Satellites that come to paſs conformable to the calculus of *Caſſini*, and differ days and hours from the calculus and predictions made upon the hypotheſes of *Galilæi*: Beſides that there ſhould happen a great many which do not happen according to the ſyſtem of *Caſſini*. *E.g.* according to the hypotheſis of *Galilæi*, the fourth of the Satellites ſhould have more than 90 Eclipſes in a year, of the duration of three or four hours; but according to the ſyſtem of *Caſſini*, the ſame Satellit will be three or four years without ſuffering any Eclipſe. Which proceeds from nothing but the falſe ſcituation of the Orbs ſuppoſed by *Galilæi*; as the great difference of the time of the Eclipſes that happen depends from this, that neither *Galilæo* nor the other Aſtronomers do ſeparate from the proper motion of the Satellites the appearances which do befal it by that of *Jupiter* about the Sun. And therefore 'tis, that they have taken for a ſimple and equal motion a motion compounded of an equal and unequal; whence they have ſlipped into an error about the Mean motions, which in progreſs of time hath ſo increaſed, that the Configurations drawn from their hypotheſes for that time have almoſt no likeneſs at all with thoſe that are obſerved.

Theſe old hypotheſes were therefore far off from ſerving to find the Longitudes, as their Authors intended them; ſince it was impoſſible for them not only to obſerve the Eclipſes of the Satellites for ſome years to the nearneſs of an hour, but even to make us know and diſtinguiſh at this time one Satellit from another, whereas by the Syſtem of Signor *Caſſini* one may predict for many years to come the Eclipſes of the Satellites with as much preciſeneſs, as thoſe of the Sun and Moon by the Aſtronomical Tables.

Methodus directa & Geometrica, cujus ope inveſtigantur Aphelia, Eccentricitates, Proportioneſque orbium Planetarum primariorum, abſque ſuppoſita æqualitate anguli motûs, ad alterum Ellipſeos focum, ab Aſtronomis hactenus uſurpatâ. Auth. *Edmundo Hally* Jun. è Collegio Reginæ *Oxon.*

MOtus Terræ annuus per Eclipticam, opticam inæqualitatem inducit motibus cæterorum planetarum, Aſtronomis Copernicanis *nomine Parallaxeos orbis notiſſimam; quam quidem inæqualitatem, ex obſervationibus non multâ operâ datam, methodi ſequentis baſin firmiſſimam conſtituo; ubi præter obſervata nihil aliud ſupponitur, quàm quòd orbes Planetarum ſint Ellipſes, quódque Sol in foco, omnium orbibus communi, ſit conſtitutus, & denique, quòd tempora periodica*

ſingulorum

ſingulorum ita innoteſcant, ut non ſentiatur error aliquis, ſaltem in duabus vel tribus revolutionibus: His conceſſis, motus Terræ, pro cæteris Planetis neceſſariò requiſitus, primò aggrediendus eſt.

Tab.I. Fig.2. *Sit* S *Sol*; ABCDE, *orbis Terræ*; P, *Planeta* ♂ *Mars*, (*qui in hanc rem plurimis de cauſis longè præferendus eſt*;) *& primò obſervetur verum tempus & locus, quo* ♂ *Mars opponitur Soli*; *tunc enim Sol & Terra coincidunt in lineam rectam cum Marte*; *vel*, (*quod fere ſemper accidit*) *ſi habuerit latitudinem, cum puncto, ubi perpendicularis à Marte demiſſa in planum Eclipticæ incidit. Sic in* Schemate, S, A, *&* P *ſunt in linea recta*; *deinde poſt* 687 *dies, Mars revertitur ad idem punctum* P, *ubi in priori obſervatione Soli opponebatur*; *Terra verò, cùm non revertatur ad* A, *niſi poſt* 730½ *dies, in* B, *Solem reſpicit in linea* SB, *Martem verò in linea* BP, *& obſervatis longitudinibus Solis & Martis, omnes anguli Trianguli* PBS *dantur, & ſuppoſitâ* PS 100000, *in iiſdem partibus invenitur longitudo lineæ* SB; *pari ratione poſt alteram Martis periodum, Terra exiſtente in* C *invenitur linea* SC, *nec abſimiliter lineæ* SD, SE, SF; *differentiæque obſervatorum locorum Solis, ſunt anguli ad Solem* ASB, BSC, CSD, DSE: *Sic tandem ventum eſt ad hoc problema Geometricum*: Datis tribus lineis, in uno Ellipſeos foco coeuntibus, tam longitudine quàm poſitione, invenire longitudinem tranſverſæ diametri, cum diſtantiâ focorum: *Cujus reſolutio extenditur etiam ad reliquos planetas, ſi, poſt Theoriam motûs Terræ cognitam, ſcrutemur* (*ſecundum methodum propoſitam à Reverendiſſ. Epiſcopo* Sarisburienſi *in* Aſtronomia *ejus* Geometricâ lib. 2. part. 2. cap. 5.) *tres diſtantias planetæ alicujus à Sole in poſitionibus ſuis. Quoniam verò Rev. Epiſcopus ſupponit planetam ita ferri in orbe ſuo, ut æqualibus temporibus æquales angulos ad focum alterum Ellipſeos abſolvat, & ei calculum ſuum ſuperſtruit, non incongruum videtur, oſtendere, quomodo id ipſum fieri poſſit abſque iſta ſuppoſitione, quam obſervatio nos rejiciendam monet.*

