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In defense of Copernicus: Paolo Foscarini (ca. 1565–1616) and the heliocentric system

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IN DEFENSE OF COPERNICUS: PAOLO FOSCARINI (ca. 1565-1616) AND THE HELIOCENTRIC SYSTEM

by

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i.a.k.

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INTRODUCTION

On March 5, 1616, the Roman Catholic Church's Sacred Congregation of the Index issued a decree prohibiting, until corrected, both Nicholas Copernicus' classic work, the De revolutionibus orbium coelestium, and the In Job commentaria by the Spanish theologian Diego de Zuñiga, a portion of which dealt with the reconciliation of the Copernican system of the universe with the Bible. The same decree condemned absolutely the Lettera...sopra l'opinione de' Pittagorici e del Copernico della mobilità della terra e stabilità del sole, published in Naples in 1615 by the Carmelite monk, Paolo Antonio Foscarini.[1] In his role as an ardent exponent of the Copernican cosmology and ally of Galileo, Foscarini has been duly noticed but scarcely studied by historians.

Some attention has been paid to Foscarini's role as a Copernican spokesman by historians interested either in chronicling the spread of Copernicanism in Europe or in detailing the events leading up to the condemnation of 1616, which itself set the stage for Galileo's personal condemnation of 1633. Consequently, works such as Dorothy Stimson's Gradual Acceptance of the Copernican Theory of the Universe, which first appeared in 1917 and is still the only book-length survey in English of the spread of the new cosmology, contained a summary of

Foscarini's ideas as they were presented in the Lettera.[2]

Scholars interested in Galileo's own career and his relations with the Church, such as Giorgio de Santillana (The Crime of Galileo) and Jerome Langford (Galileo, Science and the Church) have both paid some attention, albeit brief, to the role and ideas of Foscarini.[3] In the same category can be included the valuable information contained in the now standard work, Discoveries and Opinions of Galileo, by Stillman Drake, the preeminent Galileo scholar of our time, and that contained in the "Antecedenti al processo galileiano e alla condanna della dottrina copernicana," by Domenico Berti, a Galileo expert of the nineteenth century.[4] The latter study is particularly important in that it printed for the first time, from manuscript originals, documents necessary to a proper assessment of Foscarini and the condemnation of 1616.

However, until this decade, only two monographic studies of Foscarini existed. The more complete of the two was a chapter in C. Nardi's 1954 collection of sketches of famous people from Montalto Uffugo, Foscarini's birthplace. Nardi included in his discussion an examination of Foscarini's family history as well as an account of the procedure leading to the condemnation of the Lettera. Unfortunately, Nardi made no attempt to analyze Foscarini's arguments nor those of

his opponents, and included only the briefest discussion of other works related to the condemnation.[5]

The second study, "Paulus Antonius Foscarini," by Antonio Franco in the Analecta Ordinis Carmelitarum, (1911), was even more limited in scope. It focused solely on the prohibition of Foscarini's Lettera and was of value for its inclusion of other versions of certain of the documents originally printed by Berti.[6]

Recently, more attention has been evinced in Foscarini's role as a propagandist for the new astronomy, an interest demonstrated by the publication of Bruno Basile's essay in 1983 and Stefano Caroti's in 1987. Basile provided a re-evaluation of Foscarini's arguments in favor of Copernicus based exclusively on the Lettera, with some attempt to place these arguments in their contemporary intellectual context.[7]

Caroti's essay was undoubtedly the best synoptic investigation of Foscarini's Copernicanism. Caroti brought his expertise as a historian of late medieval science and philosophy to this task and, unlike Basile, endeavored to discuss not only the Lettera but other works by Foscarini which bore on this issue, most importantly his lengthy theological defense of the Lettera and his letter to Galileo on the physical implications of Copernican astronomy. This essay was particularly important for its inclusion of the results

of the research, by the Carmelite archivist E. Boaga, into the records dealing with the condemnation of Foscarini's book.[8] Owing to the constraints of space and the author's intent, Caroti did not provide an in-depth examination of Foscarini's theological and scientific/ philosophic sources and arguments. As E. Garin observed in 1984, there is still a need for a systematic investigation of Foscarini as Copernican spokesman.[9]

The present investigation is an analysis of what can be called the "context ofjustification" of Foscarini's Copernicanism. The concept of a scientific thinker's "context of justification" has been borrowed from the work of Hans Reichenbach, the philosopher of science. Reichenbach draws a sharp distinction between the "context of justification" and the "context of discovery" in relation to scientific geniuses and their creations. According to Reichenbach, an insurmountable gap separates these two contexts and a logical analysis is only possible for the justifications offered for scientific theories and discoveries. "The act of discovery escapes logical analysis."[11]

Although Foscarini was neither a scientific genius nor a discoverer in Reichenbach's sense, a logical analysis of Foscarini's "context of justification" is certainly possible and valuable. He was, as he himself

stated, the first Catholic author to devote an entire printed treatise to the critical task of reconciling the new cosmology with Sacred Scripture. At the same time, he presented the scientific and religious advantages of the new cosmology over the old. In his fulfillment of his task, Foscarini was intimately involved in the attempt to create a modus vivendi between the new science of the seventeenth century and the Christian faith.

Foscarini's "context of justification" for Copernicanism must be analyzed first in terms of his condemned Lettera. Beyond that his arguments must be drawn from other documents related to the ecclesiastical debate over Copernicus of 1615 to 1616. These documents include an anonymous theological Judicium and refutation of the Lettera, Foscarini's answer in the form of a theological Defensio, his personal letter to Galileo on the acceptance of geokineticism as physical truth and the letter of Robert Cardinal Bellarmine to Foscarini on the subject of the new astronomy.

To fully grasp this "context of justification," Foscarini ought not to be treated apart from other Catholic defenders of Copernicus. For this reason, his name has generally been coupled with those of Galileo and Campanella. Whereas these comparisons are valuable and have been undertaken where appropriate in this study, another kind of comparison has been made as well.

To understand any thinker's justificatory arguments, an attempt must be made to see the arguments not only in comparison to those from thinkers of the same intellectual camp, but also in contrast to those from thinkers of an opposing camp. Such opposing camps always exist in the case of radically new scientific theories. Only by presenting arguments form the contra-Copernican intellectual camp, can a proper understanding be gained of why a specific scientific theory, in this case Copernicanism, needed "justification" and how particular positions advanced by men such as Foscarini attempted to serve such a function. Consequently, considerable attention has been paid to philosophers, theologians and exegetes who reflected the Catholic intellectual world of the sixteenth and seventeenth centuries. In a number of cases these thinkers demonstrated an explicit knowledge of, and opposition to, the Copernican cosmology.

The fact that Foscarini was more of a propagandist for others' ideas than an innovative thinker in his own right makes him a valuable object of attention in terms of the effects wrought on European culture by the Copernican Revolution. Perhaps too much attention has been paid to Copernicus, Galileo and Kepler, who, by their genius and creativity, separated themselves from the average intellectual of early modern times. Their

thought certainly does not help us to see how revolutionary theories in astronomy and physics came to be generally accepted norms. As W.H. Donahue observed:

> ...the new theories thus produced could never have been accepted had there not been a simultaneous and gradual change in the kind of ideas that were regarded as traditional. Such changes can be discovered only by turning to the works of the less prominent and brilliant authors, who by their very mediocrity better represent the main-streams of educated opinion.[11]

Notes

1. S. Pagano, ed., I documenti del processo di Galileo Galilei (Vatican City: 1984), 102-103.

2. D. Stimson, The Gradual Acceptance of the Copernican Theory of the Universe (Gloucester, MA: 1972), 71-72. E. Zinner's Entstehung und Ausbreitung der Copernicanischen Lehre (Vaduz: 1978), 357, 360 contains only the briefest mention of Foscarini's name. Zinner's work, originally published in 1943, is the other major study of the spread of Copernicanism throughout Europe.

3. G de Santillana, The Crime of Galileo (Chicago: 1955), passim and J.J. Langford, Galileo, Science and the Church (Ann Arbor: 1971), esp. 59-62.

4. S. Drake, ed. and trans., Discoveries and Opinions of Galileo (Garden City: 1957), esp. 160-171 and D. Berti, "Antecedenti al processo galileiano e alla condanna della dottrina copernicana," Atti della R. Accademia dei Lincei, 279, serie terza, Memorie della classe di scienze morali, storiche e filologiche 10(1881-1882):49-96.

5. C. Nardi, Notizie di Montalto in Calabria (Rome: 1954), 257-302.

6. A. Franco, "P. Paulus Antonius Foscarini," Analecta Ordinis Carmelitarum 2(1911):461-468, 493-504, 524-527.

7. B. Basile, "Galileo e il teologo 'copernicano,' Paolo Antonio Foscarini," Rivista di letteratura italiana 1(1983):63-96.

8. S. Caroti, "Un sostenitore napoletano della mobilità della terra: il padre Paolo Antonio Foscarini," in Galileo e Napoli, ed. F. Lomonaco and M. Torrini (Naples: 1987), 81-121.

9. E. Garin, "Il 'caso' Galileo nella storia della cultura moderna," in Novità celesti e crisi del sapere, ed. P. Galluzzi (Florence: 1984), 10, n. 12.

10. H. Reichenbach, The Rise of Scientific Philosophy (Berkeley: 1973), 231.

11. W.H. Donahue, The Dissolution of the Celestial Spheres 1595-1650 (New York: 1981), 17-18.

CHAPTER ONE: FOSCARINI'S LETTERA: THE ARGUMENTS IN FAVOR OF COPERNICUS

Paolo Antonio Foscarini was born in the small town of Montalto Uffugo, in the diocese of Cosenza in Calabria, southern Italy. Much of his early life is obscure and a matter of dispute. Although his family appears to have been established in Cosenza or Montalto by the second half of the sixteenth century, it is not certain that they originated in that region. In his own writings Foscarini consistently referred to his family as of a noble Venetian origin, an origin repeated in contemporary Carmelite sources and by later members of the family.[1]

However, certain authors have accused Foscarini of fraudulently claiming a Venetian ancestry. Such an accusation originated in the eighteenth-century works of Angelo Zavarrone and Elia D'Amato, the latter a native of Montalto and Carmelite Provincial of Calabria.[2] This accusation has been repeated in the works of the great Galileo scholar Favaro.[3]

The basis of this accusation is evidence concerning the correct form of Foscarini's family name. Although Paolo Antonio consistently referred to himself, and was consistently referred to, as either Foscarini or Foscareni, other members of his family used other surnames. His father, Francesco a physician

and man of letters, used the surname Scaridino. This is demonstrated by the frontispiece of Francesco's work on epistolography, the Formolario, printed in Padua in 1569.[4] Paolo Antonio's two brothers, Polibio and Vincenzo, used the name Scarini when referring to their family and their father.[5] Consequently, by the end of the seventeenth century, a question arose as to Foscarini's origin[6] and the claim finally appeared that Paolo Antonio, in order to forge a spurious connection with a famous Venetian family, had added a prefix to the true family name.[7]

Variant forms of a surname were not uncommon in the sixteenth and seventeenth centuries. In fact, Carlo Nardi, in his detailed discussion of Foscarini's family origins, has argued that Francesco apparently migrated from northern Italy to Montalto and that the transition from Scaridino to Scarini can be explained by the linguistic peculiarities of Calabrian and Cosenzean Italian.[8] The transition to Foscarini definitely appears accomplished by the time Paolo reached adulthood at the end of the sixteenth century, although Nardi left the matter open as to why this final transformation came about.

Not only his family origins, but also Foscarini's birthdate is a matter of debate. Although some authors, such as Nardi and Favaro, have given 1580 as

the year of birth,[9] there is no contemporary documentation to support this year and none of the seventeenth and eighteenth-century lives of Foscarini contain any information concerning the year of his birth. Other authors have argued, more persuasively, for 1565. They cite the large number of positions Foscarini held within his chosen religious order, the regular Carmelites, which suggests a more lengthy career.[10]

After acquiring a doctoral degree, Foscarini was regent in the great convent of the Carmelites in Naples for six years and then professor of theology at the University of Messina for two years.[11] He rose to a position of prominence within the Carmelite order. Foscarini was named Vicar Provincial in 1607 and then in 1608 was elected to head the entire province of Calabria, a position to which he was re-elected in 1612.[12] He also served as the first Prior of the Carmelite convent in Montalto founded in 1609 by his brother Polibio.[13] Foscarini died, according to the most authoritative accounts, on the 10th of June, 1616.[14]

Foscarini's printed works show a man of varied interests, both theological and philosophical. In 1611 he published a work of spiritual theology, the Meditationes preces et exercitia quotidiana. This work

is of interest not only to students of theology but also because it contained a brief disquisition on the nature of the cosmos. An examination of this book has confirmed the short notice of it contained in the Dictionnaire de spiritualité, in which the work is described as upholding the traditional cosmology.[15]

The Meditationes contained all of the standard Aristotelian cosmological ideas. Along with the four mutable sublunar elements (earth, water, air, fire) and the fifth, incorruptible heavenly aether, Foscarini upheld the dual physics of the heavenly and earthly realms with the assertion of a perpetual circular motion natural to the heavens alone. The physical heavens, or heavenly spheres, ten in number, revolved around a corruptible earth which sat immobile at the center of the universe. This account of the cosmos was entirely traditional, including the poetic phrase describing the sun as the "leader and ruler of the planets."[16]

In 1613 Foscarini published his Institutionum omnis generis doctrinarum tomis vii comprehensarum Syntaxis, printed by the firm of Andreas Ricci in Cosenza, the same firm that had brought out the Meditationes.[17] This small treatise outlined the method and order of study one should follow to acquire knowledge in all fields and announced a grandiose plan

on the part of Foscarini to publish a vast work, the Institutes, on all branches of learning. Foscarini's enterprise was a reflection of the encyclopedism of early modern philosophers and the research of Cesare Vasoli has revealed that this treatise was still of interest to southern Italian philosophers at the end of the seventeenth century.[18]

In 1615 Foscarini chose to publish two works on scientific subjects, both of which indicated his recent conversion to Copernicanism. His lengthy Trattato della divinatione naturale cosmologica, Naples, from the press of Lazarro Scoriggio,[19] dealt specifically with prognostications and natural omens--signs of the changes of the times which foretell storms, frost, heat, earthquakes, drought, pestilence and famine. Foscarini indicated that this work was originally composed in Latin, taking the place of the first chapter of the sixth treatise of the second book of the third tome of that vast encyclopedia, the Institutes, which had been announced in 1613. He had decided to translate this work on signs into Italian and have it printed in the vernacular for the advancement of learning.[20]

In the text of the Trattato della divinatione naturale cosmologica, Foscarini demonstrated his recent adoption of the Copernican view of the cosmos. In his

treatment of the conjunction of the sun with the Dog Star (Sirius) Foscarini placed in a parenthetic remark the statement that, according to the new cosmography of the Pythagoreans and Copernicus, the sun remains fixed at the center of the universe. In the same portion of the text, Foscarini positively stated that the motion of the sum does not happen in fact but only according to appearances and in another parenthetic remark he cited two works in which he had argued for the Copernican cause. One was his Astrologia, a work which was never printed. The second work was an even lengthier treatment of this subject written as a letter to Sebastiano Fantone, General of the Carmelite Order.[21] This letter was not identical to the most detailed treatment of the Copernican cosmology from the pen of Foscarini, the Lettera. . .sopra l'opinione de' Pittagorici e del Copernico della mobilitá della terra e stabilitá del sole, which also appeared in print from the press of Lazarro Scoriggio in Naples in 1615.

With the publication of his Lettera, dedicated to the General of his Order Fantone (1550-1623),[22] Foscarini entered the lists on the side of Copernicus and Galileo and may have encouraged Galileo to carry his fight for the Copernican cause in person to Rome.[23] Foscarini's defense of Copernicanism must be examined as a work of natural philosophy and biblical exegesis.

Above all else, it was Foscarini's aim to establish:

> the Foundations on which this Opinion [Copernicanism] may be grounded least, while otherwise it is favoured with much probability, it is found in reality to be extreamly repugnant (as at first sight it seems) not onely to Physical Reasons, and Common Principles received on all hands (which cannot do so much harm) but also (which would be of far worse consequence) to many authorities of Sacred Scripture: Upon which account many at their first looking into it, explode it as the most fond Paradox and Monstrous Capriccio that ever was heard of.[24]

Foscarini first attacked the hold of "antiquated and long confirmed custom" on the minds of learned and unlearned men. Opinions, he believed, became rooted in men's minds and new ideas were subsequently considered "harsh to the Ear, discoloured to the Eye, unpleasant to the Smell, nauseous to the Tast, rough to the Touch." Yet the authority of commonly accepted custom should not be esteemed over new ideas which are firmly based on newly discovered "Reasons" or "Sense" itself.[25] This appeal to reason and sense, ragione and senso, was crucial to the approach and ideology of traditional Aristotelian natural philosophers and the exponents of the "new science" of the seventeenth century.[26]

In a recent analysis of early seventeenth-century Aristotelian natural philosophy, however, it has been observed that the authors of texts in this area "did not need to have acquired experiences directly in order

to use them in argumentation, provided that they could be drawn from the statements of a weighty authority. . . ."[27] Consequently, there was a subordination of statements based on "experience" to the structure of argument itself, without much direct investigation of such "experiences." This estimation of the state of early seventeenth-century texts in natural philosophy is confirmed by the fact that Galileo's "new science," with its emphasis on the direct investigation of natural experiences, did not enter into the textbook tradition until after 1650.[28]

In this section of his work, Foscarini sided with the Moderns in the Renaissance debate between the Ancients and the Moderns.[29] As he contended, "Nor is Posterity so to be confined, but that it may, and dares, not only proceed farther, but also bring to light better and truer Experiments [Experiences] than those which have been delivered to us by the Ancients." The Moderns have surpassed the Ancients in invention and in the knowledge of the Liberal and Mechanical Arts. He cited the "Experiments" ["Experiences"] of the Moderns which have "stopped the mouth of Venerable Antiquity, and proved many of their greatest and weightiest Opinions, to be vain and false."[30] As examples, he offered the famous doctrine of the Antipodes, which was held as no less a paradox and no

less absurd than the opinion of the motion of the earth, as well as the question of the habitability of the Torrid Zone [the Tropics]. The first, the doctrine of the Antipodes, he argued, was held to be impossible by many; the second belief had been absolutely denied by all. Yet the Modern Age, by a diligent and untiring search for the truth, proved both of these theories, as well as many others, to be undoubtedly correct.[31]

In his general assault on the positions of the ancients in natural philosophy, Foscarini referred his readers to the Examen vanitatis doctrinae gentium et veritatis Christianae disciplinae (1520) by the Italian sceptical philosopher Gianfrancesco Pico della Mirandola (1469-1533).[32] Pico's attack on Aristotelianism in natural philosophy has been judged to be more comprehensive than any earlier attack and his Examen has been characterized as containing "an exhaustive compendium of anti-Aristotelian lore. . . ."[33]

Many in the Reanissance rejected the position that the Antipodes and the Torrid Zone were uninhabitable, continuing a debate that had existed in the earlier medieval era. Such refutations can be found in astronomical, medical and theological works, as well as in geographical tomes describing the great discoveries of the modern age.[34] Nicholas Copernicus (1473-1543)

in his De revolutionibus (1543), Book 1, Chapter 3 explicitly asserted the existence of the Antipodes, as did Galileo (1564-1642) in his great Dialogo (1632).[35] Leading physicians such as Giovanni Manardi (1462-1536), Professor at the University of Ferrara, argued as early as 1514 that the habitability of the Torrid Zone, a topic of debate in medical circles, had been proven beyond doubt by the explorations of the Portugese.[36] The rejection of the position of the ancients and the Church Fathers on the Antipodes was a part of biblical exegesis as well, as can be seen in the authoritative Commentariorum et disputationum in Genesim (1589-1598) by the influential Jesuit theologian Benedict Pererius (1535-1610). Pererius had argued that those Fathers of the Church who had denied the sphericity of the earth or the existence of the Antipodes were to be properly rejected.[37]

The discoveries of the new age would most certainly be accepted, Foscarini pointed out, by Aristotle and other ancient authorities if they were living and could have access to the arguments and observations of the moderns, a rhetorical point also made by Galileo in his earlier work on sunspots (1613).[38] "In rejecting ancient authority, the 'moderns' were not rejecting the ancients themselves, but the role their writings played in intellectual

inquiry."[39] The Moderns, to use one of their favorite metaphors, were calling for an examination of the "Book of Nature" rather than of the books of Aristotle or other authorities, whether ancient, medieval or modern.[40]

As a professional theologian, however, Foscarini placed divine revelation and Sacred Scriptures above man's reason and his senses. Closely related to this hierarchical structuring of authorities was the problem of the acceptance of the Copernican theory. For, as Foscarini admitted,

> since this Opinion of Pythagoras and Copernicus hath entered upon the Stage of the World in so strange a Dress, and at the first appearance (beside the rest) doth seem to oppose sundry Authorities of Sacred Scripture, it hath (this being granted) been justly rejected by all men as a sheer absurdity.[41]

Foscarini did not enter immediately into the discussion of the scriptural problems surrounding the heliocentric theory. Instead he presented an important discussion of the scientific and philosophic validity of the two great cosmological systems, the Ptolemaic and the Copernican, completely neglecting the geo-heliocentric system proposed by Tycho Brahe (1546-1601). Denouncing the Ptolemaic system as one which even Ptolemy's own followers found unsatisfactory, Foscarini made the critical philosophical point that, while the celestial phenomena may be generally resolved

by the Ptolemaic system, this system necessitated the use of many difficulties and many devices such as eccentrics, epicycles, deferents, equants, and other "fancies" and "Chymaeras." From Foscarini's point of view, the traditional physico-mathematical devices of ancient and medieval astronomy savored more of the "Ratiocinative Entity" ("Ens rationis") of logicians than of any real thing.[42]

In his catalogue of "fancies" and "Chymaeras," Foscarini, as a disciple of Copernicus, included the Primum Mobile and what he called the "Rapid Motion" ("moto ratto"). Foscarini here attacked the assertion of the existence of spheres or physical heavens beyond the eighth sphere of the fixed stars, spheres to which some thinkers had ascribed certain of the traditional celestial motions, such as that of the diurnal rotation of the universe. It was the diurnal rotation of the universe around a supposedly immobile earth that Foscarini labelled the "Rapid Motion" or "moto ratto." Following Copernicus, Foscarini discarded all extra-stellar spheres, the last of which went by the name of the Primum Mobile, and discarded as well the diurnal rotation of the universe. Instead, as he argued later in the Lettera, it is the earth, not the universe, that has a diurnal rotation.[43]

It is interesting to note that another Copernican

natural philosopher, the ill-fated Giordano Bruno (1548-1600) used terms such as "illusion," "fantasy," and "chimeras" when denouncing the use of eccentrics, epicycles, deferents and the Primum Mobile in astronomy.[44] However, the attack on the reality of these devices had been widespread from late antiquity through the Renaissance and it is not clear that Foscarini was here echoing Bruno's words, although there are other parts of the Lettera where the influence of Bruno's writings might be seen.[45] Even Robert Bellarmine (1542-1621), future Cardinal of the Roman Church, and in no way a follower of Copernicus or Bruno, conceived in the 1570s of these very same epicycles, eccentrics and deferents as "complex and extraordinary structures. . .dreamed up" by astronomers.[46]

At this point in his exposition Foscarini provided a list of those ancient, medieval and modern astronomical theorists who had not espoused the customary Ptolemaic system, among them Eudoxus, Callipus, Averroes and Fracastoro. These non-Ptolemaists had defended a version of the cosmological system devised in the fourth century B.C., the hopelessly antiquated and anachronistic "homocentric" system, which did not utilize the eccentrics, deferents, epicycles and equants of Ptolemaic

astronomy.[47]

While Ptolemy's supporters utilized these devices, according to Foscarini, even they confessed that they could not as yet discover or teach the true hypothesis of the world and could only "save the phenomena."[48] Yet, Foscarini was convinced that the discovery of such truth was possible for astronomers and took his stand with the astronomical "realists," as Pierre Duhem called them, on this issue of the reality of astronomical hypotheses. This demand of the "realists" that astronomical hypotheses reflect the truth of the physical cosmos stood in opposition to the various arguments of "fictionalists" and "sceptics" who denied or doubted the reality of planetary models, while accepting their use for computations and predictions.[49] By making this demand for the physical reality of astronomical theories, Foscarini joined the greatest astronomers of the sixteenth and seventeenth centuries, whether they were heliocentric, such as Copernicus, Kepler or Galileo, or anti-heliocentric, such as Brahe or Christopher Clavius, S.J. (1537-1612), the greatest Catholic astronomer of the latter part of the sixteenth century.[50]

In this reagrd the Copernican theory was superior because it "rejecteth all those superfluous and imaginary inventions produced by Astronomers to the end

only, that they might be able by them to render a reason of the so many and so various motions of the Celestial orbs."[51] At this juncture, Foscarini made a critical citation to the final, revised edition of Clavius' Opera (1611-1612), where the famed Jesuit astronomer had cited Brahe's and Galileo's observations as requiring a new arrangement of the heavenly spheres.

