

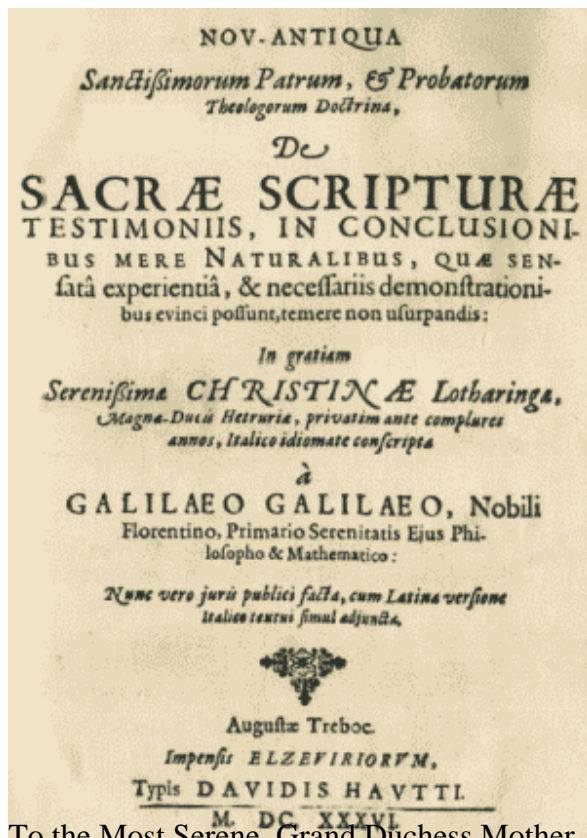


[Galileo Galilei](#) [1]

1615

*Discoveries and Opinions of Galileo*, 1957

It lasted four centuries since February 1615, when Galileo Galilei wrote an important [Letter to Mary Christine of Lorraine](#) [2], the mother of Cosimo de' Medici, the Duke of Tuscany, in the court of whom Galileo worked as mathematician and philosopher. This letter is entirely dedicated to the relationship between scientific knowledge and biblical exegesis. In those years, the Italian scientist endorsed the heliocentric Copernican system which, still lacking clearly established physical proofs, was considered by the theological establishment as contrary to sacred Scripture's teachings. Intuiting troubles and misunderstandings coming soon, by this letter Galileo intended to gain Madame Christina's protection against Roman opponents to heliocentrism. Galileo's anxiety became reality on March 3, 1616, when the Holy Office judged heliocentric thesis as theologically erroneous and asked the scientist to hold it only "*ex suppositione*", that is, as a mathematical resort having no necessary relationship with the real development of phenomena. The *Letter to Mary Christine of Lorraine* is a small, precious treatise of biblical exegesis, based on St. Augustine's doctrine, especially his work [De Genesi ad litteram](#) [3], a letter that Galileo probably wrote not without the help of clergy scholars, friends of him, promoters of Copernican system as well. Since 1615, also thanks to the "Galileo Affair", science and theology have better acknowledged their proper ambits and roles. However, we cannot exclude that new misunderstandings might rise also in the future. For this reason, Galileo's *Letter* remains a hallmark in the history of the relationship between science and theology, a text of the past still inspiring the present.



To the Most Serene, Grand Duchess Mother

Some years ago, as Your Serene Highness well knows, I discovered in the heavens many things that had not been seen before our own age. The novelty of these things, as well as some consequences which followed from them in contradiction to the physical notions commonly held among academic philosophers, stirred up against me no small number of professors—as if I had placed these things in the sky with my own hands in order to upset nature and overturn the sciences. They seemed to forget that the increase of known truths stimulates the investigation, establishment, and growth of the arts; not their diminution or destruction. Showing a greater fondness for their own opinions than for truth, they sought to deny and disprove the new things which, if they had cared to look for themselves, their own senses would have demonstrated to them. To this end they hurled various charges and published numerous writings filled with vain arguments, and they made the grave mistake of sprinkling these with passages taken from places in the Bible which they had failed to understand properly, and which were ill suited to their purposes. These men would perhaps not have fallen into such error had they but paid attention to a most useful doctrine of St. Augustine's, relative to our making positive statements about things which are obscure and hard to understand by means of reason alone. Speaking of a certain physical conclusion about the heavenly bodies, he wrote: “Now keeping always our respect for moderation in grave piety, we ought not to believe anything inadvisedly on a dubious point, lest in favor to our error we conceive a prejudice against something that truth hereafter may reveal to be not contrary in any way to the sacred books of either the Old or the New Testament.” (1)

Well, the passage of time has revealed to everyone the truths that I previously set forth; and, together with the truth of the facts, there has come to light the great difference in attitude between those who simply and dispassionately refused to admit the discoveries to be true, and those who combined with their incredulity some reckless passion of their own. Men who were well grounded in astronomical and physical science were persuaded as soon as they received my first message. There were others who denied them or remained in doubt only because of their novel and unexpected character, and because they had not yet had the opportunity to see for themselves. These men have by degrees come to be satisfied. But some, besides allegiance to their original error, possess I know not what fanciful interest in remaining

hostile not so much toward the things in question as toward their discoverer. No longer being able to deny them, these men now take refuge in obstinate silence, but being more than ever exasperated by that which has pacified and quieted other men, they divert their thoughts to other fancies and seek new ways to damage me. I should pay no more attention to them than to those who previously contradicted me—at whom I always laugh, being assured of the eventual outcome—were it not that in their new calumnies and persecutions I perceive that they do not stop at proving themselves more learned than I am (a claim which I scarcely contest), but go so far as to cast against me imputations of crimes which must be, and are, more abhorrent to me than death itself. I cannot remain satisfied merely to know that the injustice of this is recognized by those who are acquainted with these men and with me, as perhaps it is not known to others. Persisting in their original resolve to destroy me and everything mine by any means they can think of, these men are aware of my views in astronomy and philosophy. They know that as to the arrangement of the parts of the universe, I hold the sun to be situated motionless in the center of the revolution of the celestial orbs while the earth rotates on its axis and revolves about the sun. They know also that I support this position not only by refuting the arguments of Ptolemy and Aristotle, but by producing many counter-arguments; in particular, some which relate to physical effects whose causes can perhaps be assigned in no other way. In addition there are astronomical arguments derived from many things in my new celestial discoveries that plainly confute the Ptolemaic system while admirably agreeing with and confirming the contrary hypothesis. Possibly because they are disturbed by the known truth of other propositions of mine which differ from those commonly held, and therefore mistrusting their defense so long as they confine themselves to the field of philosophy, these men have resolved to fabricate a shield for their fallacies out of the mantle of pretended religion and the authority of the Bible. These they apply, with little judgment, to the refutation of arguments that they do not understand and have not even listened to.

First they have endeavored to spread the opinion that such propositions in general are contrary to the Bible and are consequently damnable and heretical. They know that it is human nature to take up causes whereby a man may oppress his neighbor, no matter how unjustly, rather than those from which a man may receive some just encouragement. Hence they have had no trouble in finding men who would preach the damnability and heresy of the new doctrine from their very pulpits with unwonted confidence, thus doing impious and inconsiderate injury not only to that doctrine and its followers but to all mathematics and mathematicians in general. Next, becoming bolder, and hoping (though vainly) that this seed which first took root in their hypocritical minds would send out branches and ascend to heaven, they began scattering rumors among the people that before long this doctrine would be condemned by the supreme authority. They know, too, that official condemnation would not only suppress the two propositions which I have mentioned, but would render damnable all other astronomical and physical statements and observations that have any necessary relation or connection with these. In order to facilitate their designs, they seek so far as possible (at least among the common people) to make this opinion seem new and to belong to me alone. They pretend not to know that its author, or rather its restorer and confirmer, was Nicholas Copernicus; and that he was not only a Catholic, but a priest and a canon. He was in fact so esteemed by the church that when the Lateran Council under Leo X took up the correction of the church calendar, Copernicus was called to Rome from the most remote parts of Germany to undertake its reform. At that time the calendar was defective because the true measures of the year and the lunar month were not exactly known. The Bishop of Fossombrone, then in charge of this matter, assigned Copernicus to seek more light and greater certainty concerning the celestial motions by means of constant study and labor. With Herculean toil he set his admirable mind to this task, and he made such great progress in this science and brought our knowledge of the heavenly motions to such precision that he became celebrated as an astronomer. Since that time not only has the calendar been regulated by his teachings, but tables of all the motions of the planets have been calculated as well. Having reduced his system into six books, he published these at the instance of the Cardinal of Capua (2) and the Bishop of Culm (3). And since he had

assumed his laborious enterprise by order of the Supreme Pontiff, he dedicated this book *On the celestial revolutions* to Pope Paul III. When printed, the book was accepted by the holy Church, and it has been read and studied by everyone without the faintest hint of any objection ever being conceived against its doctrines. Yet now that manifest experiences and necessary proofs have shown them to be well grounded, persons exist who would strip the author of his reward without so much as looking at his book, and add the shame of having him pronounced a heretic. All this they would do merely to satisfy their personal displeasure conceived without any cause against another man, who has no interest in Copernicus beyond approving his teachings.