Tab.I. Fig.3. *Sit* S, *Sol*; ALBK, *orbis Terræ*; P, *Planeta, vel Punctum in plano Eclipticæ, ubi perpendicularis, à planeta demiſſa, incidit*; AB *linea Apſidum orbis Terræ*: *Obſerventur primò Planetæ, in* P, *longitudo & latitudo, ſimulque Solis Longitudo à Terra in* K; *& poſt periodum ejuſdem planetæ, Terra exiſtente in* L, *obſerventur denuo poſitiones Planetæ Soliſque, ut prius*: *Jam ex obſervatis longitudinibus Solis & Aphelii Terræ, anguli* ASK, ASL *dantur, & conſequenter latera* SK, SL: (*Nam ſi angulus Anomaliæ coæquatæ ſit* acutus, *proportio eſt, ut differentia diſtantiæ mediæ & Co-ſinus anguli in Eccentricitatem ducti, ad diſtantiam Apheliam, ita Perihelia diſtantia, ad diſtantiam Planetæ à Sole in datâ Anomaliâ: quòd ſi angulus fuerit* obtuſus, *primus terminus proportionis*

onis est summa duarum partium, quarum in priori analogia fuit differentia : Hujus Theorematis demonstrationem neminem Analytices modicè peritum latere posse arbitror, & idcirco ei supersedeo:) Jam in Triangulo KSL *dantur latera* KS, LS, *& angulus* KSL, *quæruntur Latus* KL, *& anguli* SKL, SLK: *Deinde in Triangulo* KLP, *dantur* KL, KLP, *differentia observatarum Longitudinum planetæ, &* PKL *differentia angulorum* SKL *ultimò inventi, &* SKP *Elongationis Planetæ à Sole in prima observatione , quæritur* LP : *Tum in Triangulo* LSP, *latera* LS, LP, *& angulus* PLS *elongatio Planetæ à Sole in secunda observatione, dantur; latus* SP *& angulus* LSP *requiruntur, quibus inventis, ut* SP *ad* LP, *ita Tangens Latitudinis observatæ ex* L, *ad Tangentem Inclinationis sive Latitudinis ad Solem; & ut Co-sinus Inclinationis ad Radium, ita* SP *curtata distantia, ad veram distantiam planetæ à Sole : Sic tandem invenimus positionem & longitudinem desideratam. Jam restat ut ostendam, quomodo ex datis tribus distantiis à Sole cum angulis interceptis, invenienda sit media distantia cum Eccentricitate Ellipseos.*

Sit S *Sol, &* SA, SB, SC *tres distantiæ in debita positione, ductisque* AB, BC, *sit* AB *distantia focorum Hyperbolæ, &* SA-SB=EH *transversa diameter ; quibus positis, describatur linea ista Hyperbolica, cujus focus interior est punctum* A, *extremitas lineæ longioris* SA : *Pari modo sint* B, C, *foci alterius Hyperbolæ , cujus diameter* SB-SC=KL; *ex quibus describatur linea Hyperbolica focum habens interiorem in puncto* B : *Dico has duas Hyperbolas sic descriptas sese intersecare in puncto* F, *qui est alter Ellipseos quæsitæ focus, ductâque lineâ* FA, FB, *vel* FC, SA+FA, SB+FB *vel* SC+FC *æquabitur transversæ diametro, &* SF *est distantia focorum : quibus positis descriptio Ellipseos facillima est. Cùm verò hujus constructionis ratio non omnibus ita facile percipiatur, non abs re erit, illustrationem ejus aliquam afferre ; Ideò dico, quòd ex notissima Ellipseos proprietate* SB+FB=SA+FA, *& transpositis æquationis partibus* FB-FA=SA-SB , *ita ut etiamsi* FB *&* FA *nos lateant, earum tamen differentia æqualis sit* SA-SB , *hoc est*, EH, *cúmque sit ex natura Hyperbolæ , ut habeat quasvis duas lineas à suis focis ad quodvis punctum in sua curva constanter differentes quantitate transversæ diametri; constat, punctum* F *esse alicubi in curva Hyperbolæ, cujus diameter transversa æquatur* SA-SB, *& Foci* A, B : *Pari modo demonstrari potest punctum* F *esse in Hyperbola cujus diameter est* SB-SC , *& foci* B, C. *Ergo necesse est, ut sit in intersectione duarum istarum Hyperbolarum, quæ, cùm sese intersecent in unico solum puncto, clarè ostendunt ubi sit Focus alter Ellipseos quæsitæ.* Tab. I. Fig. 4.

