

*An Extract of Mr. Flamsteeds Letter of April. 19. 1673. containing some more accurate Observations of his own, about Jupiter's Transits near some Fixed Stars; useful for determining the Inclination of that Planet to the Ecliptique.*

SIR,

THE inclosed Paper contains some Observations of *Jupiter*, which being made from a more convenient Station, than I commonly have used, are more accurate than my former ones: And, the Planet being in a fit place of his Orbit, they are the most useful for determining his *Inclination* to the *Ecliptique*, that we can again expect this six years, or perhaps before he returns again to this place. Had the Latitudes of the Fix't Stars of *Tycho's* constitution been exact and coherent, we should easily have determined the *precise* quantity of this Inclination and those regular Inequalities we find in this and in all the other Planets, which are found irrepresentable by numbers, only by reason of some latent errors in the Places and Latitudes of the Fixed.

It would be a task deserving the pains and accuracy of the Learned *Cassini*, and of all others that have good Observatories and Instruments, to endeavour the Restoring of the Fix't Stars, especially of those that are near the *Ecliptique*. Had I only a convenient place for observing, a ready Assistant, and other necessary accommodations, I should not doubt in a few nights to rectifie many of *Tycho's* errors; and to add some Stars to his Catalogue, as well visible to the bare eye, (yet omitted,) as Telescopical ones.

I have made lately some Observations of the utmost Elongations of the three Inmost *Satellites*; which I find greater than Signor *Cassini* states them, but almost the very same with Mr. *Townley's*. But I have just cause to suspect some Excentricity in the *third*; for I find (except I mistook in my measures, which, I think, I could not possibly do,) its Elongation greater on the one hand of *Jupiter* than on the other. I intend, at another opportunity, to make more Tryals as carefully as I can, either to confirm or destroy this observation.

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Ob-

## Observationes ipsæ Joh. Flamstedii.

Quas tibi Jovis, prope Fixas transeuntis, observationes jam antea, Clarissime Oldenburgi, impertii, ejus in Tabulis motus fieri tardiores quam in cælis, (quod & Horroccio pridem subluerat,) evidentissime ostenderint: Latitudines etiam observata, minores semper supputatis, vel satis non promotum Nodi locum, vel justo latiorem Plani orbitæ Jovialis inclinationem constitutam, videbantur innuere. Nodum, numeris Rudolphinis promotiorem cælis poni, à suis observationibus reperire scribit Clar. Cassinus: Orbitæ minorem esse aliquantulum inclinationem ad Eclipticam, quam statuit Keplerus (si Fixarum latitudinibus, in catalogo Tyconica exaratis, fideadum est,) ab observationibus infra descriptis ostendam.

Anno instanti 1673. Martii 13. st. Jul. vesperi, Jupiter Aphelium, pronus ad phasin Acronicam, & limitem orbitæ Boreum paululum transgressus, Retrogradus incessit versus 9<sup>mo</sup> m<sup>o</sup> lucis 4<sup>te</sup>, è qua (alto eo sex circiter gradus) limbi ejus remotissimi distantiam, septempedali tubo & micrometro Townleiano capi 4560 = 52' - 34".

Martii 17 die 5<sup>ta</sup>, circa hora dimidiam post exortum Jovis, ejus, eodem tubo, limbi remotissimi à Fixa cepi iterum distantiam 2073 = 23' - 54".

Martii 20. die 4<sup>ta</sup>, è loco multum commodiori, sequentes habui observationes. Primam breviori tubo, digitorum tantum 85, reliquas longiori, videl. 164. dig. V. Fig. 2.

Fix. alt	hor. sup		Limbi. ph.	Centri.
1 6 — c	7 — 14	Limbi 4 <sup>te</sup> remotioris à Fixa distantia —	850 9	48 9 — 24
2 . . . . .	. . . . .	Eadem distantia tubo majori capta —	1650 9	52 9 — 28
3 14 — 4c	8 — 16	Limbus 4 <sup>te</sup> infimus depressior ac fixa —	784 4	41 4 — 17
4 15 — 4c	8 — 23	Altitudinum eadem: repetita differentia —	786 4	41 4 — 17
5 . . . . .	. . . . .	Jovis diameter —	135 0	48
6 16 — 25	8 — 29	Limborum iterum capta distantia —	1665 9	57 9 — 33
7 . . . . .	. . . . .	Denuo —	1658 9	54 9 — 30
8 19 — 0c	8 — 50	Differentia altitudinum limbi 4 <sup>te</sup> & Fixa —	838 5	0c 4 — 36

Inde ad diem 26. nubes & pluvia, continua ferè, Jovis omnem observationem prohibuere; hujus tamen vesperi, cælo præter spem factò sereno, alto 2<sup>te</sup>. 15° - 40°, limbi sui remotioris à Fixa distantiam, eodem minori tubo, dimensus sum 4205 = 48'. 30".