Now as to the false aspersions which they so unjustly seek to cast upon me, I have thought it necessary to justify myself in the eyes of all men, whose judgment in matters of religion and of reputation I must hold in great esteem. I shall therefore discourse of the particulars which these men produce to make this opinion detested and to have it condemned not merely as false but as heretical. To this end they make a shield of their hypocritical zeal for religion. They go about invoking the Bible, which they would have minister to their deceitful purposes. Contrary to the sense of the Bible and the intention of the holy Fathers, if I am not mistaken, they would extend such authorities until even in purely physical matters—where faith is not involved—they would have us altogether abandon reason and the evidence of our senses in favor of some biblical passage, though under the surface meaning of its words this passage may contain a different sense I hope to show that I proceed with much greater piety than they do, when I argue not against condemning this book, but against condemning it in the way they suggest—that is, without understanding it, weighing it, or so much as reading it. For Copernicus never discusses matters of religion or faith, nor does he use arguments that depend in any way upon the authority of sacred writings which he might have interpreted erroneously. He stands always upon physical conclusions pertaining to the celestial motions, and deals with them by astronomical and geometrical demonstrations, founded primarily upon sense experiences and very exact observations. He did not ignore the Bible, but he knew very well that if his doctrine were proved, then it could not contradict the Scriptures when they were rightly understood. And thus at the end of his letter of dedication, addressing the pope, he said: “If there should chance to be any exegetes ignorant of mathematics who pretend to skill in that discipline, and dare to condemn and censure this hypothesis of mine upon the authority of some scriptural passage twisted to their purpose, I value them not, but disdain their unconsidered judgment. For it is known that Lactantius—a poor mathematician though in other respects a worthy author—writes very childishly about the shape of the earth when he scoffs at those who affirm it to be a globe. Hence it should not seem strange to the ingenious if people of that sort should in turn deride me. But mathematics is written for mathematicians, by whom, if I am not deceived, these labors of mine will be recognized as contributing something to their domain, as also to that of the Church over which Your Holiness now reigns.” (4)

Such are the people who labor to persuade us that an author like Copernicus may be condemned without being read, and who produce various authorities from the Bible, from theologians, and from Church Councils to make us believe that this is not only lawful but commendable. Since I hold these to be of supreme authority, I consider it rank temerity for anyone to contradict them—when employed according to the usage of the holy Church, Yet I do not believe it is wrong to speak out when there is reason to suspect that other men wish, for some personal motive, to produce and employ such authorities for purposes quite different from the sacred intention of the holy Church. Therefore I declare (and my sincerity will make itself manifest) not only that I mean to submit myself freely and renounce any errors into which I may fall in this discourse through ignorance of matters pertaining to religion, but that I do not desire in these matters to engage in disputes with anyone, even on points that are disputable. My goal is this alone; that if, among errors that may abound in these considerations of a subject remote from my profession, there is anything that may be serviceable to the holy Church in making a decision concerning the Copernican system, it may be taken and utilized as seems best to the superiors. And if not, let my book be torn and



burnt, as I neither intend nor pretend to gain from it any fruit that is not pious and Catholic. And though many of the things I shall reprove have been heard by my own ears, I shall freely grant to those who have spoken them that they never said them, if that is what they wish, and I shall confess myself to have been mistaken. Hence let whatever I reply be addressed not to them, but to whoever may have held such opinions.

The reason produced for condemning the opinion that the earth moves and the sun stands still is that in many places in the Bible one may read that the sun moves and the earth stands still. Since the Bible cannot err, it follows as a necessary consequence that anyone takes an erroneous and heretical position who maintains that the sun is inherently motionless and the earth movable.

With regard to this argument, I think in the first place that it is very pious to say and prudent to affirm that the holy Bible can never speak untruth—whenever its true meaning is understood. But I believe nobody will deny that it is often very abstruse, and may say things which are quite different from what its bare words signify. Hence in expounding the Bible if one were always to confine oneself to the unadorned grammatical meaning, one might fall into error. Not only contradictions and propositions far from true might thus be made to appear in the Bible, but even grave heresies and follies. Thus it would be necessary to assign to God feet, hands, and eyes, as well as corporeal and human affections, such as anger, repentance, hatred, and sometimes even the forgetting of things past and ignorance of those to come. These propositions uttered by the Holy Ghost were set down in that manner by the sacred scribes in order to accommodate them to the capacities of the common people, who are rude and unlearned. For the sake of those who deserve to be separated from the herd, it is necessary that wise expositors should produce the true senses of such passages, together with the special reasons for which they were set down in these words. This doctrine is so widespread and so definite with all theologians that it would be superfluous to adduce evidence for it.

Hence I think that I may reasonably conclude that whenever the Bible has occasion to speak of any physical conclusion (especially those which are very abstruse and hard to understand), the rule has been observed of avoiding confusion in the minds of the common people which would render them contumacious toward the higher mysteries. Now the Bible, merely to condescend to popular capacity, has not hesitated to obscure some very important pronouncements, attributing to God himself some qualities extremely remote from (and even contrary to) His essence. Who, then, would positively declare that this principle has been set aside, and the Bible has confined itself rigorously to the bare and restricted sense of its words, when speaking but casually of the earth, of water, of the sun, or of any other created thing? Especially in view of the fact that these things in no way concern the primary purpose of the sacred writings, which is the service of God and the salvation of souls—matters infinitely beyond the comprehension of the common people.

This being granted, I think that in discussions of physical problems we ought to begin not from the authority of scriptural passages, but from sense-experiences and necessary demonstrations; for the holy Bible and the phenomena of nature proceed alike from the divine Word, the former as the dictate of the Holy Ghost and the latter as the observant executrix of God's commands. It is necessary for the Bible, in order to be accommodated to the understanding of every man, to speak many things which appear to differ from the absolute truth so far as the bare meaning of the words is concerned. But Nature, on the other hand, is inexorable and immutable; she never transgresses the laws imposed upon her, or cares a whit whether her abstruse reasons and methods of operation are understandable to men. For that reason it appears that nothing physical which sense-experience sets before our eyes, or which necessary demonstrations prove to us, ought to be called in question (much less condemned) upon the testimony of biblical passages which may have some different meaning beneath their words. For the Bible is not

chained in every expression to conditions as strict as those which govern all physical effects; nor is God any less excellently revealed in Nature's actions than in the sacred statements of the Bible. Perhaps this is what Tertullian meant by these words: "We conclude that God is known first through Nature, and then again, more particularly, by doctrine; by Nature in His works, and by doctrine in His revealed word." (5)

From this I do not mean to infer that we need not have an extraordinary esteem for the passages of holy Scripture. On the contrary, having arrived at any certainties in physics, we ought to utilize these as the most appropriate aids in the true exposition of the Bible and in the investigation of those meanings which are necessarily contained therein, for these must be concordant with demonstrated truths. I should judge that the authority of the Bible was designed to persuade men of those articles and propositions which, surpassing all human reasoning, could not be made credible by science, or by any other means than through the very mouth of the Holy Spirit. Yet even in those propositions which are not matters of faith, this authority ought to be preferred over that of all human writings which are supported only by bare assertions or probable arguments, and not set forth in a demonstrative way. This I hold to be necessary and proper to the same extent that divine wisdom surpasses all human judgment and conjecture. But I do not feel obliged to believe that that same God who has endowed us with senses, reason, and intellect has intended to forgo their use and by some other means to give us knowledge which we can attain by them. He would not require us to deny sense and reason in physical matters which are set before our eyes and minds by direct experience or necessary demonstrations. This must be especially true in those sciences of which but the faintest trace (and that consisting of conclusions) is to be found in the Bible. Of astronomy, for instance, so little is found that none of the planets except Venus are so much as mentioned, and this only once or twice under the name of "Lucifer." If the sacred scribes had had any intention of teaching people certain arrangements and motions of the heavenly bodies, or had they wished us to derive such knowledge from the Bible, then in my opinion they would not have spoken of these matters so sparingly in comparison with the infinite number of admirable conclusions which are demonstrated in that science. Far from pretending to teach us the constitution and motions of the heavens and the stars, with their shapes, magnitudes, and distances, the authors of the Bible intentionally forbore to speak of these things, though all were quite well known to them.