Jam ut id ipsum Analyticè expediatur, puta factum, sitque FE=1, SA-SB=FB-FA=b , AB=c, SB-SC=FC-FB=d, BC=f, *sitque Sinus anguli* ABC=S, *Co-sinus ejusdem*=s.

Tum

Tum ut c *ad* b, *ita* 2a-b *ad* $\frac{2ab-bb}{c}$ *&* $\frac{2ab-bb+cc}{2c}$ $=$ BD *per* 36. 3 Eucl. *& ut* f *ad* d, *ita* 2a+d *ad* $\frac{2ad+dd}{f}$ *&* $\frac{ff-2ad-dd}{2f}$ $=$ BG *per eandem*, *& ut minuatur labor calculi sit* $\frac{cc-bb}{2c}=g$ *&* $\frac{b}{c}=h$, *similiter sit* $\frac{ff-dd}{2f}=k$ *&* $\frac{d}{f}=l$, *tunc* $DB=g+ha$, *&* $BG=k-la$; *& quoniam in omni*

Per 12 & 13 lib. 2. Eclid.

Triangulo {*obtusangulo* / *acutangulo*} *quadratum basis æquatur* {*summæ* / *differentiæ*} *summæ quadratorum laterum*, *& dupli rectanguli laterum in Cosinum anguli comprehensi ducti*, *erit* $gg+2gha+hhaa+kk-2kla+llaa+2gks-2glsa+2khsa-2hlsaa$ *æqualis quadrato* DG: *Sed* DG *æqualis est sinui Anguli* DFG *vel* DBG *in* a, *id est* FB *ducto*, (*est enim quadrilaterum* FBDG *circulo*, *cujus diameter est* FB, *inscriptum*;) *ideo* $SSaa=gg+2gha+hhaa+kk-2kla+llaa+2gks-2glsa+2khsa-2hlsaa$; *quæ æquatio facile resolvitur*, *cùm non excedat quadraticam affectam*, *semperque componitur ex istis Quadratis & Rectangulis*; *signa tamen* + *&* -- *ob diversam trium linearum constitutionem multâ cautione sunt rectangulis adhibenda. Nostram æquationem aptavimus figuræ* IV, *sed in alio quovis casu non erit difficile attendenti*, *ex iis quæ superius tradidimus*, *similem constituere. Sic tandem absolvi propositum meum*, *& ostendi*, *quomodo ex tribus locis Heliocentricis Planetæ*, *& distantiis à Sole observatis*, *describi possit Orbita istius Planetæ*; *quod non nisi quinque talibus observationibus hactenus effectum vidimus.*