Nocte etiam proximâ sequente, Jovem à Fixa plus remotum vidi; sed accuratè metiri distantiam, nubium, cæli locum subtercurrentium, spiritibus haud permisit;

Ad

Ad Planeta locum ex his annotationibus eliciendum, struclis supputationibus, invenio

	hor.	<sup>h.</sup>	<sup>o</sup>	<sup>'</sup>	<sup>"</sup>	hora	<sup>h.</sup>	<sup>o</sup>	<sup>'</sup>	<sup>"</sup>
Angulum parallacticum	34	44				37	30			
Centrum $\Upsilon$ is à Fixa distitit			9	28		9	39			
Altitudinum differentia erat			4	17		4	36			
Ergo, Angulus erat positionis	80	06				78	21			
Et Joviter in antecedentia Fixa			1	38		1	55			
cum latitudine minori			9	19 $\frac{1}{2}$		9	18			

Fixa mihi locus, accepto motu annuo 50", erit  $\approx 13^{\circ} - 37' - 11''$ ; quem vult author Carolinus  $13^{\circ} - 33' - 47''$ ; latitudo ejus Borea  $1^{\circ} - 45'$ : Locus ergo verus Jovis erit mihi,

h.	<sup>o</sup>	<sup>'</sup>	<sup>"</sup>	} Latitudo vera	<sup>o</sup>	<sup>'</sup>	<sup>"</sup>
Hora 8 — 16	13	35	33		1	35	40 $\frac{1}{2}$
8 — 50	13	35	16		1	35	42.
	X <sup>2</sup> 117.				X <sup>1</sup> 1 $\frac{1}{2}$ .		

Jovis tunc locus in Ephemeride Heckeri est  $\approx 13 - 22$ , justo minor, satem 14' min. Motus retrogradus est 8' min. Propterea scrupulis hora 34' recesserit Planeta scrupulos secundos 11" fere; nostra observatio dat 17"; quae exigua differentia ejus precisionem admodum commendat.

At Fixa concessio loco Carolino, prodibit  $\Upsilon$ ' locus  $\approx 13^{\circ} - 32' - 09''$ . qui ab istis Tabulis eruitur  $13^{\circ} - 27' - 32''$ , à caelis suis deficiens 4' - 37" latitudo ab iis supputata reperietur  $1^{\circ} - 37' - 21''$ , caelos exsuperans 1' - 41".

Loco sic Planetae cum latitudine, & Tabularum à caelis deviationibus perceptis, ne commodissima observationis ulteriorem summumq; fructum perdamus, Orbitæ Jovialis ad Terrestris orbitæ Planum inclinationem inde eruere conabimur.

Huic equidem inveniende, unâ cum loco Solis, ejusdem, Jovis, & Terra intermutua distantia postulantur: quas à Tabulis quibusvis probatoribus tutissimè haurire licet: Ego Tabulis utor plerumque Carolinis; quippe quas, ut nonnunquam deviantes, caelorum motibus propius annuentes, accuratiores, & faciliores ceteris omnibus comperi, ex quibus ad 8 h. — 16' p.m. deprompsi;

Solis locum verum  $\Upsilon$  10<sup>o</sup> - 40' - 18".

distantiam à Terra ————— 100084

Jovis à Sole distantiam ————— 544921

a Terra ————— 444952

Fam in apposita figura 3. sint, S Sol, T Terra,  $\Upsilon$  Planeta, S E Radius Eclipticæ, ad  $\Upsilon$ ' orbitam protensa, & angulus  $\Upsilon$  T S, visa Planeta à Terra Latitudo  $1^{\circ} - 35' - 40\frac{1}{2}$ .