Such is the opinion of the holiest and most learned Fathers, and in **St. Augustine** we find the following words: "It is likewise commonly asked what we may believe about the form and shape of the heavens according to the Scriptures, for many contend much about these matters. But with superior prudence our authors have forborne to speak of this, as in no way furthering the student with respect to a blessed life—and, more important still, as taking up much of that time which should be spent in holy exercises. What is it to me whether heaven, like a sphere, surrounds the earth on all sides as a mass balanced in the center of the universe, or whether like a dish it merely covers and overcasts the earth? Belief in Scripture is urged rather for the reason we have often mentioned; that is, in order that no one, through ignorance of divine passages, finding anything in our Bibles or hearing anything cited from

them of such a nature as may seem to oppose manifest conclusions, should be induced to suspect their truth when they teach, relate, and deliver more profitable matters. Hence let it be said briefly, touching the form of heaven, that our authors knew the truth but the Holy Spirit did not desire that men should learn things that are useful to no one for salvation.” (6)

The same disregard of these sacred authors toward beliefs about the phenomena of the celestial bodies is repeated to us by St. Augustine in his next chapter. On the question whether we are to believe that the heaven moves or stands still, he writes thus: “Some of the brethren raise a question concerning the motion of heaven, whether it is fixed or moved. If it is moved, they say, how is it a firmament? If it stands still, how do these stars which are held fixed in it go round from east to west, the more northerly performing shorter circuits near the pole, so that heaven (if there is another pole unknown to us) may seem to revolve upon some axis, or (if there is no other pole) may be thought to move as a discus? To these men I reply that it would require many subtle and profound reasonings to find out which of these things is actually so; but to undertake this and discuss it is consistent neither with my leisure nor with the duty of those whom I desire to instruct in essential matters more directly conducing to their salvation and to the benefit of the holy Church.” (7)

From these things it follows as a necessary consequence that, since the Holy Ghost did not intend to teach us whether heaven moves or stands still, whether its shape is spherical or like a discus or extended in a plane, nor whether the earth is located at its center or off to one side, then so much the less was it intended to settle for us any other conclusion of the same kind. And the motion or rest of the earth and the sun is so closely linked with the things just named, that without a determination of the one, neither side can be taken in the other matters. Now if the Holy Spirit has purposely neglected to teach us propositions of this sort as irrelevant to the highest goal (that is, to our salvation), how can anyone affirm that it is obligatory to take sides on them, and that one belief is required by faith, while the other side is erroneous? Can an opinion be heretical and yet have no concern with the salvation of souls? Can the Holy Ghost be asserted not to have intended teaching us something that does concern our salvation? I would say here something that was heard from an ecclesiastic of the most eminent degree: “That the intention of the Holy Ghost is to teach us how one goes to heaven, not how heaven goes.” (8)

But let us again consider the degree to which necessary demonstrations and sense experiences ought to be respected in physical conclusions, and the authority they have enjoyed at the hands of holy and learned theologians. From among a hundred attestations I have selected the following: “We must also take heed, in handling the doctrine of Moses, that we altogether avoid saying positively and confidently anything which contradicts manifest experiences and the reasoning of philosophy or the other sciences. For since every truth is in agreement with all other truth, the truth of Holy Writ cannot be contrary to the solid reasons and experiences of human knowledge.” (9) And in St. Augustine we read: “If anyone shall set the authority of Holy Writ against clear and manifest reason, he who does this knows not what he has undertaken; for he opposes to the truth not the meaning of the Bible, which is beyond his comprehension, but rather his own interpretation; not what is in the Bible, but what he has found in himself and imagines to be there.” (10)

This granted, and it being true that two truths cannot contradict one another, it is the function of wise expositors to seek out the true senses of scriptural texts. These will unquestionably accord with the physical conclusions which manifest sense and necessary demonstrations have previously made certain to us. Now the Bible, as has been remarked, admits in many places expositions that are remote from the signification of the words for reasons we have already given. Moreover, we are unable to affirm that all interpreters of the Bible speak by divine inspiration, for if that were so there would exist no differences between them about the sense of a given passage. Hence I should think it would be the part of prudence

not to permit anyone to usurp scriptural texts and force them in some way to maintain any physical conclusion to be true, when at some future time the senses and demonstrative or necessary reasons may show the contrary. Who indeed will set bounds to human ingenuity? Who will assert that everything in the universe capable of being perceived is already discovered and known? Let us rather confess quite truly that “Those truths which we know are very few in comparison with those which we do not know.” We have it from the very mouth of the Holy Ghost that God delivered up the world to disputations, *so that man cannot find out the work that God hath done from the beginning even to the end.* (11) In my opinion no one, in contradiction to that dictum, should close the road to free philosophizing about mundane and physical things, as if everything had already been discovered and revealed with certainty. Nor should it be considered rash not to be satisfied with those opinions which have become common. No one should be scorned in physical disputes for not holding to the opinions which happen to please other people best, especially concerning problems which have been debated among the greatest philosophers for thousands of years. One of these is the stability of the sun and mobility of the earth, a doctrine believed by Pythagoras and all his followers, by Heracleides of Pontus (12) (who was one of them), by Philolaus the teacher of Plato, (13) and by Plato himself according to Aristotle, Plutarch writes in his *Life of Numa* that Plato, when he had grown old, said it was most absurd to believe otherwise. (14) The same doctrine was held by Aristarchus of Samos, (15) as Archimedes tells us; by Seleucus (16) the mathematician, by Nicetas (17) the philosopher (on the testimony of Cicero), and by many others. Finally this opinion has been amplified and confirmed with many observations and demonstrations by Nicholas Copernicus. And Seneca, (18) a most eminent philosopher, advises us in his book on comets that we should more diligently seek to ascertain whether it is *in* the sky or in the earth that the diurnal rotation resides.

Hence it would probably be wise and useful counsel if, beyond articles which concern salvation and the establishment of our Faith, against the stability of which there is no danger whatever that any valid and effective doctrine can ever arise, men would not aggregate further articles unnecessarily, And it would certainly be preposterous to introduce them at the request of persons who, besides not being known to speak by inspiration of divine grace, are clearly seen to lack that understanding which is necessary in order to comprehend, let alone discuss, the demonstrations by which such conclusions are supported in the subtler sciences. If I may speak my opinion freely, I should say further that it would perhaps fit in better with the decorum and majesty of the sacred writings to take measures for preventing every shallow and vulgar writer from giving to his compositions (often grounded upon foolish fancies) an air of authority by inserting in them passages from the Bible, interpreted (or rather distorted) into senses as far from the right meaning of Scripture as those authors are near to absurdity who thus ostentatiously adorn their writings. Of such abuses many examples might be produced, but for the present I shall confine myself to two which are germane to these astronomical matters. The first concerns those writings which were published against the existence of the Medicean planets recently discovered by me, in which many passages of holy Scripture were cited. (19) Now that everyone has seen these planets, I should like to know what new interpretations those same antagonists employ in expounding the Scripture and excusing their own simplicity. My other example is that of a man who has lately published, in defiance of astronomers and philosophers, the opinion that the moon does not receive its light from the sun but is brilliant by its own nature. (20) He supports this fancy (or rather thinks he does) by sundry texts of Scripture which he believes cannot be explained unless his theory is true; yet that the moon is inherently dark is surely as plain as daylight.

It is obvious that such authors, not having penetrated the true senses of Scripture, would impose upon others an obligation to subscribe to conclusions that are repugnant to manifest reason and sense, if they had any authority to do so. God forbid that this sort of abuse should gain countenance and authority, for then in a short time it would be necessary to proscribe all the contemplative sciences. People who are



unable to understand perfectly both the Bible and the sciences far outnumber those who do understand. The former, glancing superficially through the Bible, would arrogate to themselves the authority to decree upon every question of physics on the strength of some word which they have misunderstood, and which was employed by the sacred authors for some different purpose. And the smaller number of understanding men could not dam up the furious torrent of such people, who would gain the majority of followers simply because it is much more pleasant to gain a reputation for wisdom without effort or study than to consume oneself tirelessly in the most laborious disciplines. Let us therefore render thanks to Almighty God, who in His beneficence protects *us* from this clangor by depriving such persons of all authority, reposing the power of consultation, decision, and decree on such important matters in the high wisdom and benevolence of most prudent. Fathers, and in the supreme authority of those who cannot fail to order matters properly under the guidance of the Holy Ghost. Hence we need not concern ourselves with the shallowness of those men whom grave and holy authors rightly reproach, and of whom in particular St. Jerome said, in reference to the Bible: “This is ventured upon, lacerated, and taught by the garrulous old woman, the doting old man, and the prattling sophist before they have learned it. Others, led on by pride, weigh heavy words and philosophize amongst women concerning holy Scripture. Others—oh, shame!—learn from women what they teach to men, and (as if that were not enough) glibly expound to others that which they themselves do not understand. I forbear to speak of those of my own profession who, attaining a knowledge of the holy Scriptures after mundane learning, tickle the ears of the people with affected and studied expressions, and declare that everything they say is to be taken as the law of God. Not bothering to learn what the prophets and the apostles have maintained, they wrest incongruous testimonies into their own senses—as if distorting passages and twisting the Bible to their individual and contradictory whims were the genuine way of teaching, and not a corrupt one.” (21)

