor the place of the full moone ſhall be in 9 degr. and about one half of the ſigne oppoſite to Aquarius that is of Leo; becauſe it is within leſſe then 12 degr. of the dragons tayle (for the dragons tayle is in the 29 deg. 41 min. of Cancer that is in the place oppoſite to the dragons head, being in the 29 deg. 41 min. of Capricorne) therefore there was at that time an eclipſe of the moone: Alſo becauſe the place of the moone, the ſame day at noone, was about 12 degr. and on halfe of Leo; that is, about 3 deg. more then at the time of the ful moone eclipſed; it may hereby appeare abating for euery deg. 2 howres, that the midſt of the eclipſe was about 6 of the clok in the morning.

FINIS.