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Introduction

The Sun too, both in rising and in withdrawing
Beneath the waves, will give you signs; the Sun
Commands most certain signs, both those he brings
At break of day and when the stars are rising.
If hiding in a cloud he wears his morning guise
Flecked, and the centre of his disk concave,
Beware of showers: the south wind, from the deep
Driving, bodes ill for trees and crops and herds . . .
This too still more it will pay you to remember:
When, having spanned Olympus, he's departing
Often we see colours of varying hue
Wander across his face; purple means rain,
Flame-colour means east winds; but if the flecks
Begin to take a tinge of fiery red,
Then you will see a welter everywhere
Of winds and storm clouds both . . .
Who dares call the Sun a liar?

Virgil, *Georgics*[1]

1. "Sol quoque et exoriens et cum se condet in undas / signa dabit; solem certissima signa sequentur, / et quae mane refert et quae surgentibus astris. / ille ubi nascentem

The study of sunspots emerged in the second decade of the seventeenth century as an essential element of the debate about the nature of the heavens: if these evanescent phenomena were really located on the Sun, then the most splendid body in the heavens was imperfect, and with it the entire heavens. The instrument that made these and other celestial features visible, the telescope, was still a novelty, and the observations made with it were likewise subjects of controversy and negotiation. An entirely new dimension had been added to the study of the heavens; an instrument lately emerged from the mathematical or optical and mechanical traditions made available information that bore directly on philosophical and cosmological issues. Telescopic astronomy, as we might call it, was a subject that could not have been imagined in 1607—the year before the instrument came into use—and in 1612 and 1613, when the sunspot controversy raged, it had yet to find an institutional setting, an epistemological foundation, or even an adequate optical explanation. The initial arguments about the reality of the celestial phenomena originally observed through it, especially the uneven surface of the Moon and the satellites of Jupiter, were only just beginning to recede, giving way to debates about their interpretation, when the newly visible solar markings focused attention on the *precision* of telescopic observations, and added to the arguments concerning the nature of the heavens.

That Galileo's interpretation of sunspots prevailed over those of his opponents is indisputable; what one could perhaps more reasonably debate is the question of priority in their discovery.[2] This controversy, initiated by Galileo and his rival Christoph Scheiner themselves, was carried on with vigor by some

maculis uariauerit ortum / conditus in nubem medioque refugerit orbe, / suspecti tibi sint imbres: namque urget ab alto / arboribusque satisque Notus pecorique sinister. . . / hoc etiam, emenso cum iam decedit Olympo, / profuerit meminisse magis; nam saepe uidemus / ipsius in uultu uarios errare colores: / caeruleus pluuiam denuntiat, igneus Euros; / sin maculae incipiunt rutilo immiscerier igni, / omnia tum pariter uento nimbisque uidebis / feruere / Solem quis dicere falsum / Audeat?" Virgil, *Georgics*, translated with an introduction and notes by L. P. Wilkinson (London: Penguin, 1982), 1: vv. 437–444, 450–457, 463, p. 71.

2. The most exhaustive treatment of this controversy is Bellino Carrara S.J., "L'"Unicuique Suum' nella scoperta delle macchie solari," *Memorie della Pontificia Accademia in Roma dei Nuovi Lincei* 23 (1905): 191–287; 24 (1906): 47–127. See also Antonio Favaro, "Sulla priorità della scoperta e della osservazione delle macchie solari," *Memorie del Reale Istituto Veneto di Scienze, Lettere ed Arti* 22 (1887): 729–790; and Walter M. Mitchell, "The History of the Discovery of the Solar Spots," *Popular Astronomy* 24 (1916): 22–31, 82–96, 149–162, 206–218, 290–303, 341–354, 428–440, 488–499, 562–570; Emil Wohlwill, "Zur Geschichte der Entdeckung der Sonnenflecken," *Archiv für die Geschichte der Naturwissenschaften und der Technik* 1 (1908–1909): 443–454. A judicious and appropriately short judgment on this matter can be found in Michele Camerota's recent *Galileo Galilei e la cultura scientifica nell'Età della Controriforma* (Rome: Salerno Editrice, 2004), 241–254.