I do not wish to place in the number of such lay writers some theologians whom I consider men of profound learning and devout behavior, and who are therefore held by me in great esteem and veneration. Yet I cannot deny that I feel some discomfort which I should like to have removed, when I hear them pretend to the power of constraining others by scriptural authority to follow in a physical dispute that opinion which they think best agrees with the Bible, and then believe themselves not bound to answer the opposing reasons and experiences. In explanation and support of this opinion they say that since theology is queen of all the sciences, she need not bend in any way to accommodate herself to the teachings of less worthy sciences which are subordinate to her; these others must rather be referred to her as to their supreme empress, changing and altering their conclusions according to her statutes and decrees. They add further that if in the inferior sciences any conclusion should be taken as certain in virtue of demonstrations or experiences, while in the Bible another conclusion is found repugnant to this, then the professors of that science should themselves undertake to undo their proofs and discover the fallacies in their own experiences, without bothering the theologians and exegetes. For, they say, it does not become the dignity of theology to stoop to the investigation of fallacies in the subordinate sciences; it is sufficient for her merely to determine the truth of a given conclusion with absolute authority, secure in her inability to err. Now the physical conclusions in which they say we ought to be satisfied by Scripture, without glossing or expounding it in senses different from the literal, are those concerning which the Bible always speaks in the same manner and which the holy Fathers all receive and expound in the same way. But with regard to these judgments I have had occasion to consider several things, and I shall set them forth in order that I may be corrected by those who understand more than I do in these matters—for to their decisions I submit at all times.

First, I question whether there is not some equivocation in failing to specify the virtues which entitle sacred theology to the title of “queen.” It might deserve that name by reason of including everything that is learned from all the other sciences and establishing everything by better methods and with profounder learning. It is thus, for example, that the rules for measuring fields and keeping accounts are much more

excellently contained in arithmetic and in the geometry of Euclid than in the practices of surveyors and accountants. Or theology might be queen because of being occupied with a subject which excels in dignity all the subjects which compose the other sciences, and because her teachings are divulged in more sublime ways. That the title and authority of queen belongs to theology in the first sense, I think will not be affirmed by theologians who have any skill in the other sciences. None of these, I think, will say that geometry, astronomy, music, and medicine are much more excellently contained in the Bible than they are in the books of Archimedes, Ptolemy, Boethius, and Galen. Hence it seems likely that regal preeminence is given to theology in the second sense; that is, by reason of its subject and the miraculous communication of divine revelation of conclusions which could not be conceived by men in any other way, concerning chiefly the attainment of eternal blessedness. Let us grant then that theology is conversant with the loftiest divine contemplation, and occupies the regal throne among sciences by dignity. But acquiring the highest authority in this way, if she does not descend to the lower and humbler speculations of the subordinate sciences and has no regard for them because they are not concerned with blessedness, then her professors should not arrogate to themselves the authority to decide on controversies in professions which they have neither studied nor practiced. Why, this would be as if an absolute despot, being neither a physician nor an architect but knowing himself free to command, should undertake to administer medicines and erect buildings according to his whim—at grave peril of his poor patients' lives, and the speedy collapse of his edifices.

Again, to command that the very professors of astronomy themselves see to the refutation of their own observations and proofs as mere fallacies and sophisms is to enjoin something that lies beyond any possibility of accomplishment. For this would amount to commanding that they must not see what they see and must not understand what they know, and that in searching they must find the opposite of what they actually encounter. Before this could be done they would have to be taught how to make one mental faculty command another, and the inferior powers the superior, so that the imagination and the will might be forced to believe the opposite of what the intellect understands. I am referring at all times to merely physical propositions, and not to supernatural things which are matters of faith.

I entreat those wise and prudent Fathers to consider with great care the difference that exists between doctrines subject to proof and those subject to opinion. Considering the force exerted by logical deductions, they may ascertain that it is not in the power of the professors of demonstrative sciences to change their opinions at will and apply themselves first to one side and then to the other. There is a great difference between commanding a mathematician or a philosopher and influencing a lawyer or a merchant, for demonstrated conclusions about things in nature or in the heavens cannot be changed with the same facility as opinions about what is or is not lawful in a contract, bargain, or bill of exchange. This difference was well understood by the learned and holy Fathers, as proven by their having taken great pains in refuting philosophical fallacies. This may be found expressly in some of them; in particular, we find the following words of St. Augustine: “It is to be held as an unquestionable truth that whatever the sages of this world have demonstrated concerning physical matters is in no way contrary to our Bibles; hence whatever the sages teach in their books that is contrary to the holy Scriptures may be concluded without any hesitation to be quite false. And according to our ability let us make this evident, and let us keep the faith of our Lord, in whom are hidden all the treasures of wisdom, so that we neither become seduced by the verbiage of false philosophy nor frightened by the superstition of counterfeit religion.” (22)

From the above words I conceive that I may deduce this doctrine: That in the books of the sages of this world there are contained some physical truths which are soundly demonstrated, and others that are merely stated; as to the former, it is the office of wise divines to show that they do not contradict the holy Scriptures. And as to the propositions which are stated but not rigorously demonstrated, anything contrary

to the Bible involved by them must be held undoubtedly false and should be proved so by every possible means. Now if truly demonstrated physical conclusions need not be subordinated to biblical passages, but the latter must rather be shown not to interfere with the former, then before a physical proposition is condemned it must be shown to be not rigorously demonstrated—and this is to be done not by those who hold the proposition to be true, but by those who judge it to be false. This seems very reasonable and natural, for those who believe an argument to be false may much more easily find the fallacies in it than men who consider it to be true and conclusive. Indeed, in the latter case it will happen that the more the adherents of an opinion turn over their pages, examine the arguments, repeat the observations, and compare the experiences, the more they will be confirmed in that belief. And Your Highness, knows what happened to the late mathematician of the University of Pisa (23) who undertook in his old age to look into the Copernican doctrine in the hope of shaking its foundations and refuting it, since he considered it false only because he had never studied it. As it fell out, no sooner had he understood its grounds, procedures, and demonstrations than he found himself persuaded, and from an opponent he became a very staunch defender of it. I might also name other mathematicians (24) who, moved by my latest discoveries, have confessed it necessary to alter the previously accepted system of the world, as this is simply unable to subsist any longer.

If in order to banish the opinion in question from the world it were sufficient to stop the mouth of a single man—as perhaps those men persuade themselves who, measuring the minds of others by their own, think it impossible that this doctrine should be able to continue to find adherents—then that would be very easily done. But things stand otherwise. To carry out such a decision it would be necessary not only to prohibit the book of Copernicus and the writings of other authors who follow the same opinion, but to ban the whole science of astronomy. Furthermore, it would be necessary to forbid men to look at the heavens, in order that they might not see Mars and Venus sometimes quite near the earth and sometimes very distant, the variation being so great that Venus is forty times and Mars sixty times as large at one time as another. And it would be necessary to prevent Venus being seen round at one time and forked at another, with very thin horns; as well as many other sensory observations which can never be reconciled with the Ptolemaic system in any way, but are very strong arguments for the Copernican. And to ban Copernicus now that his doctrine is daily reinforced by many new observations and by the learned applying themselves to the reading of his book, after this opinion has been allowed and tolerated for those many years during which it was less followed and less confirmed, would seem in my judgment to be a contravention of truth, and an attempt to hide and suppress her the more as she revealed herself the more clearly and plainly. Not to abolish and censure his whole book, but only to condemn as erroneous this particular proposition, would (if I am not mistaken) be a still greater detriment to the minds of men, since it would afford them occasion to see a proposition proved that it was heresy to believe. And to prohibit the whole science would be but to censure a hundred passages of holy Scripture which teach us that the glory and greatness of Almighty God are marvelously discerned in all his works and divinely read in the open book of heaven. For let no one believe that reading the lofty concepts written in that book leads to nothing further than the mere seeing of the splendor of the sun and the stars and their rising and setting, which is as far as the eyes of brutes and of the vulgar can penetrate. Within its pages are couched mysteries so profound and concepts so sublime that the vigils, labors, and studies of hundreds upon hundreds of the most acute minds have still not pierced them, even after continual investigations for thousands of years. The eyes of an idiot perceive little by beholding the external appearance of a human body, as compared with the wonderful contrivances which a careful and practiced anatomist or philosopher discovers in that same body when he seeks out the use of all those muscles, tendons, nerves, and bones; or when examining the functions of the heart and the other principal organs, he seeks the seat of the vital faculties, notes and observes the admirable structure of the sense organs, and (without ever ceasing in his amazement and delight) contemplates the receptacles of the imagination, the memory, and the understanding. Likewise, that which presents itself to mere sight is as nothing in comparison with the

high marvels that the ingenuity of learned men discovers in the heavens by long and accurate observation. And that concludes what I have to say on this matter.

