

*Treatise of the usefulness of great Optick-Glasses*, where he also intends to deliver several Experiments, by him made, 1. Touching the quantity of Light, which a Body, that is 10. 15 and 20 times, &c. remoter than *Saturn*, would yet receive from the *Sun*. 2. Touching the quantity of Light, by which the *Earth* is illuminated even in the *Eclipses* of the *Sun*, in proportion of their bigness. 3. Touching the quantity of Light, which is necessary to burn Bodies: he having found, that not abating the Light, which is reflected by the Surfaces of the Glafs (whereof he confesseth, he doth not yet exactly know the quantity) there wou'd be necessary about 50 times as much Light, as we have here, for the burning of *Black* Bodies; and near 9 times more for the burning of *White* Bodies, than for the burning of *Black* ones: and so observing the immediate proportions between these two, for burning Bodies of *other* Colors. Whence (he tells us) he hath drawn some consequences, touching the distance, at which we may hope, to burn Bodies here, by the means of *great Glasses* and *great Looking-glasses*. So that (*saieth he*) we must yet be seven times neerer the *sun*, than we are, to be in danger of being burned by it. Where he mentions, that having given *Instructions* to certain persons, gon to travel in *Hot Countries*, he hath among other particulars recommended to them, to try by means of *great Burning-glasses*, with how much less *Aperture* they will burn *there*, than *here*, to know from thence, whether there be more Light *there* than *here*; and how much; since this perhaps may be the only means of trying it, supposing, the same matters be used: although the difference of the Air already heated both in *hot Countries*, and in the *Planets*, that are neerer than we may alter, if not the quantity of Light, at least that of the Heat, found there.

*A further Account, touching Signor Campani's Book and Performances about Optick-glasses.*

In the above-mentioned *French* Treatise there is also contained *M. Auxout's* Opinion of what he had found New in the *Treatise* of Signor *Campani*, which was spoken of in the first *Papers* of their *Transactions*, concerning both the Effect of the *Telescopes*, contrived after a peculiar way by the said *Campam* at *Rome*, and his

his New Observations of *Saturn* and *Jupiter*, made by means thereof.

First therefore, after that M. *Auzout* had raised some scruple against the Contrivance of Signor *Campani* for making *Great Optick-Glasses* without *Moulds*, by the means of a *Turn-lath*, he examines the *Observations*, made with such *Glasses*: Where, having commended *Campani*'s sincerity in relating what he thought to have seen in *Saturn*, without accomodating it to M. *Hugens*'s *Hypothesis*, he affirms, that supposing, there be a *Ring* about *Saturn*, Signor *Campani* could not see in all those different times, that he observed it, *the same Appearances*, which he notes to have *actually* seen. For, having seen it sometimes in *Trine Aspect* with the *Sun*, and *Oriental*; sometimes, in the same *Aspect*, but *Occidental*; sometimes in *sextil Aspect*, and *Occidental*; at another time, again in *Trine*, and *Oriental*, this Author cannot conceive, how *Saturn* could in all these different times have no difference in its *Phasis*, or keep always the same *Shadow*; seeing that, according to the *Hypothesis* of the *Ring*, when it was *Oriental*, it must cast the *Shadow* upon the *left* side of the *Ring* beneath, without casting any on the *right* side: and when it was *Occidental*, it could not but cast it on the *right* side beneath, and nothing of it on the other.

Concerning the *Shadow above*, which *Campani* affirms to be made by the *King* upon the Body of *Saturn*, M. *Auzout* judges, that there could be no such *Phenomenon*, by reason of its *Northern Latitude* at the times, wherein the *Observations* were made, *vid.* in *April* 1663; in the midst of *August*, and the beginning of *October*, next following, and in *April* 1664, except it were in *October*, and the *Shadow* strong enough to become *visible*.

But as to the *Shadow below*, he agrees with *Campani*, that it does appear, yet not as he notes it, seeing that it must be sometimes on the one side, sometimes on the other; and towards the *Quadrat* with the *Sun* it must appear biggest, as *indeed* he affirms to have seen it himself *this* year, inso much that sometimes it seemed to him, that it covered the whole *Ring*, and that the *Shadow*, joyning with the obscure space between both, did interrupt the circumference of the *Ring*; but beholding it at other times in a clear Sky, and when there was no *Trepidation* of the Air,