nineteenth-century scholars, and as recently as 1974 John North weighed in with a defense of the priority of the English scientist Thomas Harriot.[3] The very notion of "discovery" needs some qualification, for sunspots have been observed since Antiquity, and were documented for almost two millennia before the advent of the telescope. What little that can be added to the tired question of priority is that the first record of a telescopic observation of sunspots was made by Thomas Harriot on 18 December 1610 (Gregorian), and that the earliest printed reference to its telescopic appearance came in a publication by the Frisian Johannes Fabricius in the summer of 1611. We prefer to let the voluble claims of Galileo and Scheiner emerge within the context of the controversy over the nature of the spots.

At the heart of the debate lay the question of the location and nature of the spots: those issues bore directly on the ongoing cosmological quarrel that had preoccupied European astronomers and philosophers for over a century. The question of the nature of the heavens had been raised well before Copernicus; it had been addressed both by the mapping of comets in the fifteenth century and by astronomers' novel claim that parallax measurements of those comets would show whether the original distinction between the perfect and unchanging heavens and the corrupt and ever-changing terrestrial region in Aristotelian cosmology could be maintained.[4] While the pace and intensity of the debate increased with the publication of Nicolaus Copernicus's *De Revolutionibus* in 1543, heliocentrism was by no means the only issue. As James Lattis has demonstrated, the prominent Jesuit Christoph Clavius exerted himself against Copernicus's heliocentrism, Tycho Brahe's geo-heliocentrism, Girolamo Fracastoro's revival of homocentric spheres, and neo-Stoic notions of a fluid heaven in which celestial bodies flew like birds in the air or swam like fish in the sea. In each of these alternative cosmologies, the nature of the heavens was a central issue.

3. John D. North, "Thomas Harriot and the First Telescopic Observations of Sunspots," in *Thomas Harriot: Renaissance Scientist*, ed. John W. Shirley (Oxford: Clarendon Press, 1974), 129–165. An even earlier claim was made by Adriaan Metius. In his *Institutiones Astronomicae* of 1614 Metius claims to have observed sunspots as early as 1608. See Tabitta van Nouhuys, *The Age of Two-Faced Janus: The Comets of 1577 and 1618 and the Decline of the Aristotelian World View in the Netherlands* (Leiden: Brill, 1998), 228.

4. Jane L Jervis, *Cometary Theory in Fifteenth-Century Europe* (Dordrecht: Reidel, 1985); C. Doris Hellman, *The Comet of 1577: Its Place in the History of Astronomy* (New York: AMS Press, 1944); William H. Donahue, *The Dissolution of the Celestial Spheres* (New York: Arno Press, 1981); William H. Donahue, "The Solid Planetary Spheres in Post-Copernican Natural Philosophy," in Robert S. Westman, ed., *The Copernican Achievement* (Berkeley: University of California Press, 1975), 244–275.

and around centers other than its center, and still less do I deny other circular motions separated entirely from the Earth, that is, that do not go around it and enclose it in their orbits. For Mars, Jupiter, and Saturn, with their approaches and retreats, assure me of those former configurations, and Venus and Mercury, and also the four Medicean Planets prove the validity of the latter to me. Consequently, I am most certain that there are circular motions that describe eccentric circles and epicycles, but that Nature really uses that medley of spheres and orbs imagined by the astronomers [*astronomi*] so that she can describe such motions, *that* I consider not so much a necessary belief as a requirement to facilitate astronomical calculations. And I am of an opinion halfway between those astronomers [*astronomi*] who admit not only the eccentric movement of the stars [i.e., planets], but the eccentric orbs and spheres that conduct them as well, and those philosophers [*filosofi*] who with equal force deny both the orbs and the motions about any center other than that of the Earth.