This admission by Clavius created an internal debate within the Jesuit scientific community as to the final position of Clavius on Copernicanism. It was quoted by the Jesuit scientist Giuseppe Biancani (1566-1624), as well as by Johannes Kepler, to support the view that the great Jesuit authority Clavius, before his death, had come around to accept the "reasonableness," if not the truth, of the Copernican theory.[52] Indeed, Foscarini, while acknowledging the anti-Copernican position of Clavius, argued that Clavius' call for a new arrangement of the heavenly spheres was best answered by the Copernican system.[53]

After establishing the theoretical advantages of the new system over the old, Foscarini mentioned the empirical, observational evidence discovered by Galileo with the telescope. The mountains on the moon, the phases of Venus, the moons of Jupiter and the true nature of the Milky Way were all used to bolster the case for the heliocentric system.[54] As Foscarini

concluded, in a remarkably strong statement in favor of the new cosmology:

> What therefore can be inferred from hence, but that the Sun doth stand immovable in the Centre, and that the Earth, with the other Celestial Orbes, is circumvolved ablout it? Wherefore by this and many other Reasons it appears, that the Opinion of Pythagoras and Copernicus doth not disagree with Astronomical and Cosmographical Principles; yea, that it carryeth with it a great likelihood and probability of Truth: Whereas amongst the so many several opinions, that deviate from the common Systeme, and devise others, . . ., there is not one found that is more facile, more regularly and determinately, accommodated to the Phaenomena and Motions of the Heavens without Epicycles, Excentrix. . .Deferents, and the. . .Rapid Motion.[55]

Significantly, Foscarini continually claimed that the Copernican system did away with the traditional astronomical devices of eccentrics, epicycles and deferents. In the Preface to the De revolutionibus Copernicus had criticized those astronomers who used these devices for "contradicitng the first principles of uniform motion."[56] However, Copernicus was here referring to the use of the equant by the same astronomers, although he did not specifically use the term "equant" until Book 5, Chapter 25 of the De revolutionibus.[57] It was the equant that Copernicus wished to banish from astronomy and in the text of his work he employed the other ancient devices of eccentrics, epicycles and deferents.[58]

Not a professional astronomer, Foscarini did not

really comprehend the mathematical complexities of Copernicus' system. In fact, there is no indication in the Lettera that Foscarini ever read more than the Preface and Book 1 of Copernicus' De revolutionibus, in which the great Polish astronomer had sketched out the basic principles of his new cosmology and his general objections to the older system. In Book 1, Chapter 10, Copernicus had also included a diagram of his new universe in which the planets (except for the moon) are shown following simple, circular orbits around a central sun.[59] Considering these facts, it seems likely that Foscarini believed that Copernicus had devised a new "homocentric" system around a central sun which, by faithfully observing the principle of uniform circular motions for the planets and by faithfully mirroring the physical reality of the cosmos, did away with all of the unnecessary devise of Ptolemaic astronomy.[60]

The structure of Foscarini's argument, in which the learned Carmelite recounted the theoretical disadvantages of the Ptolemaic position and then moved to a brief recounting of Galileo's telescopic discoveries, concluding with this peroration in praise of the new cosmology, lends credence to William Donahue's suggestion that Foscarini was first convinced of the "truth" of the Copernican system on the basis of

its philosophical and theoretical advantages as contrasted with its empirical supports.[61] It was a system which was simpler, more rational and one which did not need to rely on the "fictions" of the followers of Ptolemy.[62] It must be remembered, however, that the Lettera does not necessarily provide the reader with a trustworthy account of how Foscarini came to adopt Copernicanism, but only his justificatory arguments for it.

The attributes of simplicity, rationality, regularity, all of which Foscarini assigned to the Copernican system, were related to the quest for a vision of the universe which was more harmonious than the Ptolemaic vision. Such a quest for harmony can be found not only in the Copernican Lettera but also in the earlier Meditationes and Syntaxis.[63] The insistence on harmony as a requirement of, and as proof for, a cosmological theory cannot be overemphasized. In the words of A.C. Crombie, the concept of the harmony of the universe "came to have various meanings such as simplicity and economy and fitness, which supplied a conception of sufficient explanation with profound influence in the history of science."[64]

Having established the philosophical worth of the Copernican system, Foscarini turned to the business of reinterpreting the Bible in the light of the new

astronomy. He tackled the supposed conflicts between Sacred Scriptures and Copernicanism with the following traditional logical argument:

> This Opinion of the Pythagoreans is either true or false; If false, it ought not to be mentioned, and deserves not to be divulged: If true, it matters not, though it contradict all, as well Philosophers as Astronomers: And though for its establishment and reducement to use a new Philosophy and Astronomy (founded upon new principles and Hypotheses) should be constituted: For the Authority of Sacred Scripture will not oppose it; neither doth one Trueth contradict another. If therefore the Opinion of Pythagoras be true, without doubt God hath disposed and dictated the words of the Holy Writ in such a manner, that they may admit an apt sense and reconciliation with that Hypothesis. Being moved by these Reasons, and the probability of the said Opinion, I thought good to try whether Texts of Sacred Scripture might be expounded according to theological and Physical Principles, and might be reconciled toit, so that (in regard that hitherto it hath been held probable) it may in after times, coming without scruple to be acknowledged for true, advance it self, and appear in publick with an uncovered Face, without any mans prohibition, and may lawfully and freely hold a Sacred intelligence with holy Truth, so earnestly coveted and commended by good men.[65]

Such an approach to the problem of the reconciliation of the Bible and Copernicanism was also that of Galileo, who, in his famous Lettera a Madama Cristina (1615), advised:

> 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.[66]

Since, as Galileo later remarked, repeating the same philosophical maxim cited by Foscarini, "two truths cannot contradict one another, it is the function of wise expositoirs 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."[67]

Both Galileo and his Carmelite ally reasoned as natural philosophers first, biblical exegetes second.

It is important to observe how Foscarini sharply delimited the respective fields of natural philosophy and biblical exegesis. As he pointedly stated at one point in the Lettera:

> God neither taught us, . . .how many the Coelestial Spheres and their Orbs are; Whether there be Epicycles or Eccentricks; nor the Vertues of Plants and Stones; nor the Nature of Animals; nor the Motion and Influence of the Planets; nor the Order of the Universe. . .: but only. . .things profitable, to wit, his Holy Law ordained to the end, that we being put into possession of Blessedness, might at length be made capable of all perfect knowledge, and the vision of the whole Order and admirable Harmony, as also the Sympathy and Antipathy of the Universe and its parts, in his Word, wherein all those things shall most clearly and distinctly, then, appear to us, which mean while, in this lefe, he hath remitted. . .to humane search and enquiry: But it was not his purpose to determine any thing, directly or indirectly, touching the truth of them.[68]

Or, as Galileo so succinctly put it, "'the intention of the Holy Ghost is to teach us how one goes to heaven,

not how heaven goes.'"[69]

This tendency of Foscarini and Galileo to separate the realms of natural philosophy and religion, never completely separated even in their writings, stood in sharp contrast to the exegetical and scientific practices of their time. As Arnold Williams demonstrated in his excellent study of commentaries on Genesis in this period, biblical exegetes adopted an expansive approach, incorporating a great deal of natural philosophy into their works and treating the and treating the books of the Bible as texts of science as well as religion.[70]

Catholic scientists, as well, included exegetical and theological arguments in their works. In the case of the debate over Copernicanism, by the time Foscarini and Galileo wrote their defenses of the new cosmology, certain biblical passages had been incorporated into astronomical texts to prove the falsity of heliocentrism and geokineticism. The In sphaeram Ioannis de Sacrobosco commentarius (1570), of Clavius,

> whose influence on seventeenth-century scholastic cosmology cannot be overestimated, was an immediate source for at least three of these, namely, Psalms 103:5, Ecclesiastes 1:4-5, and Psalms 18:6-7. In these passages, Clavius saw sacred support for the earth's immobility and for the movement of the sun and stars.[71] (See Chart of Allegedly Anti-Copernican Passages, 53-56, for Latin and English versions of these texts.)

This tendency on the part of Catholic exegetes and

scientists created the need to discuss the Copernican theory as a matter of biblical exegesis as well as astronomy.

Foscarini proceeded to answer this need and to interweave exegetical and physical arguments in his defense of Copernicus. He organized the anti-Copernican statements into six classes. (See Chart of Allegedly Anti-Copernican Passages, 53-56) These classes included the following: statements which speak of the earth at rest; statements which assert the motion of the sun; statements which place Heaven above and earth below; statements which put Hell at the center of the universe, which if we suppose the earth to be moving around the sun may place Hell in Heaven; statements which always oppose Heaven to the earth and vice versa; and finally those statements which assert that the sun, after the Day of Judgment, shall be immoveable in the east and the moon in the west.[72] Most of these statements Foscarini reconciled with Copernicanism by utilizing age-old Christian modes of exegesis: the principle of accommodation, whereby passages of the Bible are understood to have been written in the language of the "vulgar" people and accommodated to their ways of thinking; and the metaphorical-allegorical way of interpreting the Bible, in which scriptural passages are said to have deeper

and truer meanings beneath the obvious literal sense. These two approaches were standard for Copernicans trying to deal with biblical passages said to be contrary to the new astronomy.[73]

Of course, Foscarini took a heliocentric stance when intepreting biblical passages and he incorporated extensive comments on the nature of the sun in his Lettera. When discussing Genesis 1:16: "And God made two great lights: a greater light to rule the day; and a lesser light to rule the night: and the stars," Foscarini commented that, in reality, the sun and the moon are not the greater lights, save only in respect to us and our way of perceiving things.[74] Among those celestial bodies which were at least equal to the moon he numbered Saturn and some of the fixed stars. In addition, Foscarini went further by asserting the essential similarity of all celestial bodies--sun, moon and stars:

> For the Moon and Sun, considered in themselves, and as they appear to us, if they should be a far greater distance from us than indeed they are, would be no other, nor would appear to us otherwise than Stars, as the rest do in the Firmament. But Great Luminaries they neither are, nor seem to be save only in respect of us: And so, on the other side, the Stars, as to themselves are no other than so many Suns and so many Moons; yet they are so far remote from us, that by reason of their distance they appear thus small; and dim of light, as we behold them.[75]

Here Foscarini followed in the footsteps of Bruno,

who was the first thinker to regard correctly the sun as a star and the stars as suns. Whether Foscarini was indebted to Bruno for this cosmological idea, as well as to Bruno for his division of celestial bodies into suns and earths, is not clear.[76]

Although Foscarini asserted the similarity of the sun and the stars, he placed the sun in a class all its own. Trespassing over the boundaries he had himself tried to establish between biblical exegesis and the natural sciences, Foscarini argued, on the basis of biblical passages, that no matter what its distance from the earth, the intensity of the sun's light would be greater than that of any other celestial body. Although some of the fixed stars may have their own light, yet, according to Foscarini's line of reasoning, the brightness of none of these stars may be compared with the sun's splendor. The sun was created by God first, before all other luminaries, Foscarini continued, and was made of the highest kind of light, a contention that recalled the medieval exegetical and physical distinction between lux and lumen.[77] Because of his own reading of the Bible, Foscarini assigned a metaphysical and physical superiority to the sun and its light within the cosmos. In this respect he was closer to Copernicus than to Bruno, although Copernicus had not adduced biblical passages to support his view

of the special place and role of the sun in the universe.[78]

This insistence on the special role of the sun in the cosmos was part of a tradition stretching back into antiquity. Copernicus had attempted to bolster his heliocentric theory and his own picture of the sun by a citation of those ancients who called the sun "the lantern of the universe, its mind. . .and its ruler. . . . [Hermes] the Thrice Greatest labels it a visible god, and Sophocles' Electra, the all-seeing. Thus indeed, as though seated on a royal throne, the sun governs the family of planets revolving around it."[79]

The ancient tradition concerning the special role of the sun increased in power from the late Middle Ages as philosophers began to question seriously the Aristotelian and Neo-Platonic criterion of ascending order in the cosmos as a criterion of celestial perfection.[80] In the fourteenth century, Jean Buridan, the Parisian philosopher, discussed the special problem of the sun, which seemed so much more noble than any other planet, though Mars, Jupiter and Saturn were all more distant from the earth and consequently nobler in nature. It was the sun which was the greatest of the planets in magnitude and also the source of light for all the stars and planets. The sun was also, for Buridan, the cause of life and all generation on the

earth. And, as the fourth planet from the central earth, the sun was perfectly suited in its own "central" position to distribute this light and life to the universe, seated as a king in the midst of his kingdom. The particular analogy of the sun as a king in his kingdom became commonplace from the fourteenth century on.[81]

Yet, for all this, Buridan did not desert the ascending order principle of celestial perfection and he did not finally assign the most noble status to the sun. His younger, and more innovative, contemporary Nicole Oresme did reject this ascending order principle and did identify the sun as the noblest of the planets. These two positions of Oresme, separately or together, spread far and wide among early modern scholastic thinkers, though Oresme's writings themselves were probably not known to these later thinkers.[82] In fact, such an emphasis on the importance of the sun appeared in crucial early modern reference works, including the late sixteenth-century Coimbra Jesuits' commentary on Aristotle's De caelo, and in the works of openly anti-Copernican scholastics, such as Raphael Aversa, O. Carm. (1589-1657) and Bartholomew Amicus, S.J. (1562-1649).[83]

This glorification of the sun, this "valuational heliocentrism," was not a characteristic solely of a

heliocentric cosmology.[84] What did make the Copernican insistence on the special role of the sun different from that found in medieval and early modern scholastic writings was the Copernican association of the sun with the geometrical center of the universe. This immediately raised the question of the status of the geometrical center of the universe and challenged traditional physical and metaphysical notions about the relative worthlessness of the center of the universe, occupied, it was assumed, by the imperfect and changeable earth.

Such a challenge was not taken up by any important modern scholastic until the publication of the Almagestum novum (1651) of Giovanni Baptista Riccioli, S.J. (1598-1671). In this classic of anti-Copernican cosmology, Riccioli accepted the Copernicans'redefinition of the center of the universe as the best place in the cosmos but countered their insistence on placing the sun in that position. In his counterattack, Riccioli utilized the new and popular criterion of animate versus inanimate as the criterion of perfection. By emphasizing the animate nature of the earth versus the then current scholastic view of the inanimate nature of the heavens and by "making living things an integral part of the earth, Riccioli. . .made the earth ipso facto more perfect than any

celestial body. As the most noble and perfect body in the world, the earth, rather than the sun, was more fit to occupy the center, the noblest of places."[85] As a Copernican, however, Foscarini consistently maintained a double glorification: a glorification of the geometrical center of the universe and a glorification of the sun at that center.[86]

Foscarini placed this sun at the center of the universe, around which all the planets, including the earth, revolved. In discussing the famous miracle of Gabaon and in explicating Joshua 10:12: "Move not, O sun, toward Gabaon," Foscarini went beyond a simple assertion of a heliocentric and geokinetic cosmology.[87] He revealed, in his explication of this passage, a knowledge and acceptance of Copernicus' three specific motions of the earth: diurnal rotation; annual revolution around the sun; and the third motion of the earth's axis, the motion of inclination, which was designed to keep the earth's axis pointing to the same place in the heavens and to explain the precession of the equinoxes.[88] Foscarini handled the exegetical problem of this passage by arguing that it only appeared to the ancient Hebrews that God had stopped the sun. Instead, he reinterpreted the passage as arguing for a stopping of the sun's light across the face of the earth due to a cessation of the earth's

motions.[89] In this way, Foscarini retained the miraculous nature of the story of Gabaon but transformed it into a Copernican miracle.

In attempting to reinterpret Ecclesiastes 1:4: "One generation passeth away, and another generation cometh: but the earth standeth for ever,"[90] Foscarini advanced to an analysis of the nature of the earth. He proposed, in the manner of other Counter-Reformation exegetes, that this passage be taken to mean that while parts of the earth are mutable, yet the whole body of the earth remains forever.[91] If this passage be taken to refer to motion, and not to generation and corruption, as the anti-Copernicans contended, then Foscarini argued that the passage can be understood as saying that everything in the universe is assigned its natural place in which it will always abide.[92] However, the natural place of the earth was now redefined in terms of Copernican cosmology.

The earth's natural place in the universe was now known, according to Foscarini, to be above Venus and beneath Mars. In describing this natural place of the earth, Foscarini accepted Copernicus' term orbis magnus or "Great Circle" as the path of the earth around the sun and not that of the sun around the earth.[93]

Foscarini's redefinition of the earth's natural place led him further into the realm of physics and

into making other markedly anti-Aristotelian assertions. He argued that the Copernican restructuring of the universe revealed the answers to certain secrets not explainable in terms of Aristotelian natural philosophy. For example, he rejected Aristotle's conception of gravity as the motion of all heavy bodies toward the center of the earth, which is at the center of the universe.

In place of Aristotle's theory of gravity, Foscarini redefined gravity as "nothing else according to the Principles of this new Opinion [Copernicanism], than a certain power and appetite of the Parts to rejoyn with their Whole, and there to rest as in their proper place."[94] Gravity is the explanation for the spherical nature of heavenly bodies "wherein by this occult Quality naturally incident to each of them, they of themselves subsist, and are always preserved." Consequently, levity is, in the words of Foscarini, the exclusion of a more tenuous and thin body from one more solid and dense and of a heterogeneous nature. This new definition of gravity, taken directly from the De revolutionibus, Book 1, Chapter 9, was not limited to the sun and the planets, as it had been by Copernicus, but was extended by Foscarini to all bodies in the universe.[95] Though this universal theory of gravity was an important variation on a theme by Copernicus,

there were in Foscarini's writings no hints of the theory of gravity as a force of mutual attraction. Such a theory of gravity was first stated in the seventeenth century by Johannes Kepler and then formulated, in its classical form, by Isaac Newton.[96]

In his discussion of gravity, Foscarini continued to use the technical scholastic term to describe it--"occult." Gravity was so described because its qualities were not immediately identifiable to touch and the other senses. In medieval and Renaissance philosophy, "occult" meant both "hidden" ("insensible") and, at times, "unintelligible."[97] Foscarini's treatment of gravity was one instance of the willingness of early modern philosophers to incorporate "occult" qualities into their scheme of things and to attack the idea the idea that an "insensible" quality was unintelligible. Instead, early modern philosophers tried to devise causal explanations for the hidden qualities. They did not challenge the occult, according to one recent study of the matter, but "challenged the belief that man could not reduce occult properties to intelligible causes."[98] Of course, to find intelligible causes for "occult" properties was, for some, to deny the "occult" nature of those very properties.

As a consequence of his universal application of

the new concept of gravity, Foscarini flatly rejected the traditional qualitative distinctions between the celestial and terrestrial realms, radically distancing himself from the positions stated in his Meditationes of 1611.[99] First and foremost, Foscarini denied the notion of a heavenly, perfect aether, or fifth element, following the lead of Copernicus, who had effectively excluded such an aether from his cosmology.[100] As the Lettera uncompromisingly argued, the "heavens. . .shall not be constituted of a Matter different from that of the Elements, being free from all Mutation in its Substance, Quantity, and Quality."[101]

Foscarini frequently alligned himself with those early modern thinkers who argued for a corruptible and changeable heaven against the medieval Aristotelian tradition of the perfect unchanging heaven. Although Edward Grant has discovered a number of radically different positions taken by medieval philosophers on the nature of the heavens, "no medieval author has yet been identified who adopted the opinion that celestial matter is equivalent to one or more of the four terrestrial elements and therefore suffered substantial change. The Aristotelian world view could find no place for a corruptible heaven."[102] Foscarini's world view was, in this regard, no longer Aristotelian and he found no problem in discarding this aspect of the older

cosmology.