Ex datis (in triangulo  $\Upsilon$  S T) angulo,  $\Upsilon$  T S, visa latitudinis ad Circulum complemento;  $\Upsilon$  S, &  $\Upsilon$  T, Planeta à Sole & Terra distantis, ut supra, repertis, eruetur angulus  $\Upsilon$  S E, latitudo sive Inclinatio Planetae à Sole inspecta, 1<sup>o</sup>. 18'. 7.

Jovis.

Jovis locus Geo-centricus erat  $\approx 13^{\circ} 35' 33''$ ; ab iis ergò datis  $\sphericalangle$  & Parallaxis orbis invenitur  $32'. 00''$ . quæ loco Jovis Geo-centrici Subducta locum dabit Helocentricum.

Terra à Sole distantis, invenietur locus Helocentricus planetæ  $\approx 13^{\circ} 03' 33''$ ; è quo subductis sigillatim iis nodi locis, quos auctores, quorum nomina in sequenti tabella exaravimus, assumserunt, annexa produnt argumenta Latitudinis; è quibus videre est, nullis plus Jovem à limite promotum haberi quàm  $6^{\circ} 29' 56''$ , nec minus quàm  $3^{\circ} 58' 59''$ , quæ, quantavis videtur differentia, in maxima orbita inclinatione investienda, errorem scrupulis secundis  $23''$  majorem inferre nequit.

Autbores	$\delta$ loca	Argumenta latitudinis
Keplerus	3-06-33-37	3-06-29-56
Streetius	3-06-33-47	3-06-29-46
Wingius	3-07-11-39	3-05-21-54
Ricciolus	3-07-18-00	3-05-45-33
Cassinus	3-08-45-00	3-04-18-33
Bullialdus	3-09-04-34	3-03-58-59

plus Jovem à limite promotum haberi quàm  $6^{\circ} 29' 56''$ , nec minus quàm  $3^{\circ} 58' 59''$ , quæ, quantavis videtur differentia, in maxima orbita inclinatione investienda, errorem scrupulis secundis  $23''$  majorem inferre nequit.

Iste nodi locus, quem Clarissimus Cassinus elegerit, mihi eti-

am si aliquantulum justo promotior videtur, magis tamen ceteris, variis de causis, placet: sumptis propterea, in Triangulo  $\sphericalangle A \delta$ , argumento latitudinis  $\delta A 94^{\circ} 18' 33''$ , & inclinatione  $\sphericalangle A I 1^{\circ} 18' 07''$ , eruetur Angulus inclinationis plani orbitæ Jovialis ad Eclipticam  $1^{\circ} 18' 20''$ ; quem statuunt Keplerus  $1^{\circ} 19' 00''$ , Streetius  $1^{\circ} 20' 00''$ . Bullialdus & Wingius  $1^{\circ} 21' 48''$ ; omnes, justo nonnihil majorem. V. h. 4.

Tantumque esse inclinationem, vel saltem non majorem, cum hesternæ noctis, tum Mensium Februarii, Martii & Maii Anni elapsi observationes suadent. Interea verò non dissimulandum, posse & majorem (scilicet  $1^{\circ} 20' 20''$ ) à transitu  $\sphericalangle$  prope  $8^{\text{m}}$   $\text{nx}$ , Anno 1649. Maii 29 & 30, St. Juliano, Bononiæ & Majorcæ à Ricciolo \* &

\* vid. Almag. Novum part. I. pag. 710.

Muto, viris doctissimis, observato, demonstrari: id quod nobis (si quidem orbitalium inclinationes ab omnibus invariabiles habentur,) videtur innuere, errorem vel huic, vel illis Fixarum latitudinibus à Tycho assignatis, inesse aliquem: quæ propterea donec accuratius restituantur, à præcisa hujus Inclinationis quantitate determinanda merito nos arcent: Hoc tantum, quoniam fixarum ea latitudines etiam immutabiles reperiuntur, ausim affirmare; Angulum maximæ inclinationis plani orbitæ Jovialis ad Eclipticam minorem esse scrupulis  $26' 40''$  quam latitudo stellæ  $9^{\text{æ}}$   $\text{nx}$  lucis  $4^{\text{æ}}$ , quæ Tycho dicitur, ultima quatuor in sinistra ala Virginis: quæ propterea si quando correctæ dabitur, eadem eerta dabitur inclinatio.

J.F.

Derbitæ, Apr. 16.

1673.