he thought, that he saw also the Light continued from without, although very slender. But he acknowledges, that he could never yet *precisely* determine, by how much the largeness of the *Ring* was bigger than the *Diameter* of *Saturn's* Body. As for the proportion of the Length to the Breadth, he affirms, to have alwaies estimated it to be two and a half, or very neer so; and to have found in his *Observations*, that in *January* last, one time, the length of *Saturn* was 12 *Lines*, and the breadth 5. Another time, the length was 12 *Lines*, and the breadth 4. and this by a peculiar method of his own. But yet he acknowledges also, that sometimes he hath estimated it as 7, to 3. and at other times as 13. to 5. and that if there do not happen a change in the magnitude of the *Ring* (as it is not likely there does) that must needs proceed from the Constitution of the air, or of the *Glass's* having more or less *Aperture*, or from the difficulty of making an exact estimate of their proportions. However it is not much wide (saith he) of two and an half, although *Campani* make the length of the *Ring* but double to its breadth.

Monfieur *Auxout* believes, that he was one of the first that have well observed this shadow of *Saturn's* Body upon its *Ring*; which he affirms happened two years since; when, observing in *July*, for the first time, with a *Telescope* of 21. and then another of 27. foot, he perceived, that the *Angle* of the obscure space on the *right side* beneath, was bigger and wider, than the three other *Angles*, and that some interruption appear'd *there*, between the *Ring*, and the *Body of Saturn*; of which he saith to have given notice from that time to all his friends, and in particular, as soon as conveniently he could, to Monfieur *Hugens*.

He confesseth, that he hath not had the opportunity of observing *Saturn* in his *Oriental Quadrat*; yet he doubts not, but that the *shadow* appears on the *Left-side*, considering, that the *Existence* of the *Ring* can be no longer doubted of, after so many *Observations* of the *shadow* cast by *Saturn's* Body upon it, according as it must happen, following that *Hypothesis*; there being no reason, why it should cast the said *shadow* on one side, and not on the other.

Concerning the Observation of *Jupiter* and its *satellites*, the famous *Astronomer* of *Bononia*, *Cassinus*, having published,

lished, that on the 30. day of *July*, 1664. at 2 $\frac{1}{2}$  of the clock in the morning, he had observ'd, with *Campani's* Glasses, that there pass'd through the broad obscure *Belt* of *Jupiter* two obscurer spots, by him esteem'd to be the *shadows* of the *Satellites*, moving between *Jupiter* & the *Sun*, and eclipsing him, and emerging from the Occidental Brim thereof: This *Author* did first conceive, that they were not *shadows*, but some *Sallies*, or *Prominencies* in that *Belt*; which he was induc'd to believe, because he perceiv'd not, that that *Prominency*, which he there saw, was so black, nor so round as *Cassini* had represent'd his spots; wherefore, seeing it but little differing in colour, from the *Belt*, and so not judging it round, because it did stand only about half its diameter out of the *Belt*, he persuad'd himself, that it was rather a *Sally*, or *Prominency* of the *Belt*, than a round *shadow*, as that of a *Satellite* of *Jupiter* must have bin. But having been since inform'd of all the *Observations* made by *Cassini* and *Campani*, with the *New* Glasses, and seen his *Figure*, he candidly and publickly wisheth, that he had not spoken of that *Sally*, or *Prominency*; avowing that he can doubt no longer, but that it was the *shadow* of the *Satellit* between *Jupiter* and the *Sun*, having seen the other emerge, as soon as with a 20. foot Glass he made the *Observation*, and having not perceiv'd these *shadows* with a 12. foot Glass. But although he grants that they did ghes better than he, yet he doth it with this *proviso*, *vid.* in case they made that *Observation* of *July* 30. not with their 36. but 12. or 17. foot *Telescope*. If it be wondred at, that *Monsieur Auxout* did not see this *shadow* move, he allegeth his indisposition for making long *Observations*, and addeth, that it may be much more wondred at, that neither *Campani* nor himself did see upon the obscure *Belt* the Bodies of the *Satellites*, as parts more Luminous than the *Belt*. For (saith he) although the *Latitude* was *Meridional*, it being no more than of 9. or 10. minutes, the Body of the *Satellites* should, thinks he, pass between us and the *Belt*, especially according to *Campani*, whomaketh the *Belt* so large, and puts the *shadows* farr enough within the same. This maketh him conclude, that either they have not observed well enough, or that the motion of the *Satellites* doth not exactly follow the *Belts*, and is inclin'd unto them. Whereupon he resolves, that when he shall know that they are to pass between *Jupiter* and us, and to be over against the *Belt*, that then

then he will observe, whether he can see them appear upon the *Belt*, as upon a darker ground, especially, the *third* of them, which is sensibly greater, and more Luminous, than the rest. He hopeth also, that in time, the *Shadow* of *Saturns Moon* will be seen upon *Saturn*, although we are yet some years to stay for it, and to prepare also for better Glasses.