Next let us answer those who assert that those physical propositions of which the Bible speaks always in one way and which the Fathers all harmoniously accept in the *same* sense, must be taken according to the literal sense of the words without glosses or interpretations, and held as most certain and true. The motion of the sun and stability of the earth, they say, is of this sort; hence it is a matter of faith to believe in them, and the contrary view is erroneous. To this I wish first to remark that among physical propositions there are some with regard to which all human science and reason cannot supply more than a plausible opinion and a probable conjecture in place of a sure and demonstrated knowledge; for example, whether the stars are animate. Then there are other propositions of which we have (or may confidently expect) positive assurances through experiments, long observation, and rigorous demonstration; for example, whether or not the earth and the heavens move, and whether or not the heavens are spherical. As to the first sort of propositions, I have no doubt that where human reasoning cannot reach—and where consequently we can have no science but only opinion and faith—it is necessary in piety to comply absolutely with the strict sense of Scripture. But as to the other kind, I should think, as said before, that first we are to make certain of the fact, which will reveal to us the true senses of the Bible, and these will most certainly be found to agree with the proved fact (even though at first the words sounded otherwise), for two truths can never contradict each other. I take this to be an orthodox and indisputable doctrine, and I find it specifically in St. Augustine when he speaks of the shape of heaven and what we may believe concerning that.

Astronomers seem to declare what is contrary to Scripture, for they hold the heavens to be spherical, while the Scripture calls it “stretched out like a curtain.” (25) St. Augustine opines that we are not to be concerned lest the Bible contradict astronomers; we are to believe its authority if what they say is false and is founded only on the conjectures of frail humanity. But if what they say is proved by unquestionable arguments, this holy Father does not say that the astronomers are to be ordered to dissolve their proofs and declare their own conclusions to be false. Rather, he says it must be demonstrated that what is meant in the Bible by “curtain” is not contrary to their proofs. Here are his words: “But some raise the following objection. ‘How is it that the passage in our Bibles, *Who stretcheth out the heavens as a curtain*, does not contradict those who maintain the heavens to have a spherical shape?’ It does contradict them if what they affirm is false, for that is true which is spoken by divine authority rather than that which proceeds from human frailty. But it, peradventure, they should be able to prove their position by experiences which place it beyond question, then it is to be demonstrated that our speaking of a curtain in no way contradicts their manifest reasons.” (26) He then proceeds to admonish us that we must be no less careful and observant in reconciling a passage of the Bible with any demonstrated physical proposition than with some other biblical passage which might appear contrary to the first. The circumspection of this saint indeed deserves admiration and imitation, when even in obscure conclusions (of which we surely can have no knowledge through human proofs) he shows great reserve in determining what is to be believed. We see this from what he writes at the end of the second book of his commentary on Genesis, concerning the question whether the stars are to be believed animate: “Although at present this matter cannot be settled, yet I suppose that in our further dealing with the Bible we may meet with other relevant passages, and then we may be permitted, if not to determine anything finally, at least to gain some hint concerning this matter according to the dictates of sacred authority. Now keeping always our respect for moderation in grave piety, we ought not to believe anything inadvisedly on a dubious point, lest in favor of our error we conceive a prejudice against something that truth hereafter may reveal to be not contrary in any way to the sacred books of either the Old or the New Testament.”

From this and other passages the intention of the holy Fathers appears to be (if I am not mistaken) that in questions of nature which are not matters of faith it is first to be considered whether anything is demonstrated beyond doubt or known by sense-experience, or whether such knowledge or proof is



possible; if it is, then, being the gift of God, it ought to be applied to find out the true senses of holy Scripture in those passages which superficially might seem to declare differently. These senses would unquestionably be discovered by wise theologians, together with the reasons for which the Holy Ghost sometimes wished to veil itself under words of different meaning, whether for our exercise, or for some purpose unknown to me.

As to the other point, if we consider the primary aim of the Bible, I do not think that its having always spoken in the same sense need disturb this rule. If the Bible, accommodating itself to the capacity of the common people, has on one occasion expressed a proposition in words of different sense from the essence of that proposition, then why might it not have done the same, and for the same reason, whenever the same thing happened to be spoken of? Nay, to me it seems that not to have done this would but have increased confusion and diminished belief among the people. Regarding the state of rest or motion of the sun and earth, experience plainly proves that in order to accommodate the common people it was necessary to assert of these things precisely what the words of the Bible convey. Even in our own age, people far less primitive continue to maintain the same opinion for reasons which will be found extremely trivial if well weighed and examined, and upon the basis of experiences that are wholly false or altogether beside the point. Nor is it worth while to try to change their opinion, they being unable to understand the arguments on the opposite side, for these depend upon observations too precise and demonstrations too subtle, grounded on abstractions which require too strong an imagination to be comprehended by them. Hence even if the stability of heaven and the motion of the earth should be more than certain in the minds of the wise, it would still be necessary to assert the contrary for the preservation of belief among the all-too-numerous vulgar. Among a thousand ordinary men who might be questioned concerning these things, probably not a single one will be found to answer anything except that it looks to him as if the sun moves and the earth stands still, and therefore he believes this to be certain. But one need not on that account take the common popular assent as an argument for the truth of what is stated; for if we should examine these very men concerning their reasons for what they believe, and on the other hand listen to the experiences and proofs which induce a few others to believe the contrary, we should find the latter to be persuaded by very sound arguments, and the former by simple appearances and vain or ridiculous impressions.

It is sufficiently obvious that to attribute motion to the sun and rest to the earth was therefore necessary lest the shallow minds of the common people should become confused, obstinate, and contumacious in yielding assent to the principal articles that are absolutely matters of faith. And if this was necessary, there is no wonder at all that it was carried out with great prudence in the holy Bible. I shall say further that not only respect for the incapacity of the vulgar, but also current opinion in those times, made the sacred authors accommodate themselves (in matters unnecessary to salvation) more to accepted usage than to the true essence of things. Speaking of this, St. Jerome writes: "As if many things were not spoken in the Holy Bible according to the judgment of those times in which they were acted, rather than according to the truth contained." (27) And elsewhere the same saint says: "It is the custom for the biblical scribes to deliver their judgments in many things according to the commonly received opinion of their times." (28) And on the words in the twenty-sixth chapter of Job, *He stretcheth out the north over the void, and hangeth the earth above nothing*, (29) St. Thomas Aquinas notes that the Bible calls "void" or "nothing" that space which we know to be not empty, but filled with air. Nevertheless the Bible, he says, in order to accommodate itself to the beliefs of the common people (who think there is nothing in that space), calls it "void" and "nothing." Here are the words of St. Thomas: "What appears to us in the upper hemisphere of the heavens to be empty, and not a space filled with air, the common people regard as void; and it is usually spoken of in the holy Bible according to the ideas of the common people." (30) Now from this passage I think one may very logically argue that for the same reason the Bible had still more cause to call the sun movable and the earth immovable. For if we were to test the capacity of the

common people, we should find them even less apt to be persuaded of the stability of the sun and the motion of the earth than to believe that the space which environs the earth is filled with air. And if on this point it would not have been difficult to convince the common people, and yet the holy scribes forbore to attempt it, then it certainly must appear reasonable that in other and more abstruse propositions they have followed the same policy.

Copernicus himself knew the power over our ideas that is exerted by custom and by our inveterate way of conceiving things since infancy. Hence, in order not to increase for us the confusion and difficulty of abstraction, after he had first demonstrated that the motions which appear to us to belong to the sun or to the firmament are really not there but in the earth, he went on calling them motions of the sun and of the heavens when he later constructed his tables to apply them to use. He thus speaks of “sunrise” and “sunset,” of the “rising and setting” of the stars, of changes in the obliquity of the ecliptic and of variations in the equinoctial points, of the mean motion and variations in motion of the sun, and so on. All these things really relate to the earth, but since we are fixed to the earth and consequently share in its every motion, we cannot discover them in the earth directly, and are obliged to refer them to the heavenly bodies in which they make their appearance to us. Hence we name them as if they took place where they appear to us to take place; and from this one may see how natural it is to accommodate things to our customary way of seeing them.

Next we come to the proposition that agreement on the part of the Fathers, when they all accept a physical proposition from the Bible in the same sense, must give that sense authority to such a degree that belief in it becomes a matter of faith. I think this should be granted at most only of those propositions which have actually been discussed by the Fathers with great diligence, and debated on both sides, with them all finally concurring in the censure of one side and the adoption of the other. But the motion of the earth and stability of the sun is not an opinion of that kind, inasmuch as it was completely hidden in those times and was far removed from the questions of the schools; it was not even considered, much less adhered to, by anyone. Hence we may believe that it never so much as entered the thoughts of the Fathers to debate this. Bible texts, their own opinions, and the agreement of all men concurred in one belief, without meeting contradiction from anyone. Hence it is not sufficient to say that because all the Fathers admitted the stability of the earth, this is a matter of faith; one would have to prove also that they had condemned the contrary opinion. And I may go on to say that they left this out because they had no occasion to reflect upon the matter and discuss it; their opinion was admitted only as current, and not as analyzed and determined. I think I have, very good reason for saying this. Either the Fathers reflected upon this conclusion as controversial, or they did not; if not, then they cannot have decided anything about it even in their own minds, and their incognizance of it does not oblige us to accept teaching which they never imposed, even in intention. But if they had reflected upon and considered it, and if they judged it to be erroneous, then they would long ago have condemned it; and this they are not found to have done. Indeed, some theologians have but now begun to consider it, and they are not seen to deem it erroneous. Thus in the *Commentaries on Job* of Didacus à Stunica, where the author comments upon the words *Who moveth the earth from its place...*, (31) he discourses at length upon the Copernican opinion and concludes that the mobility of the earth is not contrary to Scripture.