An

Tab. I

Ph. Tr. N° 128

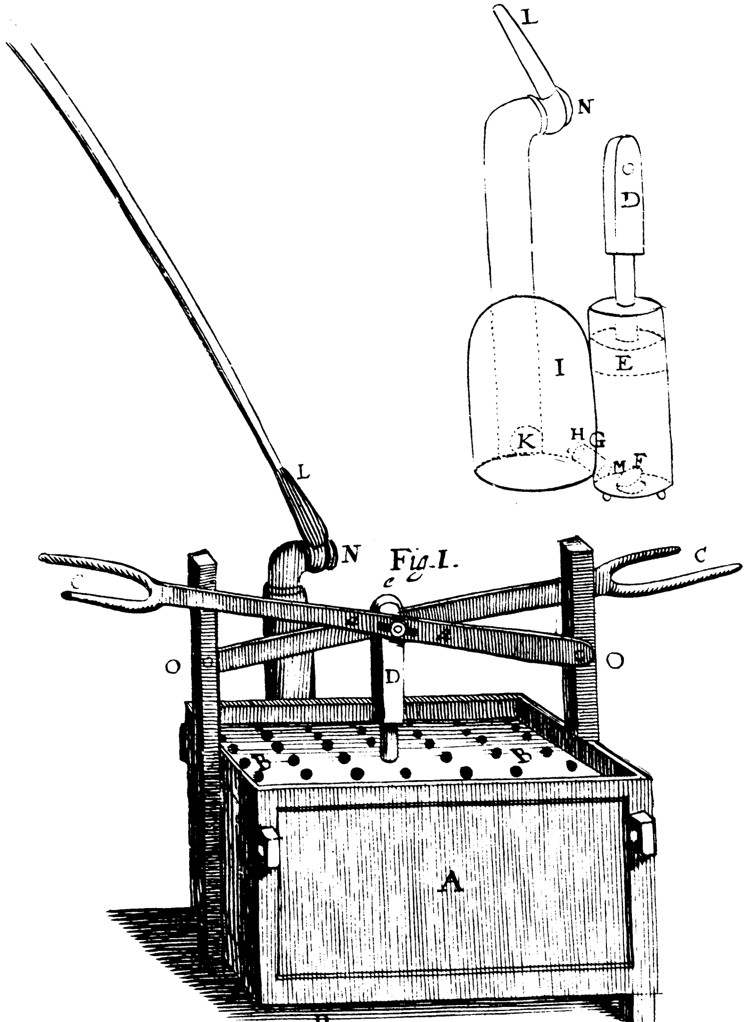

Fig. I.

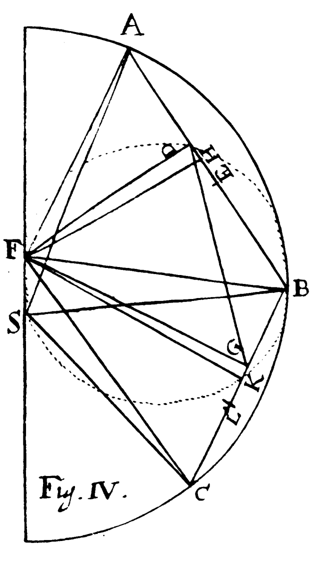

Fig. IV.

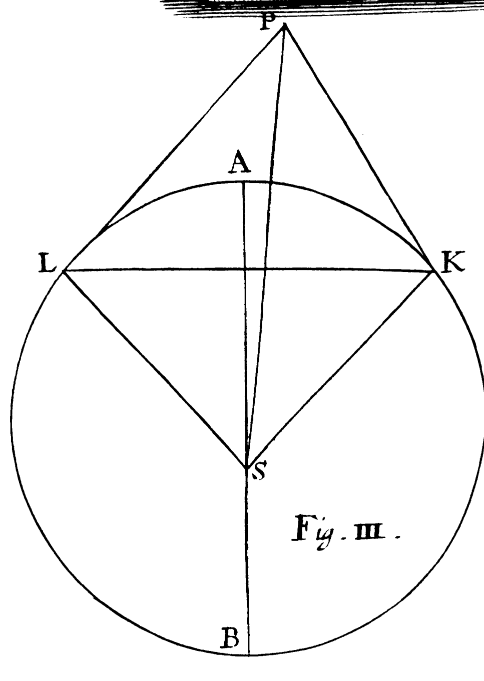

Fig. III.

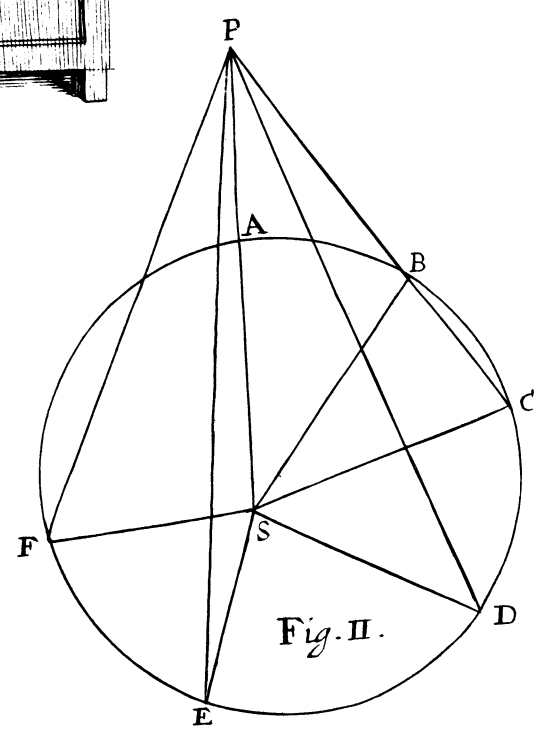

Fig. II.