However, when it is a question of investigating the place of the solar spots, I would wish that Apelles had not expelled them from a real place [*luogo*] that is among the immense spaces [*spazii*] in which the little bodies of the Moon, of Venus, and of Mercury go around—expelled, I say, by virtue of an imaginary supposition that these spaces [*spazii*] are entirely filled with orbs, eccentrics, epicycles, and deferents, and that they are disposed and even obliged to carry with them every other body placed in them, so that [such a body] cannot wander on its own toward any place [*banda*] other than where the surrounding heaven, with its too harsh shackles, compels it to go. And I would wish this all the less the more I see Apelles himself very close to conceding what he had earlier denied. He had said that the spots cannot be in any of the orbs of the Moon, of Venus, or of Mercury because if they were, they would follow the motion [of these planets]. Thus he supposes that the spots cannot have any motion of their own, and then, concluding that they are in the orb of the Sun, he allows that there they can move with their own revolutions, such that they are capable of wandering over the solar sphere. But if it is conceded to me that they can move through the heaven of the Sun, then it should not be denied to me that they can likewise course through that of Venus; and if it is conceded to me that they move a little and are not entirely obedient to the whirling movement of the sphere that contains them, then I will not consider it inappropriate that they move a lot and do not obey such spheres at all.

I do not want to pass over another small point that occurs to me about this same passage, at the end of which Apelles makes his last inference. There it appears that he ascertains that the spots are, finally, in the heaven of the Sun (and they absolutely have to be placed there, because in his opinion they revolve about it in very narrow circles). He then adds that they can neither be in the

eccentric of the Sun, nor in the eccentrics *secundum quid*,[16] nor in another orb, were there any other. Now, here I cannot understand how they can be in the heaven of the Sun and revolve around the solar body without being in any of the orbs of which the heaven of the Sun is composed.

The three arguments that Apelles puts forward next as convincing proof that the spots move circularly about the Sun appear very probable, but they are not without some cause for doubt. As for the first, it is that the decrease in the width of the spots near the limb of the Sun would be a sign that they are stars that, turning in circles slightly more ample than the solar body, were beginning to show their illuminated parts in the manner of the Moon or of Venus, whence the dark part starts to diminish. And yet it appears to some who have very diligently observed the sunspots that the diminution of the dark part happens contrary to the way it would have to, that is, not in the part that faces the center of the Sun, but on the opposite side. And it seems to me to be nothing other than the fact that they are becoming thinner. As to the second argument—the division of what had appeared to be a single spot near the circumference into many—it has this impediment, that vast changes are perceived among these spots also in the middle regions of the Sun: they increase, diminish, join, and separate, and below I shall include some [illustrations of] changes observed by me. As regards the third argument, regarding the difference that one then notes between the speed of their motion around the middle regions and the slowness at the extremes—a difference that seems very pronounced—it would appear that it suggests rather that those spots must be on the solar body itself, and that they move with its own motion, rather than turning about it in other orbits. For a similar difference in speed would remain almost invisible to the unaided eye whenever these circles expanded beyond the surface of the Sun by a perceptible but not very great space, as one understands in the very figure included by Apelles. And here it seems that a bit of contradiction arises in him: for in this passage it is necessary to put the circles of rotation of the spots very close to the solar globe, because otherwise there would have been no increase in the speed of the motion and the [mutual] separation of the spots toward the middle of the disc, which near the circumference seemed to touch each other. And on the contrary, from the argument with which a little bit earlier he proved that the spots are not contiguous to the Sun, he would necessarily have to conclude that these circles were rather far from the same [body], because only the fifth part of their circumference, at most, could remain interposed between the solar disc and our eye, given that they cross the visible hemisphere in fifteen days,

16. A common term in scholastic writing meaning "in a certain sense" or "specially defined," that is, a restricted meaning as compared with a general meaning.

and that they had not yet returned and shown themselves in two months. It is necessary, therefore, to observe diligently, from when a spot first appears until it is finally hidden, the measure by which its speed increases and then decreases, for from this proportion one can then estimate whether its motion is on the surface itself of the solar body or rather in some circle separated from it, under the assumption, however, that such variation in the spots' velocity depends on a simple circular motion.