Besides, I question the truth of the statement that the church commands us to hold as matters of faith all physical conclusions bearing the stamp of harmonious interpretation by all the Fathers. I think this may be an arbitrary simplification of various council decrees by certain people to favor their own opinion. So far as I can find, all that is really prohibited is the “perverting into senses contrary to that of the holy Church or that of the concurrent agreement of the Fathers those passages, and those alone, which pertain to faith or ethics, or which concern the edification of Christian doctrine.” So said the Council of Trent in its fourth session. But the mobility or stability of the earth or sun is neither a matter of faith nor one

contrary to ethics. Neither would anyone pervert passages of Scripture in opposition to the holy Church or to the Fathers, for those who have written on this matter have never employed scriptural passages. Hence it remains the office of grave and wise theologians to interpret the passages according to their true meaning. Council decrees are indeed in agreement with the holy Fathers in these matters, as may be seen from the fact that they abstain from enjoining us to receive physical conclusions as matters of faith, and from censuring the opposite opinions as erroneous. Attending to the primary and original intention of the holy Church, they judge it useless to be occupied in attempting to get to the bottom of such matters. Let me remind Your Highness again of St. Augustine's reply to those brethren who raised the question whether the heavens really move or stand still: "To these men I reply that it would require many subtle and profound reasonings to find out which of these things is actually so; but to undertake this and discuss it is consistent neither with my leisure nor with the duty of those whom I desire to instruct in essential matters more directly conducive to their salvation and to the benefit of the holy Church." (32)

Yet even if we resolved to condemn or admit physical propositions according to scriptural passages uniformly expounded in the same sense by all the Fathers, I still fail to see how that rule can apply in the present case, inasmuch as diverse expositions of the same passage occur among the Fathers. Dionysius the Areopagite says that it is the *primum mobile* (33) which stood still, not the sun. (34) St. Augustine is of the same opinion; that is, that all celestial bodies would be stopped; and the Bishop of Avila concurs. (35) What is more, among the Jewish authors endorsed by Josephus, (36) some held that the sun did not really stand still, but that it merely appeared to do so by reason of the shortness of the time during which the Israelites administered defeat to their enemies. (Similarly, with regard to the miracle in the time of Hezekiah, Paul of Burgos was of the opinion that this took place not in the sun but on the sundial.) (37) And as a matter of fact no matter what system of the universe we assume, it is still necessary to gloss and interpret the words in the text of Joshua, as I shall presently show.

But finally let us grant to these gentlemen even more than they demand; namely, let us admit that we must subscribe entirely to the opinion of wise theologians. Then, since this particular dispute does not occur among the ancient Fathers, it must be undertaken by the wise men of this age. After first hearing the experiences, observations, arguments, and proofs of philosophers and astronomers on both sides—for the controversy is over physical problems and logical dilemmas, and admits of no third alternative—they will be able to determine the matter positively, in accordance with the dictates of divine inspiration. But as to those men who do not scruple to hazard the majesty and dignity of holy Scripture to uphold the reputation of their own vain fancies, let them not hope that a decision such as this is to be made without minutely airing and discussing all the arguments on both sides. Nor need we fear this from men who will make it their whole business to examine most attentively the very foundations of this doctrine, and who will do so only in a holy zeal for the truth, the Bible, and the majesty, dignity, and authority in which every Christian wants to see these maintained.

Anyone can see that dignity is most desired and best secured by those who submit themselves absolutely to the holy Church and do not demand that one opinion or another be prohibited, but merely ask the right to propose things for consideration which may the better guarantee the soundest decision—not by those who, driven by personal interest or stimulated by malicious hints, preach that the Church should flash her sword without delay simply because she has the power to do so. Such men fail to realize that it is not always profitable to do everything that lies within one's power. The most holy Fathers did not share their views. They knew how prejudicial (and how contrary to the primary intention of the Catholic Church) it would be to use scriptural passages for deciding physical conclusions, when either experiments or logical proofs might in time show the contrary of what the literal sense of the words signifies. Hence they not only proceeded with great circumspection, but they left the following precepts for the guidance of others: "In points that are obscure, or far from clear, if we should read anything in the Bible that may allow of

several constructions consistently with the faith to be taught, let us not commit ourselves to any one of these with such precipitous obstinacy that when, perhaps, the truth is more diligently searched into, this may fall to the ground, and we with it. Then we would indeed be seen to have contended not for the sense of divine Scripture, but for our own ideas by wanting something of ours to be the sense of Scripture when we should rather want the meaning of Scripture to be ours.” (38) And later it is added, to teach us that no proposition can be contrary to the faith unless it has first been proven to be false: “A thing is not forever contrary to the faith until disproved by most certain truth. When that happens, it was not holy Scripture that ever affirmed it, but human ignorance that imagined it.” From this it is seen that the interpretation which we impose upon passages of Scripture would be false whenever it disagreed with demonstrated truths. And therefore we should *seek* the incontrovertible sense of the Bible with the assistance of demonstrated truth, and not in any way try to force the hand of Nature or deny experiences and rigorous proofs in accordance with the mere sound of words that may appeal to our frailty.

Let Your Highness note further how circumspectly this saint proceeds before affirming any interpretation of Scripture to be certain and secure from all disturbing difficulties. Not content that some given sense of the Bible agrees with some demonstration, he adds: “But when some truth is demonstrated to be certain by reason, it is still not certain whether in these words of holy Scripture the writer intended this idea, or some other that is no less true. And if the context of his words prove that he did not intend this truth, the one that he did intend will not thereby be false, but most true, and still more profitable for us to know.” Our admiration of the circumspection of this pious author only grows when he adds the following words, being not completely convinced after seeing that logical proof, the literal words of the Bible, and all the context before and after them harmonize in the same thing: “But if the context supplies nothing to disprove this to be the author's sense, it yet remains for us to inquire whether he may not intend the other as well.” Nor even yet does he resolve to accept this one interpretation and reject the other, appearing never to be able to employ sufficient caution, for he continues: “But if we find that the other also may be meant, it may be inquired which of them the writer would want to have stand, or which one he probably meant to aim at, when the true circumstances on both sides are weighed.” And finally he supplies a reason for this rule of his, by showing us the perils to which those men expose the Bible and the Church, who, with more regard for the support of their own errors than for the dignity of the Bible, attempt to stretch its authority beyond the bounds which it prescribes to itself. The following words which he adds should alone be sufficient to repress or moderate the excessive license which some men arrogate to themselves: “It often falls out that a Christian may not fully understand some point about the earth, the sky, or the other elements of this world—the motion, rotation, magnitude, and distances of the stars; the known vagaries of the sun and moon; the circuits of the years and epochs; the nature of animals, fruits, stones, and other things of that sort, and hence may not expound it rightly or make it clear by experiences. Now it is too absurd, yea, most pernicious and to be avoided at all costs, for an infidel to find a Christian so stupid as to argue these matters as if they were Christian doctrine; he will scarce be able to contain his laughter at seeing error written in the skies, as the proverb says. The worst of the matter is not that a person in error should be laughed at, but that our authors should be thought by outsiders to hold the same opinions, and should be censured and rejected as ignorant, to the great prejudice of those whose salvation we are seeking. For when infidels refute any Christian on a matter which they themselves thoroughly understand, they thereby evince their slight esteem for our Bible. And why should the Bible be believed concerning the resurrection of the dead, the hope of eternal life, and the Kingdom of Heaven, when it is considered to be erroneously written as to points which admit of direct demonstration or unquestionable reasoning?”

There are men who, in defense of propositions which they do not understand, apply—and in a way commit—some text of the Bible, and then proceed to magnify their original error by adducing other passages that are even less understood than the first. The extent to which truly wise and prudent Fathers



are offended by such men is declared by the same saint in the following terms: “Inexpressible trouble and sorrow are brought by rash and presumptuous men upon their more prudent brethren. When those who respect the authority of our Bible commence to reprove and refute their false and unfounded opinions, such men defend what they have put forth quite falsely and rashly by citing the Bible in their own support, repeating from memory biblical passages which they arbitrarily force to their purposes, without knowing either what they mean or to what they properly apply.”