From this rare Observation, he inferrs the *Proportion* of the *Diameter* of the *Satellites* to that of *Jupiter*; and judgeth, that no longer doubt can be made of the turning of these 4. *Satellites*, or *Moons* about *Jupiter*, as our *Moon* turns about the *Earth*, and after the same way as the rest of the Celestial Bodies of our *Systeme* do move: whence also a strong conjecture may be made, that *Saturns Moon* turns likewise about *Saturn*.

Hence he also taketh occasion to intimate, that we need not scruple to conclude, that if these two *Planets* have *Moons* wheeling about them, as our *Earth* hath one that moves about it, the conformity of these *Moons* with our *Moon*, does prove the conformity of our *Earth* with those *Planets*, which carrying away their *Moons* with themselves, do turn about the *Sun*, and very probably make their *Moons* turn about them in turning themselves about their *Axis*; and also, that there is no cause to invent perplex'd and incredible *Hypotheses*, for the receding from this *Analysie* since (saith he) if this be truth, the Prohibitions of publishing this doctrine, which formerly were caused by the offence of Novelty, will be laid aside, as one of the most zealous Doctors of the contrary Opinion hath given cause to hope, witness *Eustachius de Divinis*, in his *Tract* against Monsieur *Hugen's Systeme* of *Saturn*, p. 49. where we are inform'd, that that learned Jesuit, *P. Fabry*, Penitentiary of *S. Peter* in *Rome*, speaks to this purpose:

\* *It hath been more than once asked of your Chieftains, whether they had a Demonstration for asserting the motion of the Earth? They durst never yet affirm they had; wherefore nothing hinders, but that the Church may understand those Scripture-places, that speak of this matter, in a literal sense, and declare they should be so understood, as long as the contrary is not evinced by any demonstration; which*

\* Ex vestris, iisque Coryphæis non semel quæsitum est, utrum aliquam haberent demonstrationem pro Terræ motu adstruendo. Nunquam autem sunt id asserere. Nil igitur obstat quin loca illa in sensu literali Ecclesiæ intelligat, & intelligenda esse declaret, quamdiu nulla demonstratione contrarium evin-

which, if perhaps it should be found out by you (which I can hardly believe it wil) in this case the Church will not at all scruple to declare, that these places are to be understood in a figurative and improper sense, according to that of the Poet, Terræque Urbesque recedunt.

citur; quæ si fortè aliquando à vobis excogitetur (quod vix crediderim) in hoc casu nullo modo dubitabit Ecclesia declarare, loca illa in sensu figurato & improprio intelligenda esse, ut illud Poetæ, Terræque Urbesque recedunt.

Whence this Author concludes, that the said *Jesuite* assuring us that the *inquisition* hath not *absolutely* declared, that those Scripture-places are to be understood *literally*, seeing that the *Church* may make a contrary declaration, no man ought to scruple to follow the *Hypothesis* of the *Earths motion*, but only forbear to maintain it in *publick*, till the prohibition be called in. But to return to the matter in hand, this Author, upon all these observations and relations of *Cassini* and *Campani*, doth find no reason to doubt any more of the excellency of the Glasses used by them, above his; except this difference may be imputed to that of the *Air*, or of the *Eys*. But yet he is rather inclined to ascribe it to the goodness of their Glasses, and that the rather, because, he would not be thought to have the vanity of magnifying his own; of which, yet he intimates by the by, that he caused one to be wrought, of 150 *Parisian* feet; which though it proved none of the best, yet he despairs not to make good ones of that, and of far greater Length.

### Signor Campani's Answer: and Monsieur Auzout's Animadversions thereon.

The other part of this *French Tract*, containing *Campani's* Answer, and Mr. *Auzout* his *Reflections* thereon, begins with the pretended *Shadows* of the *Ring* upon *Saturn*, and of *Saturn* upon the *Ring*. Concerning which, the said *Campani* declareth, that he never believed them to be *shadows*, made by the *Ring* upon the *Disk* of *Saturn*, or by the body of *Saturn* upon the *Ring*, but the *Rimms* of these bodies, which being *unequally* Luminous, did shew these appearances. In which Explication, forasmuch as it represents, that the said *Campani* meant to note only the *Inequality of the Light*, which, he saith, his Glasses did discover, Mr. *Auzout* does