It remains for us to consider what Apelles decides about the essence and substance of these spots, which is, in sum, that they must be neither clouds nor comets, but rather stars revolving about the Sun. I confess to Your Most Illustrious Lordship, in regard to such a determination, that I do not yet have enough confidence to dare to establish and affirm any conclusions as certain, for I am very sure that the substance of the spots could be a thousand things unknown and unimaginable to us, and that the accidents that we observe in them—their shape, opacity, and motion—being very common, can provide us with either no knowledge at all, or little but of the most general sort. Therefore I do not believe that the philosopher who was to acknowledge that he does not and cannot know the composition of sunspots would deserve any blame whatsoever. But if by way of analogy with materials familiar and known to us we desired to proffer something that they might be, in truth I would be of an opinion entirely opposed to that of Apelles. For it does not appear to me that any condition of the essentials that belong to the stars [i.e., planets] fits these [spots], and, on the contrary, I do not find a single characteristic in them that is not likewise seen in our clouds. This we will discover if we reason in the following manner:

The solar spots appear and vanish at shorter and longer intervals; some of them come together and draw apart greatly from one day to the next; their shapes change, and most are very irregular, with greater and less darkness here and there; and because they are either on the solar body or very close to it, they must be absolutely immense bodies; because of their varying opacity, they are capable of impeding the light from the Sun here more, here less; and sometimes many appear, at other times few, and then again none at all. Now, of very large and immense masses, which appear and disappear in brief periods, which sometimes last longer and sometimes less, which expand [*distraghino*] and contract [*condensino*], which easily change their shapes, and which are here denser and more opaque, and there less so, nothing like that is found near us except for clouds; all other materials, on the contrary, differ greatly from the combination of these characteristics. And there is no doubt whatsoever that if the Earth were luminous in itself and if the illumination of the Sun did not come upon it from outside, then to someone who was able to observe it from a very great distance it would truly offer a similar appearance. For as now this and

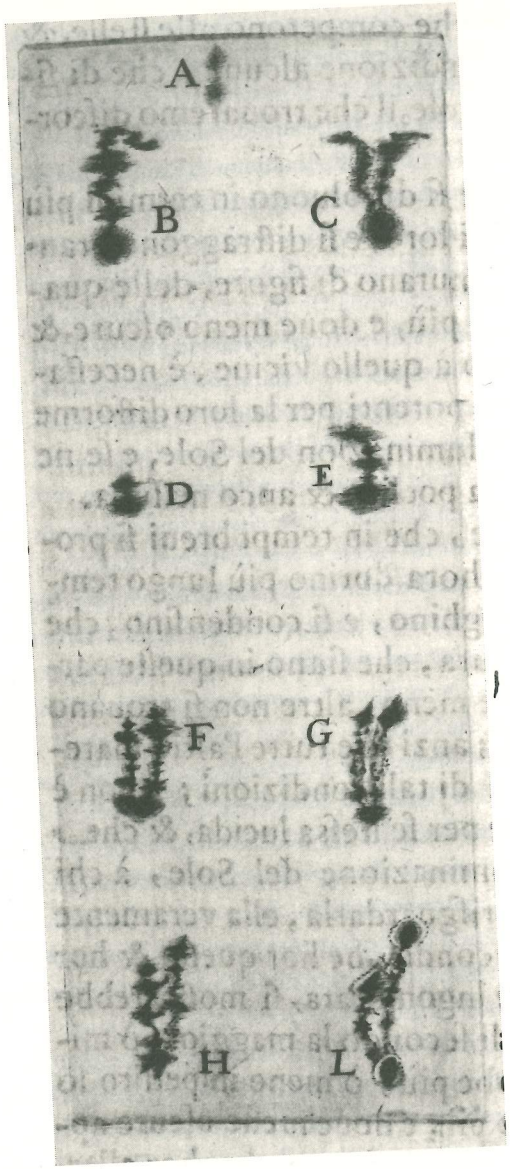
now that region were obstructed by the clouds, it would appear strewn with dark spots by which, according to the greater or lesser density of their parts, the Earth's splendor would be more or less impeded, and therefore [the spots] would appear here more and there less dark; they would appear sometimes many, at other times few, and sometimes expanding and at other times shrinking; and if the Earth rotated on its axis, those [spots] would also follow its motion; and because they are not very thick with respect to the width to which they commonly extend, those which in the middle of the visible hemisphere would appear very wide would, in approaching the extremity, seem to contract. In sum, I don't believe that a single feature would emerge that doesn't have its analogue in the solar spots. But because the Earth is dark and the illumination comes from the external light of the Sun, if the globe could be viewed now from a most distant place, one would absolutely not see any blackness or any spot caused by the scattering of clouds over it, because these, too, would receive and reflect the light from the Sun. Of the change in shape, of their irregularity, and of the unequal densities, please accept these two examples, Your Lordship.