It seems to me that we may number among such men those who, being either unable or unwilling to comprehend the experiences and proofs used in support of the new doctrine by its author and his followers, nevertheless expect to bring the Scriptures to bear on it. They do not consider that the more they cite these, and the more they insist that they are perfectly clear and admit of no other interpretations than those which they put on them, the more they prejudice the dignity of the Bible—or would, if their opinion counted for anything—in the event that later truth shows the contrary and thus creates confusion among those outside the holy Church. And of these she is very solicitous, like a mother desiring to recover her children into her lap. Your Highness may thus see how irregularly those persons proceed who in physical disputes arrange scriptural passages (and often those ill-understood by them) in the front rank of their arguments. If these men really believe themselves to have the true sense of a given passage, it necessarily follows that they believe they have in hand the absolute truth of the conclusion they intend to debate. Hence they must know that they enjoy a great advantage over their opponents, whose lot it is to defend the false position; and he who maintains the truth will have many sense-experiences and rigorous proofs on his side, whereas his antagonist cannot make use of anything but illusory appearances, quibbles, and fallacies. Now if these men know they have such advantages over the enemy even when they stay within proper bounds and produce no weapons other than those proper to philosophy, why do they, in the thick of battle, betake themselves to a dreadful weapon which cannot be turned aside, and seek to vanquish the opponent by merely exhibiting it? If I may speak frankly, I believe they have themselves been vanquished, and, feeling unable to stand up against the assaults of the adversary, they seek ways of holding him off. To that end they would forbid him the use of reason, divine gift of Providence, and would abuse the just authority of holy Scripture—which, in the general opinion of theologians, can never oppose manifest experiences and necessary demonstrations when rightly understood and applied. If I am correct, it will stand them in no stead to go running to the Bible to cover up their inability to understand (let alone resolve) their opponents' arguments, for the opinion which they fight has never been condemned by the holy Church. If they wish to proceed in sincerity, they should *by* silence confess themselves unable to deal with such matters. Let them freely admit that although they may argue that a position is false, it is not in their power to censure a position as erroneous—or in the power of anyone except the Supreme Pontiff, or the Church Councils. Reflecting upon this, and knowing that a proposition cannot be both true and heretical, let them employ themselves in the business which is proper to them; namely, demonstrating its falsity. And when that is revealed, either there will no longer be any necessity to prohibit it (since it will have no followers), or else it may safely be prohibited without the risk of any scandal.

Therefore let these men begin to apply themselves to an examination of the arguments of Copernicus and others, leaving condemnation of the doctrine as erroneous and heretical to the proper authorities. Among the circumspect and most wise Fathers, and in the absolute wisdom of one who cannot err, they may never hope to find the rash decisions into which they allow themselves to be hurried by some particular passion or personal interest. With regard to this opinion, and others which are not directly matters of faith, certainly no one doubts that the Supreme Pontiff has always an absolute power to approve or condemn; but it is not in the power of any created being to make things true or false, for this belongs to their own nature and to the fact. Therefore in my judgment one should first be assured of the necessary and immutable truth of the fact, over which no man has power. This is wiser counsel than to condemn either

side in the absence of such certainty, thus depriving oneself of continued authority and ability to choose by determining things which are now undetermined and open and still lodged in the will of supreme authority. And in brief, if it is impossible for a conclusion to be declared heretical while we remain in doubt as to its truth, then these men are wasting their time clamoring for condemnation of the motion of the earth and stability of the sun, which they have not yet demonstrated to be impossible or false.

Now let us consider the extent to which it is true that the famous passage in Joshua may be accepted without altering the literal meaning of its words, and under what conditions the day might be greatly lengthened by obedience of the sun to Joshua's command that it stand still.

If the celestial motions are taken according to the Ptolemaic system, this could never happen at all. For the movement of the sun through the ecliptic is from west to east, and hence it is opposite to the movement of the *primum mobile*, which in that system causes day and night. Therefore it is obvious that if the sun should cease its own proper motion, the day would become shorter, and not longer. The way to lengthen the day would be to speed up the sun's proper motion; and to cause the sun to remain above the horizon for some time in one place without declining towards the west, it would be necessary to hasten this motion until it was equal to that of the *primum mobile*. This would amount to accelerating the customary speed of the sun about three hundred sixty times. Therefore if Joshua had intended his words to be taken in their pure and proper sense, he would have ordered the sun to accelerate its own motion in such a way that the impulse from the *primum mobile* would not carry it westward. But since his words were to be heard by people who very likely knew nothing of any celestial motions beyond the great general movement from east to west, he stooped to their capacity and spoke according to their understanding, as he had no intention of teaching them the arrangement of the spheres, but merely of having them perceive the greatness of the miracle.

Possibly it was this consideration that first moved Dionysius the Areopagite to say that in this miracle it was the *primum mobile* that stood still, and that when this halted, all the celestial spheres stopped as a consequence —an opinion held by St. Augustine himself, and confirmed in detail by the Bishop of Avila. And indeed Joshua did intend the whole system of celestial spheres to stand still, as may be deduced from his simultaneous command to the moon, which had nothing to do with lengthening the day. And under his command to the moon we are to understand the other planets as well, though they are passed over in silence here as elsewhere in the Bible, which was not written to teach us astronomy.

It therefore seems very clear to me that if we were to accept the Ptolemaic system it would be necessary to interpret the words in some sense different from their strict meaning. Admonished by the useful precepts of St. Augustine, I shall not affirm this to be necessarily the above sense, as someone else may think of another that is more proper and harmonious. But I wish to consider next whether this very event may not be understood more consistently with what we read in the Book of Joshua in terms of the Copernican system, adding a further observation recently pointed out by me in the body of the sun. Yet I speak always with caution and reserve, and not with such great affection for my own inventions as to prefer them above those of others, or in the belief that nothing can be brought forth that will be still more in conformity with the intention of the Bible.

Suppose, then, that in the miracle of Joshua the whole system of celestial rotations stood still, in accordance with the opinion of the authors named above. Now in order that all the arrangements should not be disturbed by stopping only a single celestial body, introducing great disorder throughout the whole of Nature, I shall next assume that the sun, though fixed in one place, nevertheless revolves upon its own axis, making a complete revolution in about a month, as I believe is conclusively proven in my *Letters on Sunspots*. With our own eyes we see this movement to be slanted toward the south in the more remote

part of the sun's globe, and in the nearer part to tilt toward the north, in just the same manner as all the revolutions of the planets occur. Third, if we consider the nobility of the sun, and the fact that it is the font of light which (as I shall conclusively prove) illuminates not only the moon and the earth but all the other planets, which are inherently dark, then I believe that it will not be entirely unphilosophical to say that the sun, as the chief minister of Nature and in a certain sense the heart and soul of the universe, infuses by its own rotation not only light but also motion into other bodies which surround it. And just as if the motion of the heart should cease in an animal, all other motions of its members would also cease, so if the rotation of the sun were to stop, the rotations of all the planets would stop too. And though I could produce the testimonies of many grave authors to prove the admirable power and energy of the sun, I shall content myself with a single passage from the blessed Dionysius the Areopagite in his book *Of the Divine Name*, (39) who writes thus of the sun: "His light gathers and converts to himself all things which are seen, moved, lighted, or heated; and in a word all things which are preserved by his splendor. For this reason the sun is called HELIOS, because he collects and gathers all dispersed things." And shortly thereafter he says: "This sun which we see remains one, and despite the variety of essences and qualities of things which fall under our senses, he bestows his light equally on them, and renews, nourishes, defends, perfects, divides, conjoins, cherishes, makes fruitful, increases, changes, fixes, produces, moves, and fashions all living creatures. Everything in this universe partakes of one and the same sun by His will, and the causes of many things which are shared from him are equally anticipated in him. And for so much the more reason," and so on. The sun, then, being the font of light and the source of motion, when God willed that at Joshua's command the whole system of the world should rest and should remain for many hours in the same state, it sufficed to make the sun stand still. Upon its stopping all the other revolutions ceased; the earth, the moon, and the sun remained in the same arrangement as before, as did all the planets; nor in all that time did day decline towards night, for day was miraculously prolonged. And in this manner, by the stopping of the sun, without altering or in the least disturbing the other aspects and mutual positions of the stars, the day could be lengthened on earth—which agrees exquisitely with the literal sense of the sacred text.