At the same time, Foscarini attacked other traditional notions of the heavens (spheres) by denying that they were made up of a solid body and were impermeable, and of an impenetrable and great density. Against the twin positions of the solidity and hardness of the heavens (spheres), positions which may only have become linked in the sixteenth century,[103] Foscarini put forth the evidence of sunspots. He offered two explanations of sunspots: they were either exhalations from the sun or an attraction of vapors to the sun.[104]

In place of the concept of the solidity of the heavenly spheres, and in the context of interpreting any biblical passages which may speak of such a solidity, Foscarini stated that the solidity of the heavens may be understood in the sense of allowing no vacuum in the universe. Linked to this rejection of the vacuum, Foscarini retained the idea of an aether which filled the heavens and which, although not the perfect aether of Aristotle, is "the most Rare [matter]. . .and tenuouse beyond all Human Conception, and happly hath the same proportion to the Aire, as the Aire to the Water."[105]

A more detailed study of Foscarini's writings, both published and unpublished, may reveal the extent to which this conception of the aether as a "most rare

and tenuous matter", less dense than air, reflects the ideas of medieval and Renaissance optical theorists. Edward Rosen has pointed out that medieval theorists, such as Al-Hazen (965-ca. 1040) and Witelo (13th century), adhered to the same idea of the aether, as did the Renaissance natural philosopher Jean Pena (ca. 1528-1558).[106]

Having rejected the Aristotelian conception of the heavenly fifth element and the qualitative distinctions between the celestial and terrestrial realms, Foscarini also rejected Aristotle's two different kinds of motion: right (rectilinear) motion, which can be both away from and toward the center, associated with terrestrial bodies, and circular motion, which is around the center, associated with celestial bodies alone. Foscarini absolutely denied that this was a true distinction and contended that both circular motion and reight motion can subsist in the same body, as circular motion is proper to the whole and right motion to its parts. Consequently, different kinds of motion should not be opposed to each other, but only rest and immobility are to be opposed to motion. As Copernicus argued in De revolutionibus, Book 1, Chapter 8, so Foscarini concluded: "And for the differences a medio, ad medium, and circa medium, they are distinguished not really, but only formally, as the

Point, Line and Superficies [Surfaces], none of which can be without the other two, or without a Body."[107]

Such a redefinition of motion was crucial for two reasons. First, it was part of the creation of one physics to govern the celestial and terrestrial realms, realms completely split asunder by Aristotle. Second, the specific assertion that circular and rectilinear motion can subsist in the same body was necessary for Copernicus and his followers, all of whom argued for the physical reality of projectile motion on a rotating and revolving earth.[108] Foscarini had to present not only a new cosmology but a new physics as well.

In addition to the physical doctrines affected by an acceptance of the Copernican system, there were important theological doctrines affected by such an acceptance. In his Disquisitiones mathematicae (Ingolstadt: 1614), Johann Locher, pupil of the Jesuit astronomer Christopher Scheiner (1575-1650), had pointed to the doctrines of the Incarnation and the Resurrection of Christ as contrary to the Copernican view of the universe. Displacing the earth from its central position in the cosmos, and transforming it into a planet revolving around a central sun, Locher objected, would imply that "Christ when he left the Earth to go to his Father, actually descended rather than ascended into Heaven."[109]

A similar problem appeared with the doctrine of Hell and its location, which Catholic theologians placed at or near the center of the earth. Copernicus' reordering of the cosmos would mean, some theologians argued, that Hell was being placed in Heaven. A perfect illustration of this type of reasoning can be found in the De situ et quiete terrae contra Copernici systema disputatio by Francesco Ingoli (1578-1649), a Catholic cleric and first secretary of the Office of the Propaganda Fidei, which was established by the Church in 1616. This particular work was written in early 1616, seemingly just before the official condemnation of Copernicus and Foscarini, and was sent in the form of a letter to Galileo.[110]

In that section of his work devoted to theological arguments against the location of the earth in the Copernican system, Ingoli reasoned as follows:

> Another argument is from the doctrines of theologians, the most powerful tenet of which is the doctrine of hell, that is the place of demons and the damned which is in the center of the earth, because, as heaven is the place of the angels and the blessed, it is proper that the place of demons and the damned be in the place most remote from heaven, which is the center of the earth. . . . Since therefore hell is in the center of the earth, and it must be in a place most removed from heaven, it must be admitted that the earth is in the center of the universe, which is the place most remote from heaven.[111]

Such an argument, which had a long history stretching back to the beginnings of Christianity, was

buttressed by Ingoli with citations from the Bible, such as Psalms 13 and Isaiah 14. Ingoli also appealed for support to critical Counter-Reformation texts, such as Robert Bellarmine's De Christo and De Purgatorio.[112] The doctrines of Hell, the Incarnation and the Resurrection firgued prominently, as well, in the work of Melchior Inchofer (1585-1648), S.J., Consultor of the Holy Office and judge of theological orthodoxy, as damning doctrinal points against Galileo's Dialogo and its defense of Copernicanism.[113]

It would seem that Copernicus did indeed thereaten the concern with "order" which obsessed many in this period of European history:

> Order in Heaven, order on earth, order even in Hell: men's minds during the Renaissance tended towards such affirmations invariably and often too insistently. The propensity was by no means a display of excessive piety. It was on the contrary the result of a deep-seated, fully experiential awareness that chaos could come again readily enough. Disorder. . .was after all a palpable reality, its omnipresence inescapable in the political sphere as in the religious, and in the social as in the economic. It were indeed a wonder had order not become an obsession, not that it had.[114]

To assuage this visceral fear of disorder, Foscarini had to deal with any theological doctrines threatened by the Copernican cosmology, above all the Incarnation, the Resurrection and the doctrine of Hell. He accomplished this task in two basic ways.

In the case of the doctrines of the Incarnation

and the Resurrection, foscarini insisted that those who invoked theological doctrines which rested on a spatial distinction between a "higher" Heaven and a "lower" earth must realize in what respect a thing can be said to be "higher" or "lower" than another. To argue that the earth is "high" or "low" in comparison to other parts of the universe or "absolutely High" in comparison to the "Centre of the World"-- or those bodies like the sun, Mercury and Venus closer to the center than the earth--was to reason falsely.

To understand the earth's true position in the universe, it must be compared to the majority of the bodies in the universe. If this comparison is made, it will be realized that in comparison to the entire circuit of the eighth sphere (the sphere of the fixed stars), which includes all corporeal bodies, and in comparison to specific bodies such as Saturn, Jupiter and Mars, the earth can truly be placed in the lowest part of the universe. In fact, it can be said that the earth is almost in the center of the universe. Only the sun, Mercury and Venus, are closer to the true center. Consequently, the earth <u>is</u> a "Low" body and not a "High" or "Middle" one. If this chain of reasoning be accepted, then it can continue to be asserted as doctrine that Christ "descended" from Heaven to earth in the Incarnation and "ascended" into

Heaven in the Resurrection.[115]

Another approach to this problem, an approach of greater import for the future relationship of scientific and theological discourse, dealt with the way theologians and scientists should define the term "Heaven" in matters of theology and doctrine. Foscarini sharply chastised those who misused the term "Heaven" and confused the physical heavens with the spiritual paradise, the home of the blessed. Basing himself explicitly on the testimony of St. Paul, and implicitly on the traditions of medieval cosmology and theology, Foscarini distinguished among three heavens: the Empyrean, the planetary and the starry.[116]

The Empyrean heaven was the most supreme or highest of the heavens and was, according to Foscarini, completely spiritual in terms of its end or purpose.[117] It was the Empyrean which Foscarini identified as the third heaven into which St. Paul ascended, according to 2 Corinthians 12. It was this heaven which theologians should understand as paradise and as the spiritual heaven. Consequently, when confronting those who dared to accuse the Copernicans of putting "Hell" into "Heaven," Foscarini discovered "nothing but Ignorance and Calumny" and an attempt to "insinuate" beliefs by a "corrupt sense of the Words, [rather] than by solid Reasons taken from the bosome of the Nature of

things."[118] Astronomical and physical heaven must be understood not as spiritual paradise but as that "subtilest and Purest Aire" discussed earlier in the Lettera.[119]

Foscarini's final position on the problem of the location of Hell was not as radical as one would expect. In contrast to his Dominican compatriot Campanella, who denied that there were any biblical or patristic authorities to decide the question of the location of Hell, Foscarini continued to adhere to the traditional doctrine.[120] He asserted that Hell was indeed among the dregs of the elements in the center of the earth, which rests and moves in Heaven. Yet, there was no problem for theologians and scientists here. For cosmological Heaven was not to be confused with spiritual paradise and spiritual Heaven. And, in conclusion, we:

> ought not for want of Reasons to trifle away time in vain and impertinent strife about words, since their true Sense is clouded then with no obscurity. . .and it is very clear to any man indued with a refined Intellect. . .that the same, or not very different Consequences do flow from both these Opinions [the Ptolemaic and the Copernican].[121]

Lastly, in the third and final portion of his Lettera, Foscarini attempted to apply the truths of the Copernican system to the mysteries contained in the Bible. Selecting the text Exodus 25 to dwell upon, he

claimed to see in the description of the candlestick placed in the Lord's tabernacle by the ancient Hebrews a reflection of the structure of the cosmos. To the verse Exodus 25:32: "Six branches shall come out of the sides, three out of the one side, and three out of the other," Foscarini assigned a Copernican meaning.[122] Placing the sun in the center of the candlestick, the latter taken as a representation of the universe itself, Foscarini equated the three branches on either side of the candlestick with the planets and their spheres (or heavnes).[123]

Recently, this interpretation has been identified as a "unique interpretation of the secrets of the tabernacle, explicated with a hermetic fantasy" and it has been argued that the "sole possible antecedent for such a strange biblical exegesis is that represented by cabalistic hermeneutics."[124] Although hermetic or cabalistic, numerological influences on the thought of Foscarini cannot be rejected out of hand, this specific cosmological interpretation of Exodus 25:32 was not a "unique interpretation" traceable only to the medieval Jewish Cabala and its Renaissance continuators. This interpretation, minus the Copernican application of course, can be found in Christian exegesis as early as the Stromata of Clement of Alexandria (d. between 211 and 215).[125] Such a cosmological interpretation and

exegesis of Exodus 25:32 continued in the Catholic tradition through the Counter-Reformation period. This continuation is attested to by the inclusion, once again in a non-Copernican form, of the same reading of Exodus 25:32, in the standard biblical commentaries of Cornelius a Lapide, S.J. (1567-1637), christened the "universal commentator of the Baroque age."[126]

In point of fact, Foscarini does not even merit the distinction of being the first to introduce this biblical passage into the debates raging over the correct constitution of the cosmos. The Dianoia astronomica (Venice: 1611), by the Florentine Francesco Sizzi (1585-1618), had already contained an attack on the physical reality of the moons of Jupiter on the grounds that no more than seven planets could exist because the candlestick described in Exodus 25:32 had only seven branches.[127] Sizzi's Dianoia bears the mark of being "the first attack against Galileo's book [the Sidereus nuncius] to introduce theological issues into the debate over the reality of Galileo's newly discovered 'planets'."[128]

Considering his penchant for astrological and physical speculations, it is no surprise to find Foscarini uncovering new truths of these types in biblical passages. Moving on, he attempted to peer into the depts of Exodus 25:33-34:

> Three cups as it were nuts to every branch, and a bowl withal, and a lily; and three cups likewise of the fashion of nuts in the other branch, and a bowl withal, and a lily. Such shall be the work of the six branches, that are to come out from the shaft:
>
> And in the candlestick itself shall be four cups in the manner of a nut, and at every one, bowls and lilies.[129]

About this passage Foscarini contended, with humble words that belied his true intent:

> The truth is, the shallownesse of my understanding cannot fathome the depth of all the Mysteries that are couched in the most wise disposure of things: neverthelesse being amazed, and transported with admiration, I will say; Who knows but that those three Bowls like unto Almonds to be represented on each of the Branches of the Candlestick may signifie those Globes which are apter (as is this our Earth) for the receiving than emitting of Influences? Perhaps also they denote those Globes of late discovered by the help of the Optick Telescope, which participate with Saturn, Jupiter, Venus, and possibly also with the other Planets? Who knows likewise, but that there may be some occult proportion between these Globes and those Mysterious Knops and Lilies insinuated unto us in the sacred Scriptures? But that this shall here suffice to bound humane Presumption, and to teach us to expect with an Harpocratick silence from Time, the Indice of Truth, a discovery of these Mysteries.[130]

Whereas this passage has been seen as a humorous reversion to medieval analogy,[131] it may reasonably be argued that it had a much more serious purpose. Foscarini's specific speculations concerning Exodus 25:33-34 may very well have been his answer to intellectual such as Sizzi, who had utilized these biblical verses to reject the reality of Galileo's

telescopic discoveries.

With these astrological-physical speculations about Exodus 25, along with other musings on other biblical passages, Foscarini concluded his apology for the "not improbable" Copernican "opnion."[132] He had argued that this "opinion" was simpler, more harmonious and more in accord with recent observational evidence than the Ptolemaic one. In fact, the Copernican "opinion" could even be the key to unlock passages of Sacred Scriptures which had remained mysteries until the modern age. As had been announced at the outset of the Lettera, Foscarini planned to set off immediately for Rome to preach at the order of his General.[133] There, in the capital city of his faith, he would face whatever reaction awaited him.

CHART

THE SIX CLASSES OF ALLEGEDLY ANTI-COPERNICAN PASSAGES

First Class: Those passages which affirm the earth's stability and lack of motion:

Psalms 92:1: "Etenim firmavit orbem terrae, qui non commovebitur." Rheims-Douay translation: "For he hath established the world which shall not be moved." [All future English translations of biblical passages are taken from the Rheims-Douay translation.]

Psalms 103:5: "Qui fundasti terram super stabilitatem suam, Non inclinabitur in saeculum saeculi." Translation: "Who hast founded the earth upon its own bases: it shall not be moved for ever and ever."

Ecclesiastes 1:4: "Terra autem in aeternum stat." Translation: ". . .but the earth standeth for ever."

Second Class: Those passages which affirm that the sun moves and turns around the earth:

Psalms 18:6-7: "In sole posuit tabernaculum suum; Et ipse tanquam sponsus procedens de thalamo suo. Exsultavit ut gigas ad currendam viam; A summo caelo egressio eius. Et occursus eius usque ad summum eius; Nec est qui se abscondat a calore eius." Translation: "He hath set his tabernacle in the sun: and he, as a

bridegroom coming out of his bride chamber, Hath rejoiced as a giant to run the way: His going out is from the end of heaven, And his circuit even to the end thereof: and there is no one that can hide himself from his heat."

Ecclesiastes 5-6: "Oritur sol et occidit, Et ad locum suum revertitur; Ibique renascens, gyrat per meridiem, et flectitur ad aquilonem." Translation: "The sun riseth, and goeth down, and returneth to his place: and there rising again, Maketh his round by the south, and turneth again to the north. . ."

Isaiah 38:8: "Et reversus est sol decem lineis. . . ." Translation: "And the sun returned ten lines. . . ."

Ecclesiasticus 48:26: "In diebus ipsius retro rediit sol, Et addidit regi vitam." Translation: "In his days the sun went backward, and he lengthened the king's life."

Joshua 10:12: "Sol, contra Gabaon ne movearis. . . ." Translation: "Move not, O sun, toward Gabaon. . . ."

Third Class: Those passages which affirm that Heaven is above and the earth is below:

Joel 2:30: "Et dabo prodigia in caelo et in terra. . . ." Translation: "And I will shew wonders

in heaven; and in earth. . . ."

Acts 2:19: "Et dabo prodigia in caelo sursum, Et signa in terra deorsum. . . ." This passage is itself a quotation of Joel 2:30. Translation: And I will shew wonders in the heaven above, and signs on the earth beneath. . . ."

Fourth Class: Statements which assert that Hell is at the center of the world, which is the common opinion of theologians. No biblical passages cited.

Fifth Class: Those passages which always contrapose Heaven and the earth, as having the relationship of the center to the circumference and the circumference to the center:

Genesis 1:1: "In principio creavit Deum caelum et terram." Translation: "In the beginning God created heaven and earth."

Psalms 113:15: "Qui fecit caelum et terram." Translation: ". . .who made heaven and earth."

Matthew 6:10: "Fiat voluntas tua, sicut in caelo, et in terra." Translation: "Thy will be done on earth as it is in heaven."

I Corinthians 15:47: "Primus homo de terra, terrenus: secundus homo de caelo, caelestis." Translation: "The first man was of the earth, earthly:

the second man, from heaven, heavenly."

Colossians 1:16: ". . .in ipso condita sunt universa in caelis, et in terra. . . ." Translation: "For in him were all things created in heaven and on earth. . . ."

Colossians 1:20: ". . .pacificans per sanguinem crucis eius, sive quae in terris, sive quae in caelis sunt." Translation: ". . .making peace through the blood of his cross, both as to the things that are on earth, and the things that are in heaven."

Colossians 3:2: ". . .quae sursum sunt sapite, non quae super terram." Translation: ". . .the things that are above, not the things that are upon the earth."

Sixth Class: The Sixth, and Final, Class of Statements (relating more immediately to the Fathers and the theologians than to Divine Scripture) is that in which statements are made which speak of the Sun being fixed in the East and the Moon in the West after the Last Judgment. No biblical passages cited.

Notes

1. C. Nardi, Notizie di Montalto in Calabria (Rome: 1954), 265-268.

2. A. Zavarrone, Bibliotheca calabra (Naples: 1753; reprinte ed., Bologna: 1967), 117-118; E. D'Amato, Museum literarium (Naples: 1730), 350 and Pantopologia calabra (Naples: 1725), 265.

3. Galileo Galilei, Opere, ed. A. Favaro (Florence: 1929-1939), 20:443.

4. C. Nardi, Notizie di Montalto, 261-262 and unpaginated reproduction of the Formolario's frontispiece opposite 278.

5. C. Nardi, Notizie di Montalto, 263.

6. The problem of Foscarini's origin can be demonstrated by the fact that in Daniel a Virgine Maria, Speculum carmelitarum (Antwerp: 1680), 2:1073, no. 3747, the author states that Foscarini was from Montalto and makes no mention of Venice. In Cosmas de Villiers, Bibliotheca camelitana (Orleans: 1752; reprint ed., Rome: 1927), 2:525, Foscarini's origin is said to be a matter of debate.

7. See the references in n. 2, above.

8. C. Nardi, Notizie di Montalto, 265.

9. C. nardi, Notizie di Montalto, 286 and Galileo Galilei, Opere, ed. A. Favaro, 20:443.

10. P.A. de Saint-Paul, "Paul-Antoine Foscarini," in Dictionnaire de théologie catholique (Paris: 1933), 12:53 and L. Saggi, "Foscarini," in Dictionnaire de spiritualité (Paris: 1937), 727.

11. The immediate source for this information is the eulogistic unpaginated material on Foscarini and his family printed at the end of Foscarini's Institutionum omnis generis doctrinarum tom. VII comprehensarum Syntaxis (Cosenza: 1613). This material was by Foscarini's fellow Carmelite Chrysostomus Marinus. The information reappears in later lives of Foscarini.

12. A. Franco, "P. Paulus Antonius Foscarini," Analecta Ordinis Carmelitarum 2(1911):463-464; C. Nardi, Notizie di Montalto, 268-269.

13. A. Franco, "P. Paulus Antonius Foscarini," 464; C. Nardi, Notizie di Montalto, 269. The immediate source of information on Polibio Foscarini's establishment of the Carmelite convent of Montalto is the material by Marinus cited in n. 11, above.

14. Danile a Virgine Maria, Speculum carmelitarum, 2:1073, no. 3747 and the works by D'Amato cited in n. 2, above.

15. L. Saggi, "Foscarini," 727-728.

16. P. Foscarini, Meditationes, preces, et exercitia quotidiana (Cosenza: 1611), 136-142. The quotation concerning the sun appears on 140.

17. Ricci is mentioned as a printer in Cosenza in L. Giustiniani, Saggio storico-critico sulla Tipografia del Regno di Napoli (Naples: 1793), 185.

18. C. Vasoli, "L'abate Gimma e la "Nova Encyclopaedia" (Cabbalismo, lullismo, magia e "nuova scienza" in un testo della fine del Seicento)," in his Profezia e ragione: Studi sulla cultura del Cinquecento e del Seicento (Naples: 1974), 840, 891.

19. L. Giustiniani, Saggio storico-critico sulla Tipografia, 163-164 and 168-169 offers general details on Scoriggio as a printer. S. Volpicella, in his "Relazione delle stamperie e stampatori e proibizione de' libri per causa di giurisdizione," Archivio storico per le province napoletane, 3(1878-1879):202-205, reveals that Scoriggio was imprisoned by the Holy Office in Naples on the grounds that he had printed Foscarini's Lettera without the requisite ecclesiastical license (imprimatur). Scoriggio defended himself by stating that the work had been granted said imprimatur, which does appear on the final page of the Lettera. If the license had not been granted, then Scoriggio claimed that he had been deceived by Foscarini into thinking that this license had been granted. Scoriggio was fined 100 ducats by the Holy Office. However, through the good offices of clerical friends, the fine was cancelled by Cardinal Caraffa, the Archbishop of Naples. For reprints of the correspondence (June 1616) between Cardinal Caraffa in Naples and Cardinal Millini in Rome on the incarceration of Scoriggio, see S. Pagano, ed., I documenti del processo di Galileo Galilei (Vatican City: 1984), 104.

20. P. Foscarini, Trattato della divinatione naturale cosmologica (Naples: 1615), 7.

21. P. Foscarini, Trattato della divinatione, 41. This personal letter to Fantone is cited in P. Foscarini, Lettera. . .sopra l'opnione de' Pittagorici e del Copernico della mobilità della terra e stabilità del sole (Naples: 1615), 4; T. Salusbury, Mathematical collections and translations: the first tome (London: 1661), 473.