Spot A, which on the 5th of this past April, at sunset, looked very thin and not very dark, the following day appeared once again at sunset, [but,] like spot B, increased in darkness and changed in shape, and on the seventh day [of the month] it was similar to figure C, and their position was always far from the circumference of the Sun.

On the 26th day of the same month, at sunset, on the upper part of the Sun's circumference, a spot similar to D began to appear, which on the 28th day was like E, on the 29th like F, on the 30th like G, on the 1st of May like H, and on the 3rd like L; and the changes of spots F, G, H, and L occurred rather far from the circumference of the Sun, so that such a change in appearance could not have been caused by the fact that they were seen under different angles [*diversamente*] (which near the circumference, because of the receding of the curved surface, causes a great difference).[17]

From these and other observations, and from those that can be made from day to day, one can clearly gather that among our [terrestrial] substances there is none that better imitate the characteristics of these spots than clouds, and the reasons that Apelles adduces to demonstrate that they cannot be clouds appear to me to be extremely feeble. To his question "Who would ever posit that there are clouds about the Sun?" I would respond, "He who saw these spots and wanted to say something plausible about their essence, for he would not find anything known to us that resembles them more." To the question he asks about how large they are, I would say: "As large as we see them in comparison

17. The original observations are reproduced at *OGG*, 5: 253–254.



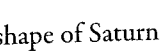
to the Sun, as large as those that sometimes cover a large territory of the Earth." And were this not large enough, I would say two, three, four, and ten times as great. And finally, to the third impediment that he produces, how these [spots] could cast such a shadow, I would respond that their blackness is less than that which our densest clouds would present to us when interposed between our

eye and the Sun. This can be easily seen whenever one of the darkest clouds covers a part of the Sun and there are some spots in the uncovered portion, for no small difference will be observed between the blackness of the former and the latter, even though the edge of the cloud crossing the Sun cannot be of great thickness. And from this we can infer that a very thick cloud could cause much greater darkness than that of the darkest spots. But if, however, that were not the case, who would prohibit us from believing and saying that some of the solar clouds are denser and deeper than the terrestrial ones?

By this I am not asserting that these spots are clouds of the same substance as ours, consisting of aqueous vapors ascended from the Earth and attracted by the Sun; but I am merely saying that we have no knowledge of anything that resembles them more. Whether they are vapors or exhalations or clouds or smoke produced by the solar body or attracted to it from elsewhere is uncertain to me, because they could be a thousand other things imperceptible to us.

From what has been said, it can be gathered that the term "stars" is poorly suited to these spots, for stars, whether they are fixed or wandering, are always observed to maintain their shape, and that shape is circular; and it is not observed that some [stars] dissolve and others appear again anew, but rather that they always remain the same. And they have periodical motions such that they return after some fixed time, but these spots are not observed returning unchanged; on the contrary, some can be seen to dissolve on the face of the Sun. And I believe that one would wait in vain for the return of those that Apelles believes capable of moving around the Sun in very small circles. The principal conditions that belong to these natural bodies to which we have given the name "stars" are thus lacking. That they should be called stars, then, because they are opaque bodies and denser than the substance of the heavens, and therefore better withstand the Sun['s light], and are illuminated strongly by it on the side struck by its rays and on the opposite side produce a heavy and deep shadow, and so forth, these are conditions that belong to every stone, to wood, to the denser clouds, and in sum to all opaque bodies. And a ball of marble, because of its opacity, resists the light of the Sun, is illuminated by it, as is the Moon or Venus, and on the opposite part produces a shadow, so that in this respect it could be called a star. But because they lack the other, more essential, conditions—conditions of which the solar spots are also likewise deprived—it therefore appears that the name "star" should not be attributed to them.