But if I am not mistaken, something of which we are to take no small account is that by the aid of this Copernican system we have the literal, open, and easy sense of another statement that we read in this same miracle, that the sun stood still *in the midst of the heavens*. (40) Grave theologians raise a question about this passage, for it seems very likely that when Joshua requested the lengthening of the day, the sun was near setting and not at the meridian. If the sun had been at the meridian, it seems improbable that it was necessary to pray for a lengthened day in order to pursue victory in battle, the miracle having occurred around the summer solstice when the days are longest, and the space of seven hours remaining before nightfall being sufficient. Thus grave divines have actually held that the sun was near setting, and indeed the words themselves seem to say so; *Sun, stand thou still, stand thou still*. (41) For if it had been near the meridian, either it would have been needless to request a miracle, or it would have been sufficient merely to have prayed for some retardation. Cajetan (42) is of this opinion, to which Magellan (43) subscribes, confirming it with the remark that Joshua had already done too many things that day before commanding the sun to stand still for him to have done them in half a day. Hence they are forced to interpret the words *in the midst of the heavens* a little knottily, saying that this means no more than that the sun stood still while it was in our hemisphere; that is, above our horizon. But unless I am mistaken we may avoid this and all other knots if, in agreement with the Copernican system, we place the sun in the "midst"—that is, in the center—of the celestial orbs and planetary rotations, as it is most necessary to do. Then take any hour of the day, either noon, or any hour as close to evening as you please, and the day would be lengthened and all the celestial revolutions stopped by the sun's standing still *in the midst of the heavens*; that is, in the center, where it resides. This sense is much better accommodated to the words, quite apart from what has already been said; for if the desired statement was that the sun was stopped at midday, the proper expression would have been that it "stood still at noonday," or "in the meridian

circle,” and not “in the midst of the heavens.” For the true and only “midst” of a spherical body such as the sky is its center.

As to other scriptural passages which seem to be contrary to this opinion, I have no doubt that if the opinion itself were known to be true and proven, those very theologians who, so long as they deem it false, hold these passages to be incapable of harmonious exposition with it, would find interpretations for them which would agree very well, and especially if they would add some knowledge to astronomical science to their knowledge of divinity. At present, while they consider it false, they think they find in Scripture only passages that contradict it; but if they once entertained a different view of the matter they would probably find as many more that would harmonize with it. And then they might judge that it is fitting for the holy Church to tell that God placed the sun in the center of heaven, and that by rotating it like a wheel gave to the moon and the other wandering stars their appointed courses, when she sings the hymn:

Most Holy God of Heaven

Who paints with fiery splendor

The brilliant center of the pole

Enriched with beauteous light;

Who, creating on the fourth day

The flaming disk of the sun

Gave order to the moon

And wandering courses to the stars... (44)

And they could say that the name “firmament” agrees literally quite well with the starry sphere and all that lies beyond the revolutions of the planets, which according to this arrangement is quite firm and immovable. Again, with the earth turning, they might think of its poles when they read *He had not yet made the earth, the rivers, and the hinges of the terrestrial orb*, (45) for hinges would seem to be ascribed in vain to the earth unless it needed them to turn upon.

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(1) *De Genesi ad litteram*, end of Book II. (Citations of theological works are taken from Galileo's marginal notes, without verification.)

(2) Nicholas Schoenberg, spoken of by Copernicus as “celebrated in all fields of scholarship.”

(3) Tiedmann Giese, to whom Copernicus referred in his preface as “that scholar, my good friend.”

(4) Copernicus, *De Revolutionibus* (Nuremberg, 1543), f. iiiii.

(5) *Adversus Marcionem*, I, 18.

(6) *De Genesi ad litteram* II, 9. Galileo has noted also: “The same is to be read in Peter the Lombard, master of opinions.”



(7) *Ibid.*, II, 10.

(8) A marginal note by Galileo assigns this epigram to Cardinal Baronius (1538-1607). Baronius visited Padua with Cardinal Bellarmine in 1598, and Galileo probably met him at that time.

(9) Pererius on Genesis, near the beginning.

(10) In the seventh letter to Marcellinus.

(11) Ecclesiastes 3:11.

(12) Heracleides was born about 390 b.c. and is said to have attended lectures by Aristotle at Athens. He believed that the earth rotated on its axis, but not that it moved around the sun. He also discovered that Mercury and Venus revolve around the sun, and may have developed a system similar to that of Tycho.

(13) Philolaus, an early follower of Pythagoras, flourished at Thebes toward the end of the fifth century b.c. Although a contemporary of Socrates, the teacher of Plato, he had nothing to do with Plato's instruction. According to Philolaus the earth revolved around a central Fire, but not about the sun.

(14) "Plato held opinion in that age, that the earth was in another place than in the very midst, and that the centre of the world, as the most honourable place, did appertain to some other of more worthy substance than the earth." (Trans. Sir Thomas North.) This tradition is no longer accepted.

(15) Aristarchus (ca. 310-230 ) was the true forerunner of Copernicus in antiquity, and not the Pythagoreans as was generally believed in Galileo's time.

(16) Seleucus, who flourished about 150 B.C., is the only ancient astronomer known to have adopted the heliocentric system of Aristarchus. After his time this gave way entirely to the system founded by his contemporary Hipparchus.

(17) Nicetas is an incorrect form given by Copernicus to the name of Hicetas of Syracuse. Of this mathematician nothing is known beyond the fact that some of the ancients credited him instead of Philolaus with the astronomy which came to be associated with the Pythagoreans in general.

(18) Seneca (ca. 3- 65) was the tutor of Nero. He devoted the seventh book of his *Quaestiones Naturales* to comets. In the second chapter of this book he raised the question of the earth's rotation, and in the final chapters he appealed for patience and further investigation into such matters.

(19) The principal book which had offended in this regard was the *Dianoia Astronomica* ... of Francesco Sizzi (Venice, 1611). About the time Galileo arrived at Florence, Sizzi departed for Franco, where he came into association with some good mathematicians. In 1613 he wrote to a friend at Rome to express his admiration of Galileo's work on floating bodies and to deride its opponents. The letter was forwarded to Galileo. In it Sizzi had reported, though rather cryptically, upon some French observations concerning sunspots, and it was probably this which led Galileo to his knowledge of the tilt of the sun's axis. Sizzi was broken on the wheel in 1617 for writing a pamphlet against the king of France.

(20) This is frequently said to refer to C. Lagalla's *De phaenominis in orbe lunae* ... ( Venice, 1612), a wretched book which has the sole distinction of being the first to mention the word "telescope" in print.

A more probable reference, however, seems to be to the *Dialogo di Fr. Ulisse Albergotti . . . nel quale si tiene . . . la Luna esser da sé luminosa . . .* (Viterbo, 1613).

(21) *Epistola ad Paulinum*, 103.

(22) *De Genesi ad litteram* I, 21.

(23) Antonio Santucci (d. 1613).

(24) A marginal note by Galileo here mentions Father Clavius.

(25) Psalms 103:2 (Douay); 104:2 (King James).

(26) *De Genesi ad litteram* [ ii ,] 9.

(27) Jeremiah, ch. 28.

(28) On Matthew, ch. 13.

(29) Job 26:7.

(30) Aquinas on Job.

(31) Job 9:6. The commentary was that of Didacus à Stunica, published at Toledo in 1584.

(32) Cf. note (6).

(33) The outermost crystalline sphere was known as the *primum mobile*, or prime mover, and was supposed to complete each revolution in twenty-four hours, causing light and day. A part of its motion was imagined to be transmitted to each inner sphere, sweeping along the fixed stars and the planets (which included the sun and moon) at nearly its own speed. The inherent motion of the other spheres was supposed to be eastward at much slower rates. In the case of the sun, this speed would have the same proportion to that of the *primum mobile* as a day has to a year.

(34) In the *Epistola ad Polycarpum*.

(35) In the second book of St. Augustine 's *De Mirabilibus Sacras Scripturae*. The Bishop of Avila referred to was Alfonso Tostado (1400-55), and the reference is to his twenty-second and twenty-fourth questions on the tenth chapter of Joshua.

(36) Flavius Josephus (ca. 37- 95), historian of the Jews.

(37) Isaiah 38:8. Paul of Burgos (ca. 1350-1435), also known as Paul de Santa Maria , was a Jewish convert to Christianity who became Bishop of Burgos.

(38) This and the ensuing quotations from St. Augustine are referred to *De Genesi ad litteram* i, 18 and 19.

(39) The book *Of the Divine Name*, then attributed to Dionysius the disciple of Paul, actually belongs to

the late fifth or early sixth century.

(40) Joshua 10:13.

(41) Joshua 10:12.

(42) Thomas de Vio (1468-1534), Bishop of Gaeta, commenting on the *Summa Theologica* of Thomas Aquinas.

(43) Cosme Magalhaens (1553-1624), a Portuguese Jesuit who in 1613 had published a two-volume treatise on the Book of Joshua.

(44) From the hymn *God, Creator of All*, attributed to St. Ambrose.

(45) Proverbs 8:26 (Douay). At present the word in question is translated "poles."

*Discoveries and Opinions of Galileo*, edited by Stillman Drake (New York: Anchor-Doubleday, 1957), pp. 173-216. Original Italian text published in *Opere di Galileo Galilei*, Edizione Nazionale edited by Antonio Favaro (Firenze: Giunti-Barbera, 1968), vol. V, pp. 309-348. Translation and footnotes by Stillman Drake, and confronted with the original Italian source *Lettera a Cristina di Lorena*, in *Opere di Galileo Galilei*.

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