22. On the life of Sebastiono Fantone, see A. Miraeus, Bibliotheca ecclesiastica sive de scriptoribus ecclesiasticis, pars altera (Antwerp: 1640) in J.A. Fabricius, Bibliotheca ecclesiastica (Hamburg: 1713; reprint ed., Farnborough: 1967), 290 and M. Ventimiglia, Historia chronologica priorum Generalium latinorum Ordinis B.V. Mariae de Monte Carmelo (Naples: 1773), 215-218.

23. S. Drake, ed. and trans., Discoveries and Opinions of Galileo (Garden City: 1957), 161 and his Galileo At Work: His Scientific Biography (Chicago: 1978), 245, emphasize the importance of Foscarini's work in convincing Galileo to carry his fight for Copernicanism personally to Rome in December, 1615.

24. P. Foscarini, Lettera, 4-5; T. Salusbury, Mathematical collections, 473-474. The seventeenth-century English translation of Foscarini's Lettera by Thomas Salusbury has been used for purposes of quotation and the spelling and grammatical structure have been left unchanged. Citations will be given first to the original Italian edition and then to the corresponding passage in the English translation.

Another printed edition of Foscarini's Lettera, an edition different from the original Italian version, can be found in Galileo Galilei, Opere, ed. E. Alberi (Florence: 1855), 13:73-135. There was a Latin translation of Foscarini's Lettera which was printed as an appendix to the Latin translation of Galileo's Dialogo (1632),in Galileo Galilei, Systema cosmicum (Strasburg: 1635), 465-495. For a reprint of this Latin version of Foscarini's work, see Z. Wardęska, Teoria heliocentryczna w interpretacji teologów XVI wieku (Wrocław: 1975), photoreproduction 10. The present author's research supports S. Drake's assumption that thomas Salusbury's translation, although close to the original Italian text of the Lettera, was actually made from the Latin translation

of Foscarini. T. Salusbury, Mathematical collections and translations, ed. S. Drake (London: 1967), 4.

25. P. Foscarini, Lettera, 5-6; T. Salusbury, Mathematical collections, 474.

26. P. Dear, "Totius in verba: Rhetoric and Authority in the Early Royal Society," Isis 76(1985):146-151 and P. Reif, "Textbooks in Natural Philosophy, 1600-1650," Journal of the History of Ideas 30(1969):30-32.

27. P. Dear, "Totius in verba," 149. Dear continues this argument in his "Jesuit Mathematical Science and the Reconstitution of Experience in the Early Seventeenth Century," Studies in History and Philosophy of Science 18(1987):133-175. These articles confirm the conclusion of P. Reif, "Textbooks in Natural Philosophy," 31-32.

28. C.B. Schmitt, "Galilei and the Seventeenth-Century Text-Book Tradition," in Novitá celesti e crisi del sapere, ed. P. Galluzzi (Florence: 1984), 217-228.

29. For a recent discussion of the seventeenth-century debate between the "Ancients" and the "Moderns", see F. Baumer, Modern European Thought: Continuity and Change in Ideas, 1600-1950 (New York: 1977), 117-137. On the late medieval and Renaissance antecedents to this debate consult "Ancients and Moderns: A Symposium," Journal of the History of Ideas 48(1987):3-50. The latter includes contributions from W.J. Courtenay, C. Trinkaus, H. Oberman and N. Gilbert. An interesting discussion of the idea of progress in the history of science is provided in A.C. Crombie, "Some Attitudes to Scientific Progress: Ancient, Medieval and Early Modern," History of Science 13(1975):213-230.

30. P. Fsocarini, Lettera, 6; T. Salusbury, Mathematical collections, 474.

31. P. Fsocarini, Lettera, 6-7; T. Salusbury, Mathematical collections, 474-475.

32. P. Fsocarini, Lettera, 7. This reference is missing in the Latin translation printed with Galileo Gailei's Systema cosmicum, 468 and in T. Salusbury, Mathematical collections, 475.

33. C.B. Schmitt, Gianfrancesco Pico della Mirandola (1469-1533) and his Critique of Aristotle (The Hague: 1967), 55.

34. J.K. Wright, The Geographical Lore of the Time of the Crusades (New York: 1925), 55-57, 385-386 and P. Delhaye, "Antipodes," New Catholic Encyclopedia (New York: 1967), 1:631-632 offer brief discussions of the patristic and early medieval denial of the antipodes. According to Delhaye, early popes raised the issue of the habitability of the antipodes as a theological issue but never declared it to be heetical. By the thirteenth century, according to Delhaye, the antipodea were seen as a scientific question to be settled by "experiments." The statement by F.S. Benjamin, Jr. and G.J. Toomer, eds. and trans., Campanus of Novara and Medieval Planetary Theory: Theorica Planetarum (Madison: 1971), 397, n. 60, that the belief in the existence of inhabited antipodes was "heretical" in the Middle Ages seems mistaken. H.B. Johnson, "New Geographical Horizons: Concepts," in First Images of America, ed. F. Chiappelli (Berkeley: 1976), 2:625-626, deals with the impact of the new discoveries of the Renaissance on geographical ideas concerning the Torrid Zone and the antipodes.

35. N. Copernicus, On the Revolutions, ed. J. Dobryzycki, trans. and comm. E. Rosen (Baltimore: 1978), 10 and Galileo Galilei, Dialogue Concening the Two Chief World Systems, trans. S. Drake (Berkeley: 1967), 331.

36. On Manardi and his discussion of the habitability of the Torrid Zone, see W.P.D. Wightman, Science in a Renaissance Society (London: 1972), 74, 86 and G. Sarton, The Appreciation of Ancient and Medieval Science during the Renaissance (1450-1600) (Philadelphia: 1955), 27. N.G. Siraisi in Taddeo Alderotti and His Pupils: Two Generations of Italian Medical Learning (Princeton: 1981), 184, deals with the debate, in Italian medical circles of the thirteenth and fourteenth centuries, over the habitability of the equatorial regions. Certain thirteenth-century authors such as Peter of abano and Robert Grossesteste are cited as supporting the idea of the habitability of these regions.

37. A. Williams, The Common Expositor: An Account of the Commentaries on Genesis 1527-1633 (Chapel Hill: 1948), 195. For a general introduction to the life and thought of Pererius, see C. Giacon, La seconda scolastica (Milan: 1946), 2:33-49 and L. Thorndike, A History of magic and Experimental Science (New York: 1966), 6:409-413. A.C. Crombie, "The Sources of

Galileo's Early Natural Philosophy," in Reason, Experiment, and Mysticism in the Scientific Revolution, ed. M.L. Righini-Bonelli and W.R. Shea (New York: 1975), 162-166 and W.A. Wallace, ed. and trans., Galileo's Early Notebooks: The Physical Questions (Notre Dame: 1977), 13-15, and passim, emphasize Pererius' role as Professor of Logic and Natural Philosophy at the Collegio Romano and his influence on the thought of the young Galileo.

38. P. Foscarini, Lettera, 6-7; T. Salusbury, Mathematical collections, 474-475; S. Drake, ed. and trans., Discoveries and Opinions, 118.

39. P. Dear, "Totius in verba," 150.

40. P. Dear, "Totius in verba," 150-151; E. Garin, "La nuova scienza e il simbolo del 'libro'," in his La cultura filosofica del Rinascimento (Florence: 1961), 451-465. M. de Grazia, in her study of "The Secularization of Language in the Seventeenth Century," Journal of the History of Ideas 41(1980):319-329, argues that there were radical changes in the writings of seventeenth-century scientists concerning the relationship between the Book of Nature and the Book of God (the Bible). These changes were, in de Grazia's view, steps in the "secularization" of European culture.

41. P. Foscarini, Lettera, 8; T. Salusbury, Mathematical collections, 475.

42. P. Foscarini, Lettera, 9; T. Salusbury, Mathematical collections, 476.

43. P. Foscarini, Lettera, 9; T. Salusbury, Mathematical collections, 476. Foscarini speaks here, in Salusbury's translation, of "the Heaven void of Stars, moving the inferior Heavens or Orbes," whereas the Italian original speaks of "varii Cieli" or "various Heavens without stars, moving all the inferior Heavens." One finds the term Primum Mobile included as an explanatory marginal addition in the Salusbury translation. In his Meditationes, 141-142, Foscarini had accepted the existence of a ninth sphere which he called the "Coelum Aqueum" or "Christallinum" and a tenth sphere which he identified with the Primum Mobile.

On the development in medieval cosmology of adding a sphere beyond that of the fixed stars, the Primum Mobile as it was called, whose motion caused the "first

motion" or diurnal rotation of the entire universe, see J.L.E. Dreyer, A History of Astronomy from Thales to Kepler, ed. W.H. Stahl (New York: 1953), 233 and E. Grant, "Cosmology," in Science in the Middle Ages, ed. D. Lindberg (Chicago: 1978), 278-279, 284. Galileo, in his Dialogo (1632) used the term Primum Mobile in the medieval sense when he put into the mouth of the Aristotelian spokesman, Simplicio, the assertion that "astronomers and philosophers have discovered another very high sphere, devoid of stars, to which the diurnal rotation naturally belongs. To this they have given the name primum mobile; this speeds along with it all the inferior spheres, contributing to and sharing with them its motion." In the Copernican cosmology, however, it is the earth that has the "first motion" of diurnal rotation and thus can be called the primum mobile. Galileo Galilei, Dialogue, 121-122.

44. G. Bruno, De l'infinito, universe e mondi in his Dialoghi italiani, ed. G. Gentile (Florence: 1958), 353-354, 435, 515. For an English translation of these passages, see D.W. Singer, Giordano Bruno: His Life and Thought (New York: 1950), 238, 303, 361.

45. On the polemic by philosophers against the reality of the Ptolemaic devices of eccentrics and epicycles, see P. Duhem, To Save the Phenomena: An Essay on the Idea of Physical Theory from Plato to Galileo, trans. E. Doland and C. Maschler (Chicago: 1969), 18-60; E. Rosen, Copernicus and the Scientific Revolution (Malabar, FL: 1984), 38-61; E. Grant, "Eccentrics and epicycles in medieval cosmology," in Mathematics and its applications to science and natural philosophy in the Middle Ages: Essays in honor of Marshall Clagett, ed. E. Grant and J.E. Murdoch (Cambridge: 1987), 189-214.

46. U. Baldini and G. Coyne, S.J., eds. and trans., The Louvain Lectures (Lectiones Lovanienses of Bellarmine) and the Autograph Copy of his 1616 Declaration to Galileo (Vatican City: 1984), 22-23.

47. P. Foscarini, Lettera, 10-11; T. Salusbury, Mathematical collections, 476-477. On the creation of the homocentric on concentric system to explain celestial motion in the fourth century B.C. by the Greek astronomer Eudoxus, see J.L.E. Dreyer, A History of Astronomy, 87-107 and D.R. Dicks, Early Greek Astronomy to Aristotle (Ithaca: 1970), 151-219. This system was later subjected to searching criticism soon after its creation because of certain anomalies, such

as the fact that no number of extra spheres could account for the variations in the brightness of the planets which suggested that distances from the earth were not constant. Although astronomers later adopted the superior Ptolemaic system to explain the heavens, there continued to be a certain amount of loyalty to the homocentric system among medieval and Renaissance Aristotelian philosophers, as Aristotle himself had subscribed to that system. On the medieval debate between the followers of Ptolemy and those of Aristotle and Eudoxus, see, along with the items cited in n. 45 above, E. Grant, "Cosmology," 280-284 and O. Pedersen, "Astronomy," in Science in the Middle Ages, ed. D. Lindberg (Chicago: 1978), 320-322.

On the revival of the homocentric system in the Renaissance when natural philosophers such as Giorlamo Fracastoro and Giovanni Amici devoted entire treatises to it, see the older treatments by J.L.E. Dreyer, A History of Astronomy, 296-304 and L. Thorndike, A History of Magic, 5:488-497; 569-570. A more recent and far more technical account is that of N. Swerdlow, "Aristotelian Planetary Theory in the Renaissance: Giovanni Battista Amico's homocentric spheres," Journal for the History of Astronomy 3(1972):36-48.

48. P. Foscarini, Lettera, 9; T. Salusbury, Mathematical collections, 476.

49. On the debate between Renaissance "realists" and "fictionalists"/"instrumentalists" concerning the status of astronomical theories, see the traditional accounts of P. Duhem, To Save the Phenomena, 61-117 and R.M. Blake, "Theory of Hypothesis among Renaissance Astronomers," in Theories of Scientific Method: The Renaissance through the Nineteenth Century, ed. E.H. Madden (Seattle: 1966), 22-49. Duhem and Blake argue that ancient and medieval astronomers tended to adopt a "fictionalist" approach towards planetary models. G.E.R. Lloyd, The Revolutions of Wisdom: Studies in the Claims and Practice of Ancient Greek Science (Berkeley: 1987), 293-319 and N. Jardine, The Birth of History and Philosophy of Science: Kepler's "A Defense of Tycho Against Ursus" (Cambridge: 1984), 225-257, offer more recent, revisionist discussions of this matter. Both Lloyd and Jardine contend that ancient and medieval astronomers were concerned with the reality of planetary models and Jardine goes so far as to state that the "fictionalist" approach did not become prevalent until the sixteenth century.

50. U. Baldini, "Christoph Clavius and the Scientific

Scene in Rome," in Gregorian Reform of the Calendar, ed. G.V. Coyne, S.J., M.A. Hoskin and O. Pedersen (Vatican City: 1983), 137-170, provides a good introduction to Clavius. P. Duhem, To Save the Phenomena, 92-96 and N. Jardine, "The Forging of Modern Realism: Clavius and Kepler against the Sceptics," Studies in History and Philosophy of Science 10(1979):141-171, treat Clavius' "realist" position concerning astronomical theories and planetary models.

51. P. Foscarini, Lettera, 57; T. Salusbury, Mathematical collections, 500.

52. U. Baldini, "Christoph Clavius," 165, n. 75.

53. P. Foscarini, Lettera, 11; T. Salusbury, Mathematical collections, 477.

54. P. Foscarini, Lettera, 9-10; T. Salusbury, Mathematical collections, 476.

55. P. Foscarini, Lettera, 10-11; T. Salusbury, Mathematical collections, 476-477.

56. N. Copernicus, On the Revolutions, 4.

57. N. Copernicus, On the Revolutions, 278.

58. E. Rosen, ed. and trans., Three Copernican Treatises (New York: 1971), 34-53 and J.L.E. Dreyer, A History of Astronomy, 331-344.

59. N. Copernicus, On the Revolutions, 21. This reproduces the diagram drawn by Copernicus himself in the autograph copy. E. Rosen's commentary in On the Revolutions, 359 discusses the difference between the diagram contained in the autograph copy and that found in the printed edition (1543). For a convenient reprint of the diagram as it appeared in the printed edition, see S.K. heninger, Jr., The Cosmographical Glass: Renaissance Diagrams of the Universe (San Marino: 1977), 46.

60. As N. Steneck, Science and Creation in the Middle Ages: Henry of Langenstein (d. 1397) on Genesis (Notre Dame: 1976), 70 observes: "The appeal of homocentric spheres is their readily imaginable, physical nature." This readily imaginable, physical nature must have appealed to Foscarini, considering his quest for a physically true system of the universe.

61. Whether Foscarini ascribed "truth" to the Copernican cosmology is a matter of debate. When speaking of the new cosmology and the ideas associated with it, Foscarini always used words such as "ragionevole" (reasonable), "verisimile" (likely), "molto verisimile" (very likely), "probabile" (probable), but never the simple term "vero" (true). However, it is not necessary to assume that by not use the term "vero" Foscarini was denying that Copernicanism was the true system of the universe. For a more detailed discussion of this issue see Chapters Four and Five, below.

62. This is W.H. Donahue's suggestion concerning the motivations behind Foscarini's acceptance of Copernicanism, in The Dissolution of the Celestial Spheres 1595-1650 (New York: 1981), 106. N. Copernicus had argued that his system was simpler, and therefore more correct, than the Ptolemaic cosmology, in On the Revolutions, Book 1, Chapter 10, 20. Recently, A.M. Smith, "Galileo's Proof for the Earth's Motion from the Movement of Sunspots," Isis 76(1985):543-551, argued that Galileo's geokinetic cosmology explained the motions of sunspots in a simpler manner, requiring fewer motions. This, according to Smith, demonstrated the logical and scientific superiority of Copernicanism.

The desire to escape from the "fictions" of Ptolemy can be found in colonial New England, as well as in Europe. According to D. Fleming, Puritan astronomers associated Ptolemy "with an unworthy complacency at the mere mathematical 'saving the phenomena' in disregard of the physical realities," "The Judgment Upon Copernicus in Puritan New England," in Mélanges Alexandre Koyré (Paris: 1964), 2:163.

63. S. Caroti, "Un sostenitore napoletano della mobilità della terra," 108 notes the same theme in the Syntaxis of 1613. In the Meditationes, 145-146, Foscarini had included a brief panegyric on the universe which emphasized its "harmony" and the fact that everything in it was most admirably connected and perfectly arranged.

64. A.C. Crombie, "Science and the Arts in the Renaissance: The Search for Truth and Certainty, Old and New," in Science and the Arts in the Renaissance, ed. J.W. Shirley and F.D. Hoeniger (Washington, D.C.: 1985), 20. Also see the pertinent comment of A.R. Peacocke, Creation and the World of Science (Oxford: 1979), 73: "it is salutary to remember that most

cosmological theories are underdetermined by the facts and greatly influenced by mathematical considerations, from which quasi-aesthetic criteria are not entirely absent."

65. P. Foscarini, Lettera, 12-13; T. Salusbury, Mathematical collections, 478. On this approach in medieval scholasticism, see E. Grant, "Science and Theology in the Middle Ages," in God and Nature: Historical Essays on the Encounter between Christianity and Science, ed. D. Lindberg and R.L. Numbers (Berkeley: 1986), 63-70. Grant goes so far as to say: "We may reasonably conclude that the application of science to medieval scriptural exegesis was effected without noticeable constraints or intereference. Indeed, the text of Holy Scripture was more often compelled to conform to the established truths of science than vice versa," 67. This is precisely what Foscarini was attempting to do.

66. S. Drake, Discoveries and Opinions, 182.

67. As S. Drake, Galileo At Work, 226, demonstrates, this particular passage already appeared in Galileo's Letter to Castelli of 1613 on the religious problems surrounding Copernicanism.

68. P. Foscarini, Lettera, 32-33; T. Salusbury, Mathematical collections, 488.

69. S. Drake, Discoveries and Opinions, 186. Galileo is supposedly quoting a statement made by Cardinal Baronius (1538-1607).

70. A. Williams, The Common Expositor, 38-39, 174-198.

71. E. Grant, "In Defense of the Earth's Centrality and Immobility: Scholastic Reaction to Copernicanism in the Seventeenth Century," Transactions of the American Philosophical Society 74(1984):61. L. Olivieri, "Crisi del sapere tradizionale e idea della filosofia in Galileo," in Novità celesti e crisi del sapere, ed. P. Galluzzi (Florence: 1984), 115 and n. 67, comments on the similarity between the terms used by Clavius to condemn Copernicanism and those used by the Church theologians in 1616. A citation to Psalms 103, to prove the immobility of the earth, also appears in the immensely influential commentary on Aristotle's De caelo (1596) by the Coimbra Jesuits. Z. Wardęska, Teoria heliocentryczna, photoreproduction 7.

72. P. Foscarini, Lettera, 14-18; T. Salusbury, Mathematical collections, 478-481.

73. On the development of Catholic principles of biblical exegesis see R.E. Brown, S.S., "Hermeneutics," in The Jerome Biblical Commentary, ed. R.E. Brown, S.S., J.A. Fitzmyer, S.J., and R.E. Murphy, O. Carm. (Englewood Cliffs: 1968), 2:605-623. On the relationship betwwen these principles and questions concerning the physical universe consult the following: W.A. Wallace's commentary in Thomas Aquinas, Summa theologiae, ed. and trans. W.A. Wallace (New York: 1964), 10:202-223; A. Funkenstein, Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century (Princeton: 1986), 213-221; E. Grant, "Science and Theology in the Middle Ages," 63-67; R. Hookaas, ed. and trans., G.J. Rheticus' Treatise on Holy Scripture and the Motion of the Earth (Amsterdam: 1984), 28-38, 174-176 and R.S. Westman, "The Copernicans and the Churches," in God & Nature: Historical Essays on the Encounter between Christianity and Science, ed. D. Lindberg and R.L. Numbers (Berkeley: 1986), 89-103.

74. P. Foscarini, Lettera, 25-26; T. Salusbury, Mathematical collections, 484. In the Latin Vulgate, Genesis 1:16 reads as follows: "Fecitque Deus duo luminaria magna: luminare maius, ut praeesset diei: et luminare minus, ut praeesset nocti: et stellas."

75. P. Foscarini, Lettera, 27; T. Salusbury, Mathematical collections, 485.

76. For the novel aspects of Bruno's cosmology see P.O. Kristeller, Eight Philosophers of the Italian Renaissance (Stanford: 1964), 134-138; A. Koyré, From the Closed World to the Infinite Universe (Baltimore: 1976), 39-57 and P.H. Michel, The Cosmology of Giordano Bruno, trans. R. Maddison (Ithaca: 1973).

77. P. Foscarni, Lettera, 28; T. Salusbury, Mathematical collections, 485-486. J.A. Weisheipl, "Science in the Thirteenth Century," in The History of the University of Oxford, ed. J.I. Catto (Oxford: 1984), 1:443-446 and N.H. Steneck, Science and Creation in the Middle Ages, 42-55 treat of the medieval exegetical and philosophical/physical distinction between lux, which was the initial active form of light, and lumen, which was its likeness or a mathematical ray.

78. The author owes this observation to his esteemed mentor, the late Professor Edward Rosen.

79. For Copernicus' famous paean of praise to the sun, see N. Copernicus, On the Revolutions, Book 1, Chapter 10, 22. A. Koyré, The Astronomical Revolution: Copernicus-Kepler-Borelli, trans. R. Maddison (Ithaca: 1973), 59-66, 114-115, n. 24, offers a brief discussion of the role of the sun in Copernicus' cosmology.