Indeed, I would wish that Apelles had not counted the companions of Jupiter—by which I believe he means the four Medicean Planets—in this group, because they appear most constant, like all the other stars, [and] always bright except when they enter the shadow of Jupiter, for then they are eclipsed like the Moon in the shadow of the Earth. They have their fixed peri-

ods, which are different for each of them, and already precisely determined by me.[18] Nor do they move in a single circle, as Apelles seems to have believed or at least thought that others had believed, but rather they each have their distinct circles of different sizes around Jupiter as center, the sizes of which I have likewise determined. I have also found the causes of when and why now one, now another of them declines either to the north or to the south in relation to Jupiter; and once he has specified them, perhaps I shall have responses to the objections that Apelles suggests arise in this matter. But that there are more of these Medicean Planets than the four observed up to now, as Apelles says he holds for certain, this could perhaps be true, and such a resolute affirmation by a person who is, as far as I know, very knowledgeable makes me believe that he might have some grand hypothesis about it, one that I surely lack. But I would not be so bold as to affirm anything, because I would fear that I would have to retract it with time. And in this respect, I would not decide to propose anything around Saturn except what I have already observed and discovered, that is, two small stars that touch it, one toward the east and the other toward the west, in which no change whatsoever has yet been seen; nor surely will any [alteration] be seen in the future, if not perhaps some very strange property not only most remote from the other motions known to us, but also far removed from our every fantasy. But what Apelles proposes, that Saturn appears sometimes oblong and sometimes accompanied by two stars on its sides, let Your Lordship understand that this is caused by imperfection in the instrument or in the eye of the observer, for the shape of Saturn being thus,  —as perfect instruments reveal to perfect eyes—where this flawlessness is lacking it appears like this:  , the separation between the three stars and their shapes not being perfectly distinguished. But I, who have observed it a thousand times under different conditions with an excellent instrument, can assure Your Lordship that no change whatsoever is perceived in it [Saturn], and reason itself, based on the experience that we have of all the other motions of the stars, can render us certain that likewise none will take place. For if there were any motion in these stars similar to the motions of the Medicean or of other stars, they would already have to be either separated from or completely conjoined to the principal star of Saturn, even if their motion were a thousand times slower than

18. Galileo published the periods of Jupiter's satellites for the first time in his *Discorso intorno alle cose, che stanno in sù l'acqua, ò che in quella si muovono* (Florence 1612). See *OGG*, 4: 63; Stillman Drake, ed., Thomas Salusbury, tr., *Discourse on Bodies in Water* (Urbana: University of Illinois Press, 1960), 1.

any other such movement of any other star that might go wandering through the heavens.

In response to what Apelles has put forward as his final conclusion, that is that these spots are more likely wandering than fixed stars, and that between the Sun and Mercury and Venus there are rather many of them, of which only those that interpose themselves between the Sun and us are manifest to us, I say, as for the first part, that I believe that they are neither wandering, nor fixed, nor stars, nor that they move about the Sun in circles distinct and distant from it. And were I obliged to offer my opinion in confidence to a friend and patron, I would say that the solar spots were produced and dissolved near the surface of the Sun, and that they were contiguous to it, and that the Sun itself, rotating around its axis in about a lunar month, carried them with itself, and perhaps sometimes brought back some of them, those of a duration longer than one of its revolutions, but so changed in shape and company that we cannot easily recognize them. And however far my conjecture now extends, I have great hopes that with what I have pointed out to you, Your Lordship will consider this matter finished. That there could then be some other planet between the Sun and Mercury that moves about the Sun, and remains invisible to us because of its small digressions [from the Sun], and can make itself visible to us only when it passes linearly below the solar disc, is for me not at all improbable. And it appears to me equally credible that [such stars] exist as that they don't exist. But I would not believe in a vast multitude [of these stars], for if they existed in great numbers, then it stands to reason that frequently one would have to be seen below the Sun, and this has thus far not befallen me, nor have I seen anything [below the Sun] other than these spots. And it is not likely that a star of this kind could have passed among those [spots], even if this star were to manifest itself, in terms of its appearance, as a black spot. I say it is not likely, for its movement would have to appear uniform and very rapid with respect to that of the spots: very rapid because moving in a smaller circle than that of Mercury, it is probable, in analogy with the motions of all the other planets, that its period would be shorter and its motions more rapid than the motion and the period of Mercury. In its passage below the Sun, Mercury traverses its disk in about six hours, such that another planet whose motion is yet more rapid should not have to remain in conjunction with it for a longer interval, excluding the possibility that one wanted to make this hypothetical body move in a circle so small that it almost touched the solar body, an arrangement that would be entirely too chimerical. But even in circular orbits whose diameters were two or even three times as great as the diameter of the Sun, it would take place as I have said: yet in fact the spots remain in conjunction with the Sun for many days, and therefore it is not likely that any planets whatsoever pass

among them or in their guise. Such a planet, besides its velocity, would also have to move almost uniformly, being some considerable space away from the Sun, because only a small part of its circle would be under the Sun, and this small part would face the rays from our eyes directly and not obliquely. Thus, equal parts of it would be seen under angles of negligible inequality, that is, almost equal, and therefore its motion would appear uniform. This does not happen with the motion of the sunspots, which traverse the middle region [of the Sun] with great rapidity, while the closer they are to the circumference, the more sluggishly they proceed. Thus, the stars that go wandering about between the Sun and Mercury can in all likelihood not be many in number, and [there would be fewer still] between Mercury and Venus, for since [these hypothetical stars'] greatest digressions [from the Sun] are necessarily greater than that of Mercury, they would, like Venus and Mercury itself, have to be visible as brilliant [stars], and especially since they are not very far from the Sun and from the Earth. And so, because of the small distance from us and because of the Sun's strong illumination they would be visible because of the vividness of the light, even if they were very small in size.

I know that I have excessively wearied Your Most Illustrious Lordship with my great prolixity and few conclusions. Please recognize in the length [of this letter] the pleasure I take in conversing with you, and the desire to obey and serve you as much as my strength will allow me. And in these respects, please pardon my excessive loquacity, and receive with pleasure the readiness of my affection. May my uncertainty be excused by the novelty and difficulty of the material, where the various ideas and different opinions that have passed through my imagination, sometimes finding assent and sometimes rejection and contradiction, have rendered me bashful and perplexed, for I hardly dare open my mouth to affirm anything. I do not want on this account to despair and to abandon the enterprise; on the contrary, I would hope that these novelties might serve me wonderfully to adjust a few pipes of this grand [but] discordant organ of our philosophy, which, in my view, many organists labor in vain to tune to perfection. And this is because they go about leaving and preserving three or four of the principal pipes out of tune, such that it is impossible for the others to respond in complete harmony.

As a servant of Your Lordship, I desire to take part in the friendship that you have with Apelles, because I consider him a person of sublime skill and a lover of truth. I ask you, therefore, to greet him cordially in my name, giving him to understand that in a few days I will send him some observations and drawings of the solar spots, ones of absolute precision, in their shapes as well as in their daily changes in position, without a hairsbreadth of error, all made by a most exquisite method discovered by one of my students. These [observations]

will perhaps be of benefit to him in philosophizing about their essence. It is time to cease troubling you. Therefore, kissing your hands with every reverence, I recommend myself to your good graces, and I pray to God for the greatest happiness for you.

From the Villa delle Selve, 4 May 1612
Your Most Illustrious Lordship's
Most Devoted Servant
Galileo Galilei L[inceo]