In "Was Copernicus a Hermetist?," in Historical and Philosophical Perspectives of Science, ed. R.H. Stuewer (Minneapolis: 1970), 163-171, and in "Was Copernicus a Neoplatonist?," Journal of the History of Ideas 44(1983):667-669, E. Rosen maintained that Copernicus was not motivated to adopt heliocentrism because he was a devotee of Hermetism, Neoplatonism and/or Neopythagoreanism. Instead, Rosen insisted that Copernicus be taken at his word concerning his reasons for abandoning the traditional geocentric cosmology. For Copernicus' statement in this regard see On the Revolutions, Preface, 4. Among the reasons given were the lack of symmetry in the traditional cosmology, the problems of calendar reform and the violation of the primary, regulative principle of uniform, circular motion because of the use of the Ptolemaic equant.

80. E. Grant, "Celestial Perfection from the Middle Ages to the Late Seventeenth Century," in Religion, Science, and Worldview: Essays in Honor of Richard S. Westfall, ed. M.J. Osler and P.L. Farber (Cambridge: 1985), 137-146. On the medieval thinkers who glorified the sun, also see J. McEvoy, The Philosophy of Robert Grosseteste (Oxford: 1982), 200-203.

81. E. Grant, "Celestial Perfection," 142-143 and n. 12. E. Garin deals with this analogy among Italian Renaissance thinkers in "La rivoluzione coprnicana e il mito solare," in his Rinascite e rivoluzioni: Movimenti culturali dal XIV al XVIII secolo (Rome: 1975), 274-276.

82. E. Grant, "Celestial Perfection," 146.

83. E. Grant, "Celestial Perfection," 146-151.

84. The term "valuational heliocentrism," as distinct from physical heliocentrism, has been borrowed from J. McEvoy, The Philosophy of Robert Grosseteste, 200-203.

85. E. Grant, "Celestial Perfection," 161 and his "In Defense of the Earth's Centrality and Immobility," 59.

86. For eloquent examples of Foscarini's glorification of the center of the universe and of the sun at that center, see P. Foscarini, Lettera, 52 and T. Salusbury, Mathematical collections, 497, 498. A glorification of both the central position and of the sun can also be found in the ecclesiastical rhetoric and oratory of the Counter-Reformation concerning the position and role of the pope. On Counter-Reformation preachers who referred to the pope as "the solar umbilical cords [sic] that assured all members within the Church a continuous flow of divine power and truth" and as "a sun illuminating the Church which is his world" see F.J. McGinness, "Rhetoric and Counter-Reformation Rome: Sacred Oratory and the Construction of the Catholic World View, 1563-1621" (Ph.D. diss., University of California, Berkeley, 1982), 337, 340.

87. In the Latin Vulgate, Joshua 10:12 reads as follows: "Sol, contra Gabaon ne movearis."

88. P. Foscarini, Lettera, 38-39; T. Salusbury, Mathematical collections, 491. For a lucid analysis of the three motions of the earth in Copernicus' cosmology, see J.L.E. Dreyer, A History of Astronomy, 321-330. As E. Rosen points out in his commentary in N. Copernicus, On the Revolutions, 360, later astronomers, such as Kepler, rejected the need for the third motion of the earth's axis in order to explain the phenomenon of the earth's axis always pointing to the same point in the heavens. However, later Copernicans did retain an extra motion of the earth's axis to explain the precession of the equinoxes. Newton finally explained this conical motion of the earth's axis as due to the gravitational attractions on the earth. On this explanation of precession, see I.B. Cohen, The Birth of a New Physics (Garden City: 1960), 182-184 and T.S. Kuhn, The Copernican Revolution: Planetary Astronomy in the Development of Western Thought (New York: 1959), 270.

89. P. Foscarini, Lettera, 36-37; T. Salusbury, Mathematical collections, 490. Foscarini interprets Isaiah 38:8 in the same way. The same interpretation of Joshua 10:12 was proposed "hypothetically" by the fourteenth-century bishop and theologian Nicole Oresme. On Oresme's exegesis, see the brief discussion in E. Grant, "Science and Theology in the Middle Ages," 65-67.

90. In the Latin Vulgate, Ecclesiastes 1:4 reads as

follows: "Generatio praeterit, et generatio advenit; Terra autem in aeternum stat."

91. For Counter-Reformation exegetical works personally examined: Cornelius à Lapide, S.J., Commentaria in Vetus et Novum Testamentum (Venice: 1761), 5:21-22 (The New York Public Library copy of this work has the volume number as volume 4); Juan Piñeda, S.J., In Ecclesiasten commentariorum liber unus, first ed. (Seville: 1619), f. 128; second ed. (Antwerp: 1620), f. 111; Diego de Zuñiga (Didacus a Stunica), In Iob commentaria (Toledo: 1584), 206; and the English translation of Zuñiga in T. Salusbury, Mathematical collections, 469 and G. McColley, "A Facsimile of Salusbury's Translation of Didacus a Stunica's Commentary Upon Job," Annals of Science 2(1937):181. For reprints of the Latin texts of Piñeda and Zuñiga, see Z. Wardeska, Teoria heliocentryczna, photoreproductions 32, 47.

Secondary bibliography on this subject, in addition to the items cited in n. 73 above, includes: F. Barone, "Diego de Zuñiga e Galileo Galilei: Astronomia eliostatics ed esegesi biblica," Critica storica 19(1982):319-334; R. Fabris, Galileo Galilei e gli orientamenti esegetici del suo tempo (Rome: 1986), 23-44; H. Grisar, S.J., Galieistudien (Regensbury: 1882). 258-265' G. Leonardi, "Verità e libertà di ricerca nell'ermeneutica biblica cattolica dell'epoca galileiana e attuale," Studia patavina 29(1982):597-635; C.H. Martini, "Gli esegeti del tempo di Galileo," in Nel quarto centenario della nascita di Galileo Galilei (Milan: 1966), 115-124; F. Russo, S.J., "Galilée et la culture théologique de son temps," in Galileo Galilei: 350 ans d'histoire, 1633-1983, ed. P. Poupard (Tournai: 1983), 151-178; and A. Williams, The Common Expositor, esp. 3-25, 174-198 and 269-277. For a further discussion of these exegetes and the problems surrounding the interpretation of Ecclesiastes 1:4-5, see Chapter

92. P. Foscarini, Lettera, 40-41; T. Salusbury, Mathematical collections, 491-492.

93. P. Foscarini, Lettera, 42; T. Salusbury, Mathematical collections, 492.

94. P. Foscarini, Lettera, 43-44; T. Salusbury, Mathematical collections, 493.

95. P. Foscarini, Lettera, 44; T. Salusbury, Mathematical collections, 493. For Copernicus' new

definition of gravity, see N. Copernicus, On the Revolutions, Book 1, Chapter 9, 18 and for brief discussions of this new doctrine, see A. Koyré, The Astronomical Revolution, 56 and O. Pedersen and M. Pihl, Early Physics and Astronomy: A Historical Introduction (New York: 1974), 317-318.

96. E. Rosen, ed. and trans., Kepler's "Somnium": The Dream or Posthumous Work on Lunar Astronomy (Madison: 1967), 218-221.

97. J.L. Heilbron, Elements of Early Modern Physics (Berkeley: 1982), 11-22; K. Hutchison, "What Happened to Occult Qualities in the Scientific Revolution?," Isis 73(1982):233-253 and R. Millen, "The Manifestation of Occult Qualities in the Scientific Revolution," in Religion, Science, and Worldview: Essays in Honor of Richard S. Westfall, ed. M.J. Osler and P.L. Farber (Cambridge: 1985), 185-216.

98. R. Millen, "The Manifestation of Occult Qualities," 190.

99. P. Foscarini, Meditationes, 136-142.

100. On Copernicus' deletion of the aether from his cosmology, see E. Rosen's commentary in N. Copernicus, On the Revolutions, 348.

101. P. Foscarini, Lettera, 45; T. Salusbury, Mathematical collections, 494.

102. E. grant, "Celestial matter: a medieval and Galilean cosmological problem," Journal of Medieval and Renaissance Studies 13(1983):164-165. According to N. Steneck, Science and Creation in the Middle Ages, 58-61, Henry of Langenstein rejected the incorruptible fifth element, or aether, of Aristotle. Instead, he argued that the stars had been created from a mixture of the four elements(earth, water, air, fire) and then were moved into the region of the firmament. The stars (celestial bodies) then became incorruptible. According to Grant's article, a similar position appears to have been adopted by Aegidius Romanus.

103. This is the conclusion reached in E. Grant, "Celestial Orbs in the Latin Middle Ages," Isis 78(1987):153-173.

104. P. Foscarini, Lettera, 45; T. Salusbury, Mathematical collections, 494.

105. P. Foscarini, Lettera, 45-46; T. Salusbury, Mathematical collections, 494.

106. E. Rosen, "The Dissolution of the Solid Celestial Spheres," Journal of the History of Ideas 46(1985):19-20 and W.H. Donahue, The Dissolution of the Celestial Spheres, 52-53. Along with a possible medieval and Renaissance "tradition" in optics which denied the perfect aether and the hard celestial spheres, similar ideas can be found among astrologers. G. Federici Vescovini in her Astrologia e scienza: La crisi dell'aristotelismo sul cadere del Trecento e Biagio Pelacani da Parma (Florence: 1979), 254-256 and n. 32, states that the astrologer Pelacani explicitly denied the incorruptible fifth element or aether of Aristotle and saw it, instead, as a "superior part of air." Consequently, for Pelacani, the essence of heaven was not the pure aether but the circular motion natural to the heavenly region. C. Trinkaus, in "The Astrological Cosmos and Rhetorical Culture of Giovanni Gioviano Pontano," Renaissance Quarterly 38(1985):455, observes that Pontano (1429-1503) explicitly rejected the transparent crystalline celestial spheres in his astrological work, De rebus coelestibus. For Pontano's rejection of the crystalline spheres, also see E.J. Aiton, "Celestial Spheres and Circles," History of science 19(1981):93 and P. Duhem, To Save the Phenomena, 54-56.

107. P. Foscarini, Lettera, 48-49; T. Salusbury, Mathematical collections, 496. Copernicus' treatment of motion can be found in On the Revolutions, 16-17. For commentaries on Copernicus' treatment, see: E. Rosen in On The Revolutions, 354; O. Pedersen and M. Pihl, Early Physics and Astronomy, 316-317 and E. Zilsel, "Copernicus and Mechanics," in Roots of Scientific Thought: A Cultural Perspective, ed. P.P. Wiener and A. Noland (New York: 1957), 278. Zilsel emphasizes the traditional nature of Copernicus' doctirne of motion, whereas Rosen and Pedersen and Pihl emphasize how far Copernicus diverged from the standard Aristotelian ideas about motion.

108. E. Grant, "In Defense of the Earth's Centrality and Immobiility," 34-54 provides a detailed treatment of the debates over the motion of bodies on or near to a moving earth.

109. The quotation from the Disquisitiones mathematicae comes from C.J. Schofield, Tychonic and

Semi-Tychonic World Systems (New York: 1981), 274. The authorship of the Disquisitiones is disputed. Schofield and W.B. Ashworth, Jr. in Jesuit Science in the Age of Galileo: An Exhibition of Rare Books from the History of Science Collection, March 24-July 31, 1986, Linda Hall Library (Kansas City, MO: 1986), 7 contend that the work was actually written by Locher's teacher, the Jesuit astronomer Christopher Scheiner. However, as Locher's name appears on the volume as the author, the present work follows W.H. Donahue's example in The Dissolution of the Celestial Spheres of citing Locher as the author.

110. Galileo Galilei, Opere, ed. A. Favaro, 5:399-401 and S. Drake, Galileo At Work, 291, 453.

111. Galileo Galilei, Opere, ed. A. Favaro, 5:408. The original text by Ingoli reads: "Alterum argumentum est, ex doctrina theologorum, tenentium ea potissimum ratione infernum, idest locum daemonum et damnatorum, esse in centro Terrae, quia, cum coelum sit locus angelorum et beatorum, oportet locum daemonum et damnatorum, esse in loco remotissimo a coelo, qui est centrum Terrae. . . . Cum itaque infernus sit in centro Terrae, et debeat esse locus remotissimus a coelo, Terram esse in medio universi, qui est locus a coelo remotissimus, fatendum est."

112. For the tradition concerning the location of Hell, see J.B. Russell, The Devil: Perceptions of Evil from Antiquity to Primitive Christianity (Ithaca: 1977), 221-249 and Lucifer: The Devil in the Middle Ages (Ithaca: 1984), 159-207. Russell remarks that the scholastics viewed Hell as an underground place, perhaps in the center of the earth. For Ingoli's use of the works of Bellarmine, see Galileo Galilei, Opere, ed. A. Favaro, 5:408 and W.R. Shea, "Galileo and the Church," in God & Nature: Historical Essays on the Encounter between Christianity and Science, ed. D. Lindberg and R.L. Numbers (Berkeley: 1986), 125, 135-136, n. 28 where it is observed that Bellarmine also placed Purgatory and Limbo at the center of the earth, near Hell.

113. W.R. Shea, "Melchior Inchofer's 'Tractatus Syllepticus': A Consultor of the Holy Office Answers Galileo," in Novità celesti e crisi del sapere, ed. P. Galluzzi (Florence: 1984), 291-292.

114. C.A. Patrides, Premises and Motifs in Renaissance Thought (Princeton: 1982), 31.

115. P. Foscarini, Lettera, 49-51; T. Salusbury, Mathematical collections, 496-497.

116. P. Foscarini, Lettera, 51-52; T. Salusbury, Mathematical collections, 497-498. E. Grant, "Cosmology," 275-280; F.S. Benjamin, Jr. and G.J. Toomer, eds., Campanus of Novara, 183, 393-394, n. 52 and 54 and P. Duhem, Medieval Cosmology: Theories of Infinity, Place, Time, Void, and the Plurality of Worlds, ed. and trans. R. Ariew (Chicago: 1985), 174-175, 177-292, passim.

117. P. Foscarini, Lettera, 51-52; T. Salusbury, Mathematical collections, 497. In his Meditationes, 143-145, Foscarini had identified the Empyrean as the seat of the Angels and the Blessed and the home of the Blessed Trinity.

118. P. Foscarini, Lettera, 55; T. Salusbury, Mathematical collections, 499.

119. P. Foscarini, Lettera, 55; T. Salusbury, Mathematical collections, 499.

120. G. McColley, ed. and trans., The Defense of Galileo, 44-50.

121. P. Foscarini, Lettera, 56; T. Salusbury, Mathematical collections, 499.

122. In the Latin Vulgate Exodus 25:32 reads: "Sex calami egredientur de lateribus, tres ex uno latere, et tres ex altero."

123. P. Foscarini, Lettera, 57-58; T. Salusbury, Mathematical collections, 500. R. Hooykaas, in G.J. Rheticus' Treatise on Holy Scripture, 174 correctly argues that Foscarini did not use this biblical passage as a source of astronomical information.

124. B. Basile, "Galileo e il teologo 'copernicano', Paolo Antonio Foscarini," Rivista di letteratura italiana 1(1983):88 and n. 28. The only antecedent to this interpretation of Exodus 25:32 offered by Basile is the work of the sixteenth-century Christian cabalist and philosopher Guillaume Postel (1510-1581).

125. H.A. Wolfson, The Philosophy of the Church Fathers (Cambridge, MA: 1964), 1:50-51; J.L.E. Dreyer, A History of Astronomy, 208-209. According to Wolfson,

Clement adopted this type of interpretation from the exegesis of Philo Judaeus of Alexandria.

126. Cornelius à Lapide, Commentaria in Vetus et Novum Testamentum (Venice: 1761), 1:388; F.J. Crehan, S.J., "The Bible in the Roman Catholic Church from Trent to the Present Day," in The Cambridge History of the Bible, ed. S.L. Greenslade (Cambridge: 1976), 3:216. a Lapide says that this interpretation came from the works of Philo and Josephus.

127. J. Brodrick, S.J., The Life and Work of Blessed Robert Francis Cardinal Bellarmine, S.J. 1541-1621 (London: 1928), 2:348.

128. S. Drake, Galileo At Work, 162. Galileo made an oblique reference, in his Lettera a Madama Cristina, to this introduction of theological issues into the debate over the moons of Jupiter. S. Drake, Discoveries and Opinions, 189 and n. 19.

129. In the Latin Vulgate, Exodus 25:33-34 reads: "Tres scyphi quasi in nucis modum per calamos singulos, sphaerulaque simul, et lilium: et tres similiter scyphi instar nucis in calamo altero, sphaerulaque simul et lilium. Hoc erit opus sex calamorum, qui producendi sunt de hastili: in ipso autem candelabro erunt quatuor scyphi in nucis modum, sphaerulaeque per singulos, et lilia."

130. P. Foscarini, Lettera, 59; T. Salusbury, Mathematical collections, 501. The words "Harpocratico silentio" or "Harpocratick silence" refer to the ancient Graeco-Egyptian god of silence, Harpocrates. This god was the subject of study by Renaissance mythographers and was sometimes represented as a youth holding his finger up to his mouth. J. Seznec, The Survival of the Pagan Gods: The Mythological Tradition and Its Place in Renaissance Humanism and Art, trans. B.F. Sessions (New York: 1961), 296-297.

131. D. Stimson, The Gradual Acceptance of the Copernican Theory of the Universe (Gloucester, MA: 1972), 72.

132. P. Foscarini, Lettera, 63; T. Salusbury, Mathematical collections, 503.

133. P. Foscarini, Lettera, 4; T. Salusbury, Mathematical collections, 473.

CHAPTER TWO: THE THEOLOGICAL JUDGMENT (JUDICIUM)

Soon after the publication of the Lettera, certain persons in Rome began to raise theological objections to Foscarini's argument, objections which led Galileo's Roman friend, Monsignor Giovanni Ciampoli (1590-1643), to fear an imminent suppression.[1] These objections are reflected in an anonymous document entitled the Judicium de epistola F. Pauli Foscarini de mobilitate terrae, printed in 1881-1882 from the manuscript copy by the famous nineteenth-century Galileo scholar Domenico Berti.[2] The Judicium is important because it supplies specific information about the theological climate in Rome when the "Copernican question" was under consideration by the Holy Office of the Inquisition.[3]

Although short, only two printed pages, the Judicium was full of antipathy for the positions advanced by Foscarini in his Lettera. Indeed, the first line branded the Lettera with the censure of "temeritas" (rashness), and Foscarini was charged with refuting the truth and deriding all those who teach opposing opinions.[4] The anonymous author of the Judicium then proceeded to strike at the essence of Foscarini's position concerning the "probability" and "verisimilitude" of the Copernican theory by denying

any and all probility to such a theory. As he said, "something cannot be clearly probable which is clearly against sacred writings."[5] The arguments concerning the philosophical and scientific superiority of Copernicanism raised by Foscarini were not dealt with in the Judicium. Instead the battle against the Lettera was fought solely in terms of biblical exegesis.

The author catalogued the errors in Foscarini's pro-Copernican work, complete with specific page citations. Allegedly, these errors were due to the improper and excessive use of the modes of interpretation adopted by Foscarini, particularly the theory of accommodation and the use of the figurative interpretation of biblical passages to support a reconciliation between Copernicus and Sacred Scriptures.

The first such misinterpretation considered in the Judicium concerned the problem of what constitutes a day in the account of the six days of creation contained in the Book of Genesis. This was not of minor importance as it had been a classic problem of Catholic biblical exegesis from late ancient times. The majority of Catholic exegetes had argued that the term "day" must be interpreted literally, while a minority, represented by such eminent theologians as

St. Augustine (354-430) and his Reniassance follower, Thomas de Vio, Cardinal Caietan (1468-1534), contended that "day" must be understood in an allegorical fashion.[6] The works of this minority were well known to Foscarini and he defended, in his Lettera, a non-literal interpretation of the term "day" in the biblical account of creation.[7]

In the text of the Lettera Foscarini had raised serious doubts concerning the true meaning of the "days of creation." As he pointed out, Genesis 1 described the creation of light before all else, including the sun and the moon, and yet the Bible then said that this was the evening and the morning of the first "day." How was this so? Did the terms day and night have reference to a "rolling" about of celestial light in the heavens and not to the supposed motion of the sun about the earth, Foscarini asked. If one wished to adopt such an interpretation of the "days" of creation and one wished to see them as referring to the circulation of celestial light from a starting point back to the selfsame point, then Foscarini raised a major objection.

Why does the Bible use the words morning and evening when it describes the "days of creation," words which denote the sun's relationship to the earth? As Foscarini said:

> the Morning is that time when the Sun begins to wax light, and to rise above the Horizon in the East, and becomes visible in our Hemisphaere, and Evening is the time in which the Sun declines in the West, and approacheth with its light neerer to the other opposite Horizon and Hemisphaere, which is contiguous to this of ours.[8]

Therefore, he concluded, the words "evening," "morning" and "day" must not be seen as speaking "absolutely" of a circulation of celestial light but only according to us ("secundum nos") and in respect to us ("respectu nostri").

Foscarini's contention that the words of Genesis should be interpreted as speaking from our point of view was explicitly rejected in the Judicium. As the author responded, although a day and night does not take place at the same time throughout the universe but only in one or the other hemisphere, we cannot say that this is sufficient proof that the passages in Genesis only refer to us and to appearance, secundum apparentiam, and are not in accord with the physical reality of a day.[9] The misuse of this kind of biblical interpretation led Foscarini into a reconciliation which, said the Judicium, "wrenches sacred writings and expounds them against the common explication of the Holy Fathers, which is consonant with the more common, indeed with the most universal and truthful beliefs of almost all the Astronomers."[10]

Foscarini's "false" reconciliation was then

demonstrated by selecting certain sections of the Lettera which were to be refuted. The biblical passages chosen in the Judicium were fundamental in the debate between the Copernicans and the anti-Copernicans as these passages spoke of the earth being "fixed" in some way. The concept of the earth being "fixed" in the universe was understood by many Catholic exegetes as establishing the immobility of the earth. Consequently, the author of the Judicium attacked Foscarini's treatment of Psalms 92:1, "For he hath established the world which shall not be moved" and 103:5, "Who hast founded the earth upon its own bases: it shall not be moved for ever and ever," as speaking according to appearances and our way of perceiving things, rather than as speaking according to the truth of things.[11]

The attempt to understand these passages according to appearances, secundum apparentiam, was rejected in this instance on the grounds that when a real reason or, in the Aristotelian terms used in the Judicium, "efficient cause" is assigned to a phenomenon, it is not possible to understand it only according to appearances. "Here however the Holy Spirit assigns a reason or cause for the immobility of the Earth and states that the immobility [of the earth] is founded on the Earth's own stability."[12] The author of the

Judicium thus made the classic anti-Copernican equation of "stability" with terrestrial "immobility," an equation found in a number of Counter-Reformation biblical commentaries.[13]

Next the author of the Judicium dealt with the variety of ways Foscarini had attempted to refute the identification of stability and terrestrial immobility. Foscarini's attempt on pages 38 and 39 of the Lettera to interpret away the "fixity" and supposed "immobility" of the earth by explaining "fixity" and "immobility" as the constancy and stability of the earth's motions, and not as an absolutely motionless state, was flatly rejected. The Judicium based this rejection on the ingenious grounds that the very same things (constancy and stability of motions) could be said of the moon and of the other celestial (planetary) and starry spheres. Consequently, Sacred Scriptures would be saying nothing peculiar about the earth and the point of these specific biblical passages would be lost.[14]

This same objection was raised to Foscarini's interpretation of Ecclesiastes 1:4, "One generation passeth away, and another generation cometh: but the earth standeth for ever," as referring not to "immobility" in the usual sense but to remaining in one's proper place in the universe, a place to be

understood in the Copernican sense of a rotating and revolving planet third from the central sun. Again it was argued, in the Judicium, that to interpret Ecclesiastes 1:4, one of the most important passages in the exegetical debate over the Copernican theory, in Foscarini's way was to deny all specific point to the passage, as the same thing, remaining in one's proper place in the universe, can be said of all things in the cosmos. Why then does Ecclesiastes speak only of the earth standing forever? Obviously, according to the author of the Judicium, the use of the verb form "stat" ("standeth") in Ecclesiastes 1:4 must signifiy "motionless" in some way other than Foscarini allowed.

The last point raised by the author of the Judicium is of particular interest to students of cosmology for it related to one of the most hotly debated issues of that time, i.e. the solidity and hardness of the celestial spheres. As was made clear in the earlier analysis of the physical ideas present in the Lettera, Foscarini had explicitly rejected the notions of solidity and rigidity of the heavens in favor of a physical heaven that was composed of a most rare and tenuous matter, fluid in nature and in no way different from the terrestrial elements save for its lower density.[16]

In this way Foscarini had allied himself with

those who were arguing against features of the Aristotelian cosmos such as the "incorruptibility," "immutability" and "solidity/hardness" of the heavens. Foscarini linked this dissolution of the Aristotelian cosmos with the Copernican astronomy, thus lending confirmation to the recent suggestion of a special compatibility of heliocentrism with the concept of the homogeneity of the universe.[17] The rejection of the "incorruptible," "immutable" and "hard" celestial spheres was not a uniquely Copernican proposition, as such a rejection was made or implied by non-Copernican scientists and philosophers such as Tycho Brahe, Francesco Patrizi (1529-1597), Christopher Clavius and Christopher Scheiner, S.J.[18]

The debate over the nature of the heavens was fought as much in terms of the Bible and the Church Fathers as it was in terms of astronomical observations and philophical argumentation. The reemphasis on the Bible and the Fathers by Protestant and Catholic theologians in this period may have led to an increasing willingness to deny Aristotelian concepts of the "hardness" and "incorruptibility" of the heavens.[19] Certain early modern Catholic authors began to use biblical quotations and patristic authorities to suuport the theory of an "elemental" and "material" heaven, with the qualities of "fluidity" and

"corruptibility."[20] Cornelius Valerius, Professor of Latin at the University of Louvain, in his Physicae seu de naturae philosophia institutio (1567) used religious authorities to such a purpose.[21]

Even more pertinent to the case of Foscarini is the fact that Prince Federico Cesi (1585-1630), head of the Roman Accademia dei Lincei and ally of Galileo, had defended the concepts of a "fluid" and "elemental" cosmos in his De caeli unitate (1618). Indeed, Cesi may even have written this work as part of a plan to resuscitate the Copernican cause after the Condemnation of 1616. What is equally significant is that Cardinal Bellarmine, to whom Cesi addressed his work, and who was by no means sympathetic to Copernicanism, accepted Cesi's theses with equanimity and responded that these positions were most certainly true.[22]

Bellarmine had himself broken away from the traditional cosmology as early as the 1570s and the concepts of "fluidity" and "corruptibility" were being defended in Jesuit colleges by the 1620s as "probable" on theological, if not on physical, grounds. By mid-century, these concepts were considered unobjectionable in terms of the rules of the Jesuit Order, as distinct from the proscribed Copernican theses of the diurnal rotation and annual revolution of the earth.[23]

A "Mosaic" and "Patristic" cosmology thus arose as

a rival to the Aristotelian cosmology of the solid/hard incorruptible heavens. Indeed, anti-Aristotelians such as Campanella were led to proclaim, in a hyperbolic fashion, that:

> All philosophers teach that heaven is not the fifth essence, but is composed either of elements or (and particularly the stars) of fire alone. This interpretation is advanced by holy Augustine, Ambrose, Basil, Cyril, Chrysostom, Theodoret, Bernard (in his discourse on women and the sun), and by the master of the Sentences [Peter Lombard]. In the Hexameron, IV, Ambrose proves heaven is not an immutable fifth essence from the passage in Scripture, "The heavens will pass away, and grow old as vestments." When he expounds for Christians Aristotle's De Caelo against Aristotle, Philoponus makes the same point. Many scholastics declare heaven may be regarded as composed of the fifth essence, and no violence done to Scripture, but Ambrose, together with Justin and Basil, repeatedly execrates this belief as a fiction and a diabolical invention.[24]

The author of the Judicium rejected this rival cosmology. Without reference to then current cosmological debates or to Foscarini's specific references to the location of comets above the moon and the existence of sunspots (phenomena taken by many to prove the falsity of the tenets of "hardness" and "incorruptibility") the Judicium blithely rejected the new cosmology on the grounds that it contradicted Job 37:18: "Thou perhaps hast made the heavens with him, which are most strong, as if they were of molten brass." Although largely ignored in the Middle Ages, this text was widely used by theologians in the

seventeenth century to uphold the concept of hard celestial spheres.[25]

Because the Latin Vulgate version of this passage, in contrast to the Hebrew original and the King James translation, presented the adjective "most strong" ("solidissimi") in the superlative degree, the passage from Job could easily be used by Catholic thinkers to support the concept of a heaven, or heavens, "most solid."[26] By adopting this approach, the author of the Judicium attempted to fight fire with fire, upholding the "traditional" cosmology by pointing to corroborative texts in the Bible.

Another example of this approach can be found in Francisco Valles' (1524-1592) De iis quae physicae in libris scripta sunt, sive de sacra philosophia (1587), where a "Mosaic" or "sacred philosophy" was constructed on the basis of biblical and patristic sources to defend, rather than refute, the traditional Aristotelian cosmology. Valles, physician to Philip II of Spain and a highly esteemed author in his time, denied that heaven might be in any way similar to the earth. To speak of an elemental heaven and of "heavenly water" and "heavenly fire," as some Church Fathers had done, should only be understood metaphorically, with heavenly "elements" having none of the qualities associated with terrestrial fire and

water. According to Valles, the heavens must be absolutely pure and immutable, unlike the earth.[27] He also defended the notion of the solidity and hardness of the heavenly spheres on the basis of Job 37:18,[28] and was acknowledged by none other than Tycho Brahe himself as an authority in this regard before Tycho rejected this tenet.[29] Valles saw the defense of the Aristotelian universe with a motionless earth at its center as a religious duty for Catholic thinkers.[30]

This duty was taken up by the author of the Judicium, who defended both the motionless status of the earth and the solidity/hardness of the heavens on biblical grounds. Although Foscarini considered the "fluidity" and "mutability" of the heavens as part of the Copernican cosmology, he never thought these specific theories in need of extended reconciliation with Sacred Scriptures nor had he ever expressly dealt with Job 37:18. However the author of the Judicium, in this case as well, raised the spectre of religious unorthodoxy and attempted to refute Foscarini's ordinary methods of defense.

In the case of Job 37:18, the idea that the Bible speaks according to appearances was inadequate, according to the Judicium, because the "solidity" of the heavens is not visibly apparent to us. Therefore this passage cannot be explicated by utilizing such a

common exegetical tool.[31] The implication was, of course, that Job 37:18 had to be taken in the simple literal sense of affirming the solidity and hardness of the celestial spheres. It is important to emphasize, however, that the author of the Judicium did not reject the use of the theory of accommodation and the explication of biblical passages according to appearances in toto, but only the specific applications by Foscarini in his pro-Copernican tract. Such exegetical tools were used by the most orthodox Catholic exegetes of the Counter-Reformation era. As an apposite example dealing with the question of the heavenly spheres, the Jesuit exegete Benedict Pererius used the theory of accommodation and exegesis secundum apparentiam in his Commentary on Genesis to reconcile those biblical passages which seemed to ascribe motion to the planets themselves with the Aristotelian idea of invisible spheres which move the planets.[32]

The intense concern of thinkers such as Francisco Valles and the author of the Judicium to defend not only geocentrism and terrestrial immobility but also the traditional terrestrial/celestial dichotomy lends weight to Barker and Goldstein's bold assertion that the Copernican Revolution has been misinterpreted of late. Arguing against the view that the Copernican Revolution was primarily a shift from a geocentric to a

heliocentric cosmos, they have contended that "if a single over-riding issue is to be identified (and any such attempt would surely be an oversimplification) then it is not heliocentrism vs. geocentrism but the debates surrounding the celestial-terrestrial distinction."[33]

The Judicium abruptly ended with a summary refutation of Foscarini's denial of the solidity (and hardness) of the spheres. There was no attempt to conclude the work and it has the character of notes or a brief, perhaps prepared for the Congregation of the Holy Office which was in the process of considering the Copernican cosmology. It may even have been prepared for one or more of the Consultors of the Holy Office, men assigned the official task of judging matters of theological error for the Cardinals of the Congregation of the Holy Office. These Consultors were clerics, expert in Canon and Conciliar Law and Sacred Theology, not in the natural sciences. This may explain the exegetical and theological nature of the Judicium, as well as the concomitant neglect of scientific matters and the extremely conservative position taken on the issue of the hardness of the heavens, especially when contrasted with such theologically orthodox and anti-Copernican thinkers as Clavius and Bellarmine.[34]

Foscarini, in Rome at the time the Judicium was

composed, either heard of the work or was shown a copy for he proceeded to compose several versions of a defense of his Lettera. To protect himself, he forwarded one of these versions, along with a copy of the Lettera itself, to Cardinal Bellarmine, senior theologian of the Church, for his opinion.[35]

Notes

1. D. Berti, "Antecedenti al processo galileiano e alla condanna della dottrina copernicana," Atti della R. Accademia dei Lincei, 279, serie terza, Memorie della classe di scienze morali, storiche e filologiche 10 (1881-1882):57 and S. Drake, Galileo At Work: His Scientific Biography (Chicago: 1978), 245. On Ciampoli's life and thought see the brief notice in S. Drake, Galileo At Work, 445 and the more detailed studies by M. Torrini, "Giovanni Ciampoli filosofo," in Novità celesti e crisi del sapere, ed. P. Galluzzi (Florence: 1984), 267-275 and A. Favaro, Amici e corrispondenti di Galileo, ed. P. Galluzzi (Florence: 1983), 1:133-190.

2. D. Berti, "Antecedenti al processo galileiano," 72-73. This manuscript belonged to the Accademia dei Lincei, Manuscript Collection Volpicelliano A, c. 151 and is now in the Biblioteca Corsiniana, Rome. For a brief discussion of this collection, see D. Berti, "Antecedenti al processo galileiano," 60-67 and his Copernico e le vicende del sistema copernicano in Italia (Rome: 1876), 224-227.

3. For discussions of the inquisitorial investigation of Galileo and the Copernican cosmology already underway when the Judicium was composed, see the still valuable older treatment in D. Berti, Il processo originale di Galileo Galilei (Rome: 1878), 19-29 and the more recent treatments by G. de Santillana, The Crime of Galileo (Chicago: 1955), 42-55; J.J. Langford, Galileo, Science and the Church (Ann Arbor: 1971), 50-78 and S. Drake, Galileo At Work, 240-251.

4. D. Berti, "Antecedenti al processo galileiano," 72.

5. The English translations of passages from the Judicium were made by the present author. The original Latin is quoted in the notes. D. Berti, "Antecedenti al processo galileiano," 72: "Non potest esse evidenter probabile quod est evidenter contra sacras literas." The words sacras literas would seem ot include the Bible and the writings of the Church Fathers, as did the medieval scholastic tradition concerning scriptura sacra. B. Vawter, Biblical Inspiration (Philadelphia: 1972), 47.

6. F. Robbins, The Hexameral Literature: A Study of the Greek and Latin Commentaries on Genesis (Chicago: 1912), 20-22 and N. Steneck, Science and Creation in

the Middle Ages: Henry of Langenstein (d. 1397) on Genesis (Notre Dame: 1976), 29-30 discuss Augustine and the allegorical tradition of exegesis of the "days" of creation. On Caietan's continuation of this interpretation, William Wallace's commentary in Thomas Aquinas, Summa theologiae, ed. and trans. W.A. Wallace (New York: 1964), 10:225 and R. Jenkins, Pre-Tridentine Doctrine: A Review of the Commentary on the Scriptures of Thomas de Vio (London: 1891), 15-16 are useful. Whereas Foscarini also adopted a non-literal intepretation of the "days" of creation, he did not adopt the specific allegorical interpretation proposed by Augustine and Caietan.

7. Foscarini's knowledge and use of the exegetical writings of St. Augustine and Cardinal Caietan are demonstrated in Chapter Three, below.

8. P. Foscarini, Lettera. . .sopra l'opinione de' Pittagorici e del Copernico della mobilità della terra e stabilità del sole (Naples: 1615), 25; T. Salusbury, Mathematical collections and translations: the first tome (London: 1661), 484.

9. D. Berti, "Antecedenti al processo galileiano," 72.

10. D. Berti, "Antecedenti al processo galileiano," 72-73: ". . .tamen ejus conciliatio extorqueat sacras literas et exponat illas contra comunem explicationem Sanctorum Patrum, quae consona est comunior imo comunissimae et verissimae sententiae omnium fere Astronomorum."

11. In the Vulgate Latin translation these Psalms read as follows: "Etenim firmavit orbem terrae, qui non commovebitur" and "Qui fundasti terram super stabilitatem suam, Non inclinabitur in saeculum saeculi."

12. D. Berti, "Antecedenti al processo galileiano," 73: "Haec explicatio audiri non potest, nam ubi assignatur realis ratio vel causa alicujus effectus, non potest id intelligi secundum apparentiam tantum; ibi autem Spiritus Sanctus assignat rationem immobilitatis Terrae et inquit eam esse quia fundata est super stabilitatem suam."

13. For Counter-Reformation exegetes who made the equation between biblical references to terrestrial "stability" and terrestrial immobility see: B. Pererius, S.J., Prior tomus commentariorum et

disputationum in Genesim (Ingolstadt: 1590), 66-67; N. Serarius, S.J., Iosuae, ab utero ad ipsum usque tumulum. . ., Tomus prior gesta eius usque ad bella, tomus posterior bella omnia ab eo gesta, ... (Paris: 1610), cols. 1004-1006; J. Piñeda, S.J., In Ecclesiasten commentariorum liber unus, first ed. (Seville: 1619), ff. 128-131; second ed. (Antwerp: 1620), ff. 111-114; J. Piñeda, S.J., Commentariorum in Iob libri tredecim tomis duobus distincti (Antwerp: 1612), 415-417; Cornelius à Lapide, S.J. Commentaria in Vetus et Novum Testamentum (Venice: 1761), 5:21-23 (The New York Public Library copy of this work has the volume marked as volume four). For reproductions of the passages from the works of Serarius and Piñeda, although sometimes from different editions, see Z. Wardęska, Teoria heliocentryczna interpretacji teologów XVI wieku (Wrocław: 1975), photoreproductions 31, 32, 40.

14. D. Berti, "Antecedenti al processo galileiano," 73.

15. D. Berti, "Antecedenti al processo galileiano," 73. In the Vulgate Latin translation Ecclesiastes 1:4 reads as follows: "Generatio praeterit, et generatio advenit; Terra autem in aeternum stat."

16. P. Foscarini, Lettera, 45-46; T. Salusbury, Mathematical collections, 494.

17. A. Funkenstein, Theology and the Scientific Imagination from the Middle Ages to the Seventeenth century (Princeton: 1986), 68-70.

18. Two important survey discussions of this issue are E. Rosen, "The Dissolution of the Solid Celestial Spheres," Journal of the History of Ideas 46(1985):13-31 and W.H. Donahue, The Dissolution of the Celestial Spheres 1595-1650 (New York: 1981). W.H. Donahue, The Dissolution of the Celestial Spheres, 47-49 and E. Rosen, "Francesco Patrizi and the Celestial Spheres," Physis 26(1984):305-324 both deal with Patrizi's cosmological ideas. The excellent articles by U. Baldini, "La nova del 1604 e i matematici e filosofi del Collegio Romano: Note su un testo inedito," Annali dell'Istituto e Museo di Storia della Scienza di Firenze 6(1981):64-98 and "Galileo, la nuova astronomia e la critica all'aristotelismo nel Dialogo Epistolaro tra Guiseppe Biancani e i revisori romani della Compagnia di Gesu," Annali dell'Istituto e Museo di Storia della Scienza di Firenze 9(1984):13-43 chart the

spread of new cosmological ideas in the Jesuit Order. On this subject also see G. Baroncini, "L'insegnamento della filosofia naturale nei collegi italiani dei Gesuiti (1610-1670): Un esempio di nuovo aristotelismo," in La "Ratio Studiorum": Modelli culturali e pratiche educative dei Gesuiti in Italia tra Cinque e Seicento, ed. G.P. Brizzi (Rome: 1981), 163-215, esp. 176-178. Baroncini discerns a resistance among some Jesuits in the early decades of the seventeenth century to accept as fact what they could accept in principle, i.e. the corruptibility of the heavens. She also discerns a tendency of these Jesuits to argue for the "fluidity" of the planetary spheres but for the "solidity" of the firmament.

Besides the works listed above the following contain valuable references to the cosmological speculations of Jesuits scientists such as Clavius and Scheiner: S. Dick, Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant (Cambridge: 1984), 99-100; E. Grant, "A New Look at Medieval Cosmology, 1200-1687," Proceedings of the American Philosophical Society 129(1985):421-422 and W.A. Wallace, "Galileo's Early Arguments for Geocentrism and his Later Rejection of Them," in Novità celesti e crisi del sapere, ed. P. Galluzzi, 33.

19. W.H. Donahue, The Dissolution of the Celestial Spheres, 38-39 and E. Grant, "Were There Significant Differences between Medieval and Early Modern Scholastic Natural Philosophy? The Case for Cosmology," Noûs 18(1984):13.

20. As S. Drake in Galileo At Work, 189 states, a similar message was sent to Galileo by Carlo Cardinal Conti in 1612. Cardinal Conti argued that the Bible not only failed to uphold Aristotle on the inalterability of the heavens but implied the opposite. J.L.E. Dreyer, A History of Astronomy from Thales to Kepler, ed. W.H. Stahl (New York: 1953), 207-214; I.P. Sheldon-Williams, "The Cappadocians," in The Cambridge History of Later Greek and Early Medieval Philosophy, ed. A.H. Armstrong (Cambridge: 1967), 432-456 and W.A. Wallace's commentary in Thomas Aquinas, Summa theologiae, 10:202-210 all provide general accounts of patristic cosmological theories. On St. Basil, a crucial figure in this regard, also see L. Thorndike, A History of Magic and Experimental Science (New York: 1966), 1:480-494.

21. W.H. Donahue, The Dissolution of the Celestial Spheres, 39-40. Although Valerius was a novel thinker

in terms of his views on the elemental, corruptible nature of the heavens, he was not a proponent of the new Copernican astronomy. He never mentioned Copernicus by name and he rejected those who argued that the earth moved. Valerius is a good example of a thinker who could be both radical and traditional at the same time. E. Rosen, "Galileo's Misstatements about Copernicus," Isis 49(1958):324, n. 34 discussed Valerius and Copernicus. Z. Wardęska, Teoria heliocentryczna, photoreproduction 43 provides extracts from Valerius' textbook where he asserted the centrality and immobility of the earth, partly on the basis of biblical passages.

22. For the texts of Cesi's De caeli unitate and Bellarmine's response, both of which were printed for the first time in the Rosa ursina (1630) of Christopher Scheiner, S.J., refer to the editions printed in M.A. Biagi and B. Basile, eds., Scienziati del Seicento (Milan: 1981), 9-38. On Cesi's work the comments of R. Morghen, "The Academy of the Lincei and Galileo Galilei," Cahiers d'histoire mondiale 7(1963):375-376 are pertinent. Ideas similar to Bellarmine's reappear in the Almagestum novum (1651) of G.B. Riccioli, S.J. Riccioli explicitly upheld the elemental and corruptible nature of the heavens as more consonant with the Bible and the Church Fathers. E. Grant, "Were There Significant Differences between Medieval and Early Modern Scholastic Natural Philosophy?," 11-12 and his "A New Look at Medieval Cosmology," 423.

23. An excellent analysis of Bellarmine's astonomical and cosmological ideas is presented in U. Baldini, "L'astronomia del cardinale Bellarmino," in Novità celesti e crisi del sapere, ed. P. Galluzzi, 293-305. For an edition and translation of Bellarmine's cosmologically radical theological lectures, which were delivered at Louvain in the early 1570s, consult U. Baldini and G.V. Coyne, S.J., eds., The Louvain Lectures (Lectiones Lovanienses) of Bellarmine and the Autograph Copy of his 1616 Declaration to Galileo (Vatican City: 1984), 3-23. This work clearly demonstrates the early development of Bellarmine's own anti-Aristotelian "patristic" cosmology which never, however, went so far as to give up geocentrism and terrestrial immobility. The importance of these lectures for the demonstration of the freedom of interpretation concerning cosmology granted to theologians by Bellarmine in the 1570s had already been pointed out in F. Soccorsi, S.J., Il processo di Galileo (Rome: 1947), 28-30. For a summary of current

perspectives on this issue, consult G.V. Coyne, S.J. and U. Baldini, "The Young Bellarmine's Thoughts on World Systems," in The Galileo Affair: A Meeting of Faith and Science, ed. G.V. Coyne, S.J., M. Heller and J. Życiński (Vatican City: 1985), 103-110. G. Baroncini, "L'insegnamento della filosofia naturale," 176-178 treats the defense of the "fluidity" and "corruptibility" of the heavens in Jesuit colleges.

24. G. McColley, ed. and trans., The Defense of Galileo of Thomas Campanella (Northampton, MA: 1937), 42-43. B.M. Banonasea, "Campanella's Defense of Galileo," in Reinterpreting Galileo, ed. W.A. Wallace (Washington, D.C.: 1986), 226-227, 229-230 and S. Dick, Plurality of Worlds, 90-92 discuss the use of the Church Fathers by Campanella and his defense of Galileo's assertion of the existence of water, mountains and valleys on the moon, and the concomitant corruptibility of the heavens. In this regard, the revival of the works of John Philoponus (sixth century A.D.) in the sixteenth century, among them a work of biblical cosmology, De opificio mundi, is important. Philoponus was perhaps the most radical ancient critic of Aristole's physics and cosmology. He is to be credited with creating a unified dynamics and he "did it by means of his belief in a creator, and in a book dedicated to the biblical account of creation." R. Sorabji,"John Philoponus," in Philoponus and the Rejection of Aristotelian Science, ed. R. Sorabji (Ithaca: 1987), 10. Grant has recently pointed to this revival of Philoponus' works and ideas, along with the new Copernican cosmology, as two important factors in the dissolution of the medieval cosmos. E. Grant, "Celestial matter: a medieval and Galilean cosmological problem," Journal of Medieval and Renaissance Studies 13(1983):184 and "Were There Significant Differences between Medieval and Early Modern Scholastic Natural Philsophy?," 13. On the importance of the revival of ancient commentaries on Aristotle, among them those of Philoponus, for "attracting the attention of scholars away from the medieval writers" see S. Drake, "Physics and Tradition before Galileo," in his Galileo Studies: Personality, Tradition, and Revolution (Ann Arbor: 1970), 38. To this constellation of factors leading to the intellectual demise of the medieval cosmos the revival of Stoic physics and cosmology should be added. Stoic writers had rejected the perfect heavenly aether and the radical distinction between the heavenly and the terrestrial realms, as P. Barker and B.R. Goldstein, "Is Seventeenth-Century Physics Indebted to the

Stoics?," Centaurus 27(1984):148-164, have emphasized.

25. E. Grant, "Celestial Orbs in the Latin Middle Ages," Isis 78(1987):168. In the Latin Vulgate translation Job 37:18 reads as follows: "Tu forsitan cum eo fabricatus es caelos, Qui solidissimi quasi aere fusi sunt."

26. E. Rosen, "The Dissolution of the Solid Celestial Spheres," 24-25. In the King James translation Job 37:18 reas as follows: "Hast thou with him spread out the sky, which is strong, and as a molten looking-glass?"

27. G. Zanier, Medicina e filosofia tra '500 e '600 (Milan: 1983), 29. L. Thorndike, A History of Magic and Experimental Science, 6:355-360 also provides a general account of Valles' views.

28. L. Thorndike, A History of Magic and Experimental Science, 6:357. Pererius also used Job 37:18 to support the idea of hard celestial spheres according to H. Grisar, Galileistudien (Regensburg: 1882), 259.

29. E. Rosen, "The Dissolution of the Solid Celestial Spheres," 24.

30. G. Zanier, Medicina e filosofia, 37; V. Navarro Brotons, "Contribución a la historia del copernicanismo en España," Cuadernos hispanoamericanos 95(1974):9.

31. D. Berti, "Antecedenti al processo galileiano," 73. Oddly enough, Pontano used this very argument against the solidity of the spheres. C. Trinkaus, "The Astrological Cosmos and Rhetorical Culture of Giovanni Gioviano Pontano," Renaissance Quarterly 38(1985):455; E.J. Aiton, "Celestial Spheres and Circles," History of Science 19(1981):93 and P. Duhem, To Save the Phenomena: An Essay on the Idea of Physical Theory from Plato to Galileo, trans. E. Doland and C. Maschler (Chicago: 1969), 55.

32. A. Williams, The Common Expositor: An Account of the Commentaries on Genesis 1572-1633 (Chapel Hill: 1948), 186. Pererius was aware of astronomical observations such as those of the Nova of 1572 which cast doubt on the traditional system of the heavens. As Williams observed, 189: "He [Pererius] offers three possible explanations [of the Nova of 1572]: that it was generated and corrupted in the heavens, that it was another wandering planet in addition to the seven

already known, and that the supposedly fixed stars are not fixed but also have their proper courses. Any one of these explanations tears a hole in the approved system. Pererius apparently did not see their bearing, for instance, on the theory of solid spheres." On this matter, see also U. Baldini and G.V. Coyne, S.J., eds., The Louvain Lectures, 34, n. 40.

33. P. Barker and B.R. Goldstein, "Is Seventeenth-Century Physics Indebted to the Stoics?," 150.

34. On the office of Consultor or Qualifier, see J. Langford, Galileo, Science and the Church, 88 and J.M. Perniconce, The Ecclesiastical Prohibition of Books (Washington, D.C.: 1932), 55-57. Also see G. de Santillana, The Crime of Galileo, 140, who, on the basis of H. Grisar, S.J., Galileistudien, 37-38 supplied the names of the eleven Consultors asked to decide the theological orthodoxy of the Copernican theory. de Santillana remarked that, "some of them had indeed attained considerable fame in the theological controversies of previous years" and added, again basing himself on Grisar's authority, that some were "deeply versed in the natural sciences." It would be interesting to investigate the writings of these eleven Consultors to see if they did deal in a significant way with questions in the natural sciences and if any discussed the Copernican theory before being asked to rule on its orthodoxy. As the only copy of the Judicium exists in the files of Accademia dei Lincei, now in the Biblioteca Corsiniana, Rome and not in the files of the Holy Office, it may very well be that the Judicium was not written specifically for the perusal of the Consultors. If the Judicium was written for the Holy Office, it would appear the Holy Office never saw it. Certainly, the Judicium does not appear in the authoritative recent edition of the Vatican documents on the Galileo affair. S. Pagano, ed., I documenti del processo di Galileo Galilei (Vatican City: 1984). Although this work deals with the trial of Galileo in 1633, it also contains all the Vatican documents concerning the official condemnation of Copernicus and Foscarini in 1616.

35. It seems definite that Foscarini sent a copy of his Lettera and a copy of his theological defense to Bellarmine based on an analysis of Bellarmine's letter to Foscarini dated April 12, 1615. Bellarmine's letter dealt explicitly with the philosophical-scientific and exegetical problems of Copernicanism and in the first sentence of the letter Bellarmine thanked Foscarini for

sending his "Italian letter" and "Latin treatise." For the Italian version version of Bellarmine's letter, see Galileo Galilei, Opere, ed. A. Favaro (Florence: 1929-1939), 12:171-172. English translations of Bellarmine's letter abound. See the following versions: S. Drake, ed. and trans., Discoveries and Opinions (Garden City: 1957), 162-164; G. de Santillana, The Crime of Galileo, 98-100; J.J. Langford, Galileo, Science and the Church, 60-62.

CHAPTER THREE: FOSCARINI IN ROME: THE THEOLOGICAL DEFENSE (DEFENSIO)

In early 1615 Foscarini went to Rome to preach at the command of the General of his Order. Federico Cesi wrote to Galileo on March 7, 1615 to inform him both that Foscarini was then preaching in Rome and that Cesi was forwarding Galileo a copy of the Lettera which "could not have appeared at a better time."[1] Monsignor Piero Dini (ca. 1570-1625), another of Galileo's friends in Rome, also wrote on March 27 to say that Foscarini had pledged to take on all comers in public debate on the Copernican issue.[2]

There is precious little information concerning these sermons and debates, although it is certain that Foscarini was preaching the Lenten sermons of 1615 for the Carmelite Order.[3] However, in the very same letter in which Cesi informed Galileo about Foscarini's public support, Cesi offered the following tantalizing piece of information. After recounting the Lettera's attempt to reconcile Copernicanism with the Bible, Cesi outlined discussions he planned to have with various figures who shared similar views on this matter. These included not only Foscarini and Dini, but also the Jesuit Torquato De Cuppis, a Roman nobleman and Professor of Philsophy (1609-1612) and later of Moral Theology (1620-1637) at the Collegio Romano.[4] De

Cuppis was said to be of the same opinion, "istesso senso," on this controversial question. The same position, Cesi said, was also held by unnamed others.[5]

Although Cesi's letter unfortunately did not catalogue by name all those who supported Foscarini's position, it did make clear that the Copernican issue was a hot topic of discussion in Rome during the spring of 1615, and that there was an important group of intellectuals receptive to Foscarini's message. The message in this case can only be understood as the assertion of a compatibility between the Copernican cosmology and Sacred Scriptures, rather than as an actual adoption of the cosmic scheme. This was how Cesi outlined Foscarini's stance and indeed criticized Foscarini for claiming, in the Lettera, that all members of the Accademia dei Lincei were Copernicans. In fact, as Cesi put it, "this is not so, as they [the Linceans] unanimously claim only freedom in philosophizing about things in nature."[6]

To protect this freedom to philosophize about things in nature, and to ward off the theological censure of temeritas already levelled against the Lettera in the anonymous Judicium, Foscarini penned a small Latin treatise, the Defensio Epistulae Pauli Antonii Foscareni. . .super mobilitate terrae, a version of which he sent to Robert Cardinal Bellarmine,

along with a copy of his printed Lettera. Bellarmine, famed Jesuit scholar and controversialist, was at this time the acknowledged senior theologian of the Roman Church and defender of its doctrines against all enemies. In particular, he was senior member of the Congregation of Cardinals of the Holy Office of the Inquisition. To gain his approval, or at least to forestall his disapproval, would have been advantageous for both Foscarini and Galileo.

Three versions of this theological defense are now known to exist.[7] The first version was composed as a letter and addressed to Bellarmine. In this form it bears the title "Ad Illustrissimum et Reverendissimum Dominum Cardinalem Bellarminum Pro Defensione Epistuale F. Pauli Antonii Veneti Ordinis Carmelitarum Provincialis Calabriae super mobilitate terrae" ("To the most illustrious and most reverend lord Cardinal Bellarmine in defense of the letter on the motion of the earth of Brother Paolo Antonio Foscarini, Venetian, Provincial of Calabria of the Carmelite Order"). Although as yet unprinted, the epistle itself is in the Carmelite archival volume Scriptores Ordinis, AGOC, II C.O. II 4 (2), at cc. 97r-100v.[8]

The second version of the Defensio is in the form of a treatise and bears the title Defensio Epistulae Pauli Antonii Foscareni and can be found in the same

archival volume at cc. 101r-104r. This version of the Defensio was printed by the Carmelite archivist Antonio Franco in the Analecta Ordinis Carmelitarum early in this century.[9]

Yet a third version of this work exists in the "Copernican dossier" among the files of the Accademia dei Lincei, a dossier which also contains the Judicium against Foscarini, the answer of Bellarmine to Foscarini's Defensio and Galileo's own comments on Bellarmine's response. This was the version of the Defensio printed by Domenico Berti in his fundamental study of the events leading up to the Condemnation of 1616, the "Antecedenti al processo galileiano e alla condanna della dottrina copernicana," which appropriately enough appeared in the Atti della R. Accademia dei Lincei in 1881-1882.[10]

Stefano Caroti, in a study based partially on the as yet unpublished research of Father Emanuele Boaga, O. Carm., has amply demonstrated the essential similarity in content of the three versions. The most detailed and audacious of the three, however, was the letter sent to Cardinal Bellarmine himself. The other two versions, the one printed by Franco from the Carmelite archives and the version printed by Berti from the files of the Accademia dei Lincei, softened some of the most extreme statements sent to Bellarmine.

The second version of the Defensio contained in the Carmelite archives appears definitely to have been written by Foscarini himself, although it is unclear whether it was composed before the letter was forwarded to Bellarmine or whether it was done later, perhaps with the idea of producing an independent form of the Defensio destined to accompany a further diffusion of the Lettera.[11] Caroti, in his useful comparison of these three versions, raised some questions about the authorship of the Lincean redaction and doubted that Foscarini composed that version. However, he neglected to mention the fact that the Lincean version contains the following signature: "Ita ego Fr. Paulus Ant.^{s}. Foscarenus Venetus Ord.^{is} Carmel.^{rum} Theologus et Provincialis Calabriae. Manu propria."[12] These words are identical with those found at the end of the version printed by Franco and, if read literally, seem to indicate that Foscarini was indeed the author of the Lincean version as well.[13]

More certain knowledge of the textual relationships among the three versions must await, however, the publication of Boaga's archival study and a further investigation of the "Copernican dossier" in the files of the Accademia dei Lincei. Because the only printed copy of the Defensio confirmed to have been written by Foscarini himself is the version

printed by Franco, the analysis presented of Foscarini's theological arguments is based on this particular version of the work. Even so, it is worth noting that this version does not differ significantly from the other two.

From the very outset, it is clear that Foscarini had either seen a copy of the anonymous Judicium or had heard of its contents for he began his Defensio with an obvious reference to the Judicium. Foscarini, concerned by the theological acusation of temeritas levelled against Copernicanism, opened his defense with the following sentence: "The fact that the mark of rashness has been branded upon this opinion of the mobility of the earth. . .is not easy to suffer."[14]

Foscarini then tried to wash off the "mark of rashness." First, he argued that to assert the mobility of the earth was not forbidden to Catholic authors. Here he had recourse to a classic work of Counter-Reformation theology, the De locis theologicis (1563) by the Spanish theologian Melchior Cano (1509-1560).[15] This, in fact, was a work Foscarini frequently cited in his Defensio. In particular, Foscarini contended that the mobility of the earth did not fall into any of the three categories of rash or inadvisable statements established by Cano, statements worthy of the stigma of temeritas. Summarizing Book

12, Chapter 10 of Cano's work, Foscarini asserted about the mobility of the earth:

> It is not of the first class of rash [statements] for it is not uttered inadvisedly nor casually, nor is it without foundation in [the] particular natural doctrines and required mathematical principles. Nor is it of the second class, for it is not from among those propositions which by the law of the Faith and Scriptures are universally rejected as without appropriate testimony or probable reasoning. . . .Nor at last is it of the third class, for it does not violate the Doctrines of the Faith, according to a general decree of some University. Therefore in no way at all is the Proposition of the Mobility of the Earth rash or inadvisable.[16]

Especially intriguing is the third class of rash statements, those which do not violate the decress of a university, as this was not pursued in detail in the Defensio. The example offered by Cano and repeated verbatim by Foscarini was the "Parisian Articles."[17] This referred to the famous "Condemnation of 219 Propositions" promulgated at Paris in 1277. This official condemnation of propositions culled from a variety of theological and philosophical works marked a reaction by ecclesiastical authorities to excessive reliance on Aristotelian ideas in theology and philosophy. This, it was argued, had caused anything rejected by Aristotle and his followers to be labelled as "impossible." Edward Grant, studying the Condemnation of 1277 and its effects, remarked that the Condemnation had been long forgotten by the seventeenth

century, although, as Grant noted, Campanella in his Apologia pro Galileo did cite it.[18]

In fact, Campanella recalled the Condemnation of 1277 to support his thesis that philosophy and theology must not rely too heavily on the authority of Aristotle and his teachings.[19] As this idea ran throughout Foscarini's Lettera, and was a theme of the Defensio as well, was Foscarini consciously recalling the "Parisian Articles" as part of his own assault on Aristotelianism? It may be that Foscarini chose to cite this passage from such an authoritiative source as Cano's De locis theologicis in order to identify Catholic universities as an appropriate arena for debating the scientific and theological issues raised by the Copernican cosmology. As Olaf Pedersen has pointed out, ecclesiastical authorities did not refer the problem of Copernicanism to the universities, as such a problem would have been referred in the Middle Ages. Less than a century earlier the debate over the humanity of the American Indians was indeed the subject of disputationes by experts in Catholic universities.[20] The fact that this was not the case in 1615-1616 is a clear example of the decline of the universities as religious authorities in the era of the Reformation and Counter-Reformation.[21]

Foscarini argued that the mobility of the earth

was not a matter of faith. Therefore, he felt free to assert it and apply it to the exegesis of Scriptures. Citing Cano again, Foscarini reasoned that if the mobility of the earth was not a matter of faith and pertained soley to human doctrines, then "it does not seem absurd to depart even from the common understanding of the Fathers (sound reverence being owed to them all), in those things regarding human doctrines, which are acquired by industry, experience, and by investigation through human debate."[22] This distinction between matters of faith and human doctrine was crucial for his case. The Council of Trent, in its decree of April 8, 1546, had prohibited any departure from the common understanding and interpretation of the Fathers in matters of faith and morals.[23]

Concerning faith and morals, Foscarini acknowledged that all Catholics were obliged to abide by the decree of Trent requiring adherence to the common interpretation of the Fathers. However, in a daring manner, Foscarini developed the thesis that it was quite proper to depart from the common interpretation of the Fathers, even in matters of faith and morals, if this was not done rashly but for a very strong reason.

Foscarini contended that some of the Fathers, when discussing matters not immediately of the faith, had

disagreed with each other and had taught things repugnant to the truth in their attempts to combine matters of human reason and art for the purpose of defending and improving the Catholic faith. "Therefore it is not rash if when we depart from the common interpretation of the Fathers in matters of faith and morals it is done unintentionally, especially if it be done for a compelling reason."[24]

In defense of this assertion, Foscarini quoted and paraphrased from such authoritative works as St. Augustine's (354-430) Contra Faustum and Contra Julianum,[25] and the Principiorum fidei Demonstratione Methodica (1578) of the sixteenth-century English Catholic Thomas Stapleton (1535-1598).[26] He added that the same proposition was "taught by the explicit and very courageous words of Caietan. . .in the beginning of his Comment. in Genesim. Neither is it repudiated by Perrerius. . .nor by Cano," except in so far as they judged that the opinion in question could be extended and related to a matter which itself directly concerned the enhancement of faith and morals.[27] At this point, Foscarini cited the decision of trent on retaining the common interpretation of the Fathers in matters of faith and morals.[28]

Believing that astronomical issues were human, not divine, matters, Foscarini urged that "the Sacred

Scriptures, where they touch on natural doctrines. . .are to be interpreted by human reason and natural experience."[29] To support this position he quoted the Fourth Rule for interpreting Scriptures found in Pererius' commentary on Genesis.[30] Pererius' commentary was the most popular commentary of the sixteenth and seventeenth centuries,[31] and was the only work of contemporary Catholic exegesis used in the Defensio, although the exegetical writings of Caietan and his arch-enemy (though fellow Dominican) Ambrosius Catharinus (1484-1553) were cited from the earlier part of the sixteenth century.[32]

The citation of both Caietan and Catharinus, the former in his historical context representing an innovative approach to biblical criticism and the latter representing a more traditional approach, may only have been the by-product of searching for apposite references. It may also have been the purposeful balancing of authorities from the "liberal" and "conservative" camps within the early modern Catholic Church.[33] Foscarini was doubtless aware of the long-standing hostility toward Caietan's exegetical writings.[34] In the Defensio itself, he frequently made reference to Cano's De locis theologicis, a work which contains sharp criticisms of Caietan.[35]

Continuing along this line, Foscarini warned:

> if the reasons of philosophy and mathematics recommend a system different from the common Ptolemaic one which has been followed up to this point, we ought not vehemently affirm that Sacred Scriptures fight for the Ptolemaic system or favor Aristotelian opinions, and thus imperil the immoveable and most august majesty of the Sacred Letters themselves. . . .[36]

At this point, he effectively employed his favorite work of patristic exegesis, Augustine's De genesi ad litteram, Book 1, Chapter 18:

> In such matters that are obscure and far beyond our vision, even in such as we may find treated in Holy Scripture, different interpretations are sometimes possible without prejudice to the faith we have received. In such a case, we should not rush in headlong and so firmly take our stand on one side that, if further progress in the search of truth justly undermines this position, we too fall with it.[37]

This warning against any inadvisable or precipitous decision on the part of the Church, clearly prophetic in retrospect, was an important theme in the Defensio and one Foscarini later repeated in the tract.[38]

Fear of a precipitous ruling against Copernicus by theologians and the consequent ill-effects this would have was hinted at in the Lettera but stressed explicitly in the Defensio. Thus, M. D'Addio's recent assessment of the true import of Foscarini's Lettera seems reasonable and could with even greater justice be applied to the Defensio. As D'Addio said:

> The Carmelite [Foscarini] signaled with his writing the true problem put by the Copernican question: the ecclesiastical authority is running the great risk of relating a question belonging to

> the study of nature to the sphere of religious doctrine, presenting it absolutely as a question of the faith and exposing the Church in this way, in a more or less distant future, to a possible repudiation on the plane of the natural sciences, so to demonstrate without a shadow of a doubt the error of fact into which it had fallen and on which it would have based the affirmation of a religious character.[39]

Galileo inscribed exactly this warning to theologians on the flyleaf of his personal copy of the Dialogo; a warning presumably written after the condemnation of Galileo and his book in 1633.[40]

Although Foscarini continually maintained that the doctrine of the earth's mobility was a human one, he was equally intent upon proving that any supposedly anti-Copernican scriptural passage could be reconciled with the new system and even interpreted correctly for the first time. In order to perform this task Foscarini clarified his theory of accommodation as stated in the Lettera and offered, as well, a special version of the literal sense of Sacred Scriptures, which he acknowledged to be the foundation of all true exegesis.

Developing his theory of accommodation, Foscarini contended that the Bible very often spoke to vulgar ears, thereby accommodating itself to the common ways of speaking. Among other patristic examples, he cited St. Jerome (d. 420) on Jeremiah 28: "Many things, he [Jerome] says, are spoken of in Scriptures according to

the opinion of the time in which the events occurred, not according to the truth of the things themselves."[41] Foscarini also observed that Thomas Aquinas (d. 1274) in his Summa theologiae[42] had employed the same argument in his interpretation of Genesis 1:16: "And God made two great lights: a greater light to rule the day; and a lesser light to rule the night. . . ."[43] The same application of the theory of accommodation to Genesis 1:16 had also been made by Pererius in his commentary on Genesis.[44] Aquinas, Pererius and Foscarini all maintained that the sun and the moon were only the great (or greater) lights in magnitude from our point of view. Unlike Aquinas and Pererius, however, Foscarini utilized the theory of accommodation to support a heliocentric astronomy.

Foscarini concluded by defending the theory of accommodation, insisting that it would not in any way threaten the literal sense of Sacred Scriptures. His concern for the literal sense was a reflection of the emphasis placed upon literal readings of the Bible in Counter-Reformation exegesis. The literal sense was in fact the foundation of all scriptural exegesis. Arnold Williams, in studying commentaries on Genesis in the early modern era, has discerned not only a decrease in the spiritual exegesis common in the Middle Ages but also a shift in it as an "application" rather than as a

true "interpretation."[45]

The tradition of literal interpretation propounded by Foscarini went back to Thomas Aquinas. This particular tradition upheld a two-fold literal sense: the simple or primary sense and the parabolic or figurative sense of a given passage.[46] In this exegetical tradition: "What happened was that the spiritual senses in their totality were subsumed under one principal sense and appeared under the designation of 'true literal'."[47]

Quoting Paul of Burgos' (d. 1435) fifteenth-century continuation of the work of the great fourteenth-century exegete Nicholas of Lyra (d. 1340), Foscarini applied this tradition as follows:

> when Scripture names the arms of God, the literal sense is not as if God has arms of a physical kind, but the literal sense is that signified by the arms, namely the active power of God, and the same is true when it is said that God descends..., namely the literal sense is not that God is moved in some way but...that his providence is applied to inferior things.[48]

This example of the "arms of God" including the same interpretation can also be found in Aquinas' Summa theologiae, although its patristic origin is certainly the work of St. Augustine, who speaks of "figurative" interpretations of biblical passages and sees them as a form of literal, not spiritual, exegesis.[49]

Applying this exegetical approach to the motion of

the earth, Foscarini asserted that Scriptures does not speak falsely_when it speaks according to the vulgar opinion of the stability of the earth and the motion of the sun. It speaks in this fashion because it is describing appearances as humans perceive them and express them. To understand these passages correctly, it is necessary to go beyond the figures of speech to what is being signified. No doubt the earth has a certain stability in its own nature; a stability, however, not to be understood in the common sense of immobility. Appealing to the telescopic observations of sunspots by Galileo, only recently available to Foscarini, he could argue that although the sun indeed moves, as certain passages of Scriptures state, this motion was one of rotation on its own axis every thirty days. By using this more profound mode of interpretation, it was possible to understand both the physical truth of astronomy and the true literal sense of the biblical passages which asserted the earth's immobility and the sun's motion.[50]

Although Foscarini's exegetical techniques were not radically new, he was forced to be innovative in using them to defend the radically new Copernican cosmos. Unaware of Zuñiga's pro-Copernican In Iob commentaria of 1584, which was reprinted in Rome in 1591, Foscarini failed to cite the one Catholic exegete

who had already espoused similar arguments.[51] Pererius, whose principles of exegesis were so amenable to Foscarini's way of thinking, never mentioned the Copernican theory in his vast Genesis commentary. Indeed, the name of Copernicus only appears in this work in a discussion of the question of when the world will end.[52] In discussing the miracle of Joshua, Pererius treated the traditional exegesis as unquestionable and spoke of Joshua as ruling ("imperaret"), the sun and the moon.[53] In discussing the motion of the sun, Pererius pointed to Ecclesiastes 1:5 as proof that according to Solomon the sun moves in a circle in the heavens.[54] In his lengthy "Section on the Position and Immobility of the Earth," Pererius included citations to standard philosophical and biblical texts which argued against the motion of the earth and he insisted on the earth's centrality, as well as its lack of motion.[55]

In the early years of the seventeenth century, more direct attention was paid by Catholic exegetes to the astronomy of Copernicus. This attention, however, was of a negative sort. Johannes Lorinus, Nicholas Serarius and Juan Piñeda, all Jesuit commentators of distinction, knew something of Copernicus' theory and harshly rejected it. Lorinus in his commentaries on the Acts of the Apostles (1605) and Ecclesiastes (1606)

attacked theory of the motion of the earth defended by Copernicus and Zuñiga, among others. Lorinus supported his arguments by recourse to the authority of "our Clavius" and the exegetical writings of Piñeda.[56] Nicholas Serarius, in his Commentary on Joshua (1610), while praising Copernicus as "a noble astronomer, whom some would call another Ptolemy," still asserted that if Coperncius' hypotheses were taken as true they they were open to the charge of heresy.[57] This particular biblical commentary was cited by the Dominican friar Caccini in the infamous sermon against Galileo and his followers delivered in Florence on December 20, 1614.[58]

Juan Piñeda attacked both Coperncius and Zuñiga in his Commentary on Job (1597, 1600, 1612) and later in his Commentary on Ecclesiastes (1619, 1620).[59] Zuñiga, a fellow Spaniard, was criticized by Piñeda in 1619 as "clearly deluded" ("perspicue hallucinatus est") when he offered his pro-Copernican exegesis.[60] At the very beginning of his discussion of Ecclesiastes 1:4, which was thought to be written by King Solomon, Piñeda wrote the following revealing statement: "Physical truths have been carefully revealed by this judgment from Solomon" ("Physica dogmata subtiliter hac sententia a Salomone indicata").[61]

Piñeda then listed seven fundamental propositions confirmed by biblical passages. All of these dealt

with the centrality and the immobility of the earth. He then went on to defend the traditional geocentric and geostatic cosmology with great erudition, while at the same time demonstrating great hostility towards the Copernican system. At the very end of his discussion of Ecclesiastes 1:4, after denouncing Zuñiga and in the context of a citation of the work of the anti-Copernican Jesuit scientist Christopher Scheiner, Piñeda derided the Copernican system as "absurd and false." These words echoed those of Clavius and possibly those of the official Church theologians who had condemned Copernicanism in 1616.[62]

The point worth emphasizing here, however, goes beyond the content of Piñeda's exegesis, important as that is, or the animosity that he felt toward the new cosmology. His entire approach to the problem of Copernicanism was the reverse of that taken by Foscarini and Galileo. Whereas they tended to argue that biblical passages about the natural world should be judged against philosophical and scientific truths, Piñeda argued that physical truths should be judged against biblical passages.

Neither Piñeda nor Lorinus nor Serarius was willing to countenance the theory of accommodation or the theory of a two-fold literal sense in order to "save" those biblical passages which seemed to

contradict Copernicus. Instead, they were wedded to what seemed the obvious literal sense of such passages, i.e. that the earth stood still and the sun moved. If we couple this growing criticism of the Copernican system by Catholic scientists and theologians with the ever-present concern to "save" the literal sense of Scriptures, it is no wonder that Foscarini had to offer a new interpretation to "save" the literal sense of the miracle of Joshua. What is essentially the same interpretation of the literal sense of Joshua 10:12 appeared in Galileo's Lettera a Madama Cristina, which was completed in the summer of 1615.[63] However, there is no evidence to suggest that Galileo borrowed this interpretation from the Defensio of Fosacarini, a work which Galileo seems never to have seen.

Jean Dietz Moss, in her survey of Galileo's rhetorical strategies in the Lettera a Madama Cristina, has criticized him for attempting to use Scriptures to "hallow a physical conclusion," something for which she quite rightly says Galileo criticized others in the same work. She trats this section of Galileo's Lettera as an unnecessary appendage.[64] Yet, if we consider the accusations of theological unorthodoxy being hurled at Galileo and Copernicanism at this time, how could Galileo have failed to respond to the charges that the Copernican system was contradicted by the literal sense

of Scriptures, a most serious charge? When viewed in this light, Galileo's foray into biblical exegesis at the end of his Lettera was not an unnecessary appendage. It was a crucial part of his plan, as it had been for Foscarini, to fend off personal attacks and to stave off a prohibition of Copernicanism by the Church.

Notes

1. Galileo Galilei, Opere, ed. A. Favaro (Florence: 1929-1939), 12:150; S. Drake, ed. and trans., Discoveries and Opinions of Galileo (Garden City: 1957), 160. This copy of the Lettera appears to be the same as that recorded in A. Favaro, "La libreria di Galileo Galilei," Bulletino di bibliografia e di storia delle scienze matematiche e fisiche 19(1886):247, no. 95. P. Pagnini appears to be the only scholar to have speculated on the possible influence of Foscarini's Lettera on the composition of Galileo's own Lettera a Madama Cristina. Galileo Galilei, Opere, ed. P. Pagnini (Florence: 1935), 3:414.

2. Galileo Galilei, Opere, ed. A. Favaro, 12:161-163; S. Drake, Discoveries and Opinions, 160.

3. See the passage from Foscarini's Defensio in A. Franco, "P. Paulus Antonius Foscarini," Analecta Ordinis Carmelitarum 2(1911):496 where Foscarini states that he is heavily pressed by the task of having to preach publicly in Rome for Lent: "quando gravi ad populum concionum quadragesimalium habendarum onere premor. . . ." This is confirmed by the records of the Carmelite Order in Rome. On these records, see S. Caroti, "un sostenitore napoletano della mobilità della terra: il padre Paolo Antonio Foscarini," in Galileo e Napoli, ed. F. Lomonaco and M. Torrini (Naples: 1987), Appendix A, no. 8, 111. As Caroti observes, Appendix A, no. 12, 112, the records of the Order register Foscarini's presence in Rome in 1609 and 1613 as well.

4. Galileo Galilei, Opere, ed. A. Favaro, 12:150 and R.G. Villoslada, S.J., Storia del Collegio Romano dal suo inizio (1551) alla soppressione della Compagnia di Gesu (1773) (Rome: 1954), 205, 326-329, 332.

5. Galileo Galilei, Opere, ed. A. Favaro, 12:150 and S. Drake, Discoveries and Opinions, 160. In a letter of May 16, 1615 from Piero Dini to Galileo, Dini informed Galileo that "many Jesuits are in secret of the same opinion, although they keep silent." Galileo Galilei, Opere, ed. A. Favaro, 12:181: ". . .intendo che molti Gesuiti in segreto sono della medesima opinione, ancorche taccino. . . ."

6. Refer to Galileo Galilei, Opere, ed. A. Favaro, 12:150 and S. Drake, Discoveries and Opinions, 160 and 77-78 for extracts from the Constitution of the Accademia dei Lincei. On Foscarini's assertion

concerning the members of the Academy, see P. Foscarini, Lettera. . .sopra l'opinione de Pittagorici e del Copernico della mobilità della terra e stabilità del sole (Naples: 1615), 13-14; T. Salusbury, Mathematical collections and translations: the first tome (London: 1661), 478.

7. For an analysis of the three versions of the Defensio, see S. Caroti, "Un sostenitore napoletano della mobilità della terra," Appendix B, 113-121.

8. S. Caroti, "Un sostenitore napoletano della mobilità della terra," 114.

9. A. Franco, "P. Paulus Antonius Foscarini," 496-504. We must be grateful to the research of Father E. Boaga, O. Carm., as reported by Caroti, for revealing Franco's error in taking this version for the one specifically addressed to Bellarmine.

10. D. Berti, "Antecedenti al processo galileiano e alla condanna della dottrina copernicana," Atti della R. Accademia dei Lincei, 279, serie terza, Memorie della Classe di scienze Morali, Storiche e Filologiche 10(1881-1882):73-78. This study contains an excellent discussion of the "Copernican dossier" in the files of the Accademia dei Lincei.

11. S. Caroti, "Un sostenitore napoletano della mobilità della terra," 114.

12. S. Caroti, "Un sostenitore napoletano della mobilità della terra," 117.

13. See D. Berti, "Antecedenti al processo galileiano," 78. Berti argued on the basis of these words that Foscarini was the author of the copy of the Defensio in the Accademia dei Lincei files.

14. A. Franco, "P. Paulus Antonius Foscarini," 496: "Quod temeritas nota inuratur ei opinioni,. . ., id non facile patior."

15. On Cano's life and work see the brief discussions in P. Mandonnet, "Cano, Melchior," in Dictionnaire de théologie catholique (Paris: 1910), 2:1537-1540 and Y. Congar, O.P., A History of Theology (Garden City: 1968), 163-175.

16. A. Franco, "P. Paulus Antonius Foscarini," 497: "Assertio de Mobilitate Terrae non est prioris generis

temeritatis; nam non inconsulte et fortuito pronunciatur, nec absque fundamentis ex propriis doctrinarum naturalium et mathematicarum principiis petitis. Nec est secundi generis: nam non est ex iis propositionibus quae a Fidei et Scripturarum lege, universali sine idoneo testimonio aut probabili ratione eximuntur;. . . .Neque demum est tertii generis, nam non pugnat in Doctrina Fidei, cum alicuius Universitatis communi decreto. Nullo igitur modo temeraria est propositio de Mobilitate Terrae." Foscarini claims to be quoting and summarizing Cano's De locis theologicis, Book 12, Chapter 10. However, in the copy of Cano's work examined in his Opera (Cologne: 1605), this material appears in Book 12, Chapter 11 of the De locis theologicis. This discrepancy may be due to the fact, noted by J. Cahill, O.P., The Development of the Theological Censures after the Council of Trent (1563-1709) (Fribourg: 1955), 16, n. 2, that "according to the different editions of this work [De locis theologicis], the enumeration of the chapters of book twelve changes, according as the introduction to this book is counted as a chapter, or not."

17. A. Franco, "P. Paulus Antonius Foscarini," 497; M. Cano, De locis theologicis, Book 12, Chapter 11 in his Opera, 635.

18. E. Grant, "The Condemnation of 1277, God's Absolute Power, and Physical Thought in the Late Middle Ages," in his Studies in Medieval Science and Natural Philosophy (London: 1981), XIII: 242 and n. 131.

19. G. McColley, ed. and trans., The Defense of Galileo of Thomas Campanella (Northampton, MA: 1937), 40, 66.

20. O. Pedersen, "Galileo and the Council of Trent: The Galileo Affair Revisited," Journal for the History of Astronomy 14(1983):24 and O. Pedersen, "Science and the Reformation," in University and Reformation: Lectures from the University of Copenhagen Symposium, ed. L. Grane (Leiden: 1981), 55-57.

21. G.F. Lytle, "Universities as Religious Authorities in the Later Middle Ages and the Reformation," in Reform and Authority in the Medieval and Reformation church, ed. G.F. Lytle (Washington, D.C.: 1981), 69-98. Lytle's general article demonstrates that the universities declined as religious authorities without explaining why they declined. Apropos of university rulings on Copernicanism, J. Vernet Gines, in "El

quinto centenario del nacimento de Copernico e Hispanoamerica," Cuadernos hispanoamericanos 95(1974):26, cited a ruling by the Sorbonne in 1578 concening the debates over the Gregorian reform of the calendar which condemned as heretics those who believed that the earth moved and called for their extirpation no less that that of the followers of Luther and Calvin. This ruling by the Sorbonne, a bastion of Catholic orthodoxy, is also cited by Z. Wardęska in her Teoria heliocentryczna w interpretacji teologów XVI wieku (Wrocław: 1975), English summary, 138. As Wardeska says, this ruling could be interpreted as an authoritative act of the Catholic Church: "this matter, however, requires further study, since that pronouncement seems to have had local significance only,"

22. A. Franco, "P. Paulus Antonius Foscarini," 498. Foscarini is citing the De locis theologicis, Book 7, Chapter 3: M. Cano, Opera, 351 ff.

23. The text of this ruling is given in the original Latin and in an English translation in H.J. Schroeder, O.P., ed. and trans., Canons and Decrees of the Council of Trent (St. Louis: 1955), 298 and 18-19.

24. A. Franco, "P. Paulus Antonius Foscarini," 499: "Non igitur temere fit si quando a communi Patrum interpretatione in rebus ad fidem et mores non spectanibus discedimus, praesentim [this has been read as praesertim, as in the Lincean version in D. Berti, "Antecedenti al processo galileiano," 75] si id ratione suadente quinimo urgente, fiat."

25. For a standard biography of Augustine, which interweaves discussions of his relations with Faustus, the Manichean, and Julian, the Pelagian bishop of Eclanum, see P. Brown, Augustine of Hippo (Berkeley: 1969).

26. The best study of Stapleton is M.R. O'Connell, Thomas Stapleton and the Counter-Reformation (New Haven: 1964), esp. 61-63 for an examination of the Principiorum fidei demonstratione methodica.

27. A. Franco, "P. Paulus Antonius Foscarini," 499: "Item docet expressis et forte audacioribus verbis Caietanus. . .initio Comm. in Genesim. Nec alias reprehenditur a Perrerio. . .et a Cano. . .nisi quatenus aliquomodo liberius visus est suam extendere sententiam ad ea etiam quae ad fidem et morum

aedificationem spectant."

28. A. Franco, "P. Paulus Antonius Foscarini," 499.

29. A. Franco, "P. Paulus Antonius Foscarini," 500: "Scripturas autem Sacras, in his quae ad naturales doctrinas. . .pertinent, non aliter esse interpretandas quam ipsa ratio humana et naturalis experentia suaserit. . . ."

30. B. Pererius, S.J., Prior tomus commentariorum et disputationum in Genesim (Ingolstadt: 1590), Book 1, Chapter 1, 27, provides the text of the fourth rule for interpreting the Bible which affirms that when judging the words of Scriptures one must never go against the knowledge confirmed by manifest experiences and philosophical proofs. A. Williams, The Common Expositor: An Account of the Commentaries on Genesis 1527-1633 (Chapel Hill: 1948), 22-23, provides a discussion of the four rules of Pererius. Pertinent to Pererius' approach to the Bible is the comment by Williams, 23: "Pererius is perhaps somewhat more rationalistic than many of the commentators. He does always seek a natural explanation, and accepts the miraculous only when he cannot find the natural."

31. A. Williams, The Common Expositor, 8.

32. A. Franco, "P. Paulus Antonius Foscarini," 499, 501.

33. Caietan had emphasized the application of the philological and historical criticism of Renaissance humanism to the text of the Latin Vulgate and had emphasized going beyond the Latin version of the Bible to the Greek and Hebrew texts. He also had questioned the canonical status of certain of the books of the Bible. J. Wicks, "Thomism between Renaissance and Reformation: The Case of Cajetan," Archiv für Reformationsgeschichte 68(1977):9-32 provides an overview of Caietan's theological and exegetical views by a leading expert in the field. Useful older studies of Caietan's exegetical writings and the controversies surrounding them are: R.C. Jenkins, Pre-Tridentine Doctrine: A Review of the Commentary on the Scriptures of Thomas de Vio (London: 1891); M.M. Gorce, O.P., "Cajetan, précurseur de Catharin et de Banes," Revue thomiste 39(1934-1935):371-399; M.J. Lagrange, O.P., "Ecriture Sainte: La critique textuelle avant le Concile de Trente," Revue thomiste 39(1934-1935):400-409; A. Allgeier, "Les commentaires de Cajetan sur les

Psaumes: Contribution à l'histoire de l'exégèse avant le Concile de Trente," Revue thomiste 39(1934-1935):410-443; T. Collins, O.P., "Cardinal Cajetan's Fundamental Biblical Principles," Catholic Biblical Quarterly 17(1955):363-378.

34. A. Allgeier, "Les commentaires de Cajetan," 428-443. This hostile reaction did not mean that Caietan's writings were not used. In fact, as A. Williams, The Common Expositor, 15, has shown, Pererius made extensive use of Caietan's commentaries in his own biblical works.

35. A. Allgeier, "Les commentaires de Cajetan," 440, n. 30 and M. Jacquin, O.P., "Melchior Cano et la théologie moderne," Revue des sciences philosophiques et théologiques 9(1920):129.

36. A. Franco, "P. Paulus Antonious Foscarini," 500: ". . .si rationes Philosophiae et Mathematicae, contrarium sistema suaserint, quam hactenus communis Ptolemaica opinio sequuta sit, non debemus affirmare asseverantur Sacras Litteras pro Ptolomaei sistemate pugnare, aut Aristotelicae opinioni favere, et sic ipsarum Sacrarum literarum immobilitatem et augustissimam maiestatem in discrimen adducere. . . ." It should be noted that the words, "aut Aristotelicae opinioni favere," are missing from the Lincean vesion of the Defensio. D. Berti, "Antecedenti al processo galileiano," 76.

37. St. Augustine, The Literal Meaning of Genesis, ed. and trans. J.H. Taylor, S.J. (New York: 1982), 41. For a thought-provoking analysis of Augustine's principles of exegesis as regards cosmology see E. McMullin, "How Should Cosmology Relate to Theology?," in The Sciences and Theology in the Twentieth Century, ed. A.R. Peacocke (Notre Dame: 1981), 18-25. McMullin discerns a tension in Augustine's writings between the "neutrality" principle, whereby it is asserted that cosmology is not relevant to salvation and not taught by the words of the Holy Spirit, and the "relevance" principle, whereby it is asserted that maximum weight must be given to the literal reading of all scriptural passages, unless one can prove the necessity of adopting an alternative metaphorical reading. One way to do this is to show that a literal reading of the Bible leads to conflicts with a "demonstrated truth." McMullin contends that this tensions in Augustine's De genesi ad litteram reappears in Galileo's Lettera a Madama Cristina. Such a tension also seems present in

Foscarini's Lettera and Defensio.

38. A. Franco, "P. Paulus Antonius Foscarini," 502.

39. M. D'Addio, "Considerazioni sui processi a Galileo," Rivista di storia della chiesa in Italia 27(1983):29. Foscarini had raised the possibility of an erroneous ruling on the part of the Church in the Lettera, 34 and T. Salusbury, Mathematical collections, 488.

40. O. Pedersen, "Galileo's Religion," in The Galileo Affair: A Meeting of Faith and Science, ed. G.V. Coyne, S.J., M. Heller and J. Życiński (Vatican City: 1985), 96 and S. Drake, Galileo (New York: 1980), 62.

41. A. Franco, "P. Paulus Antonius Foscarini," 501: "Sanctus Hieronymus super Hierem. 28: Multa inquit dicuntur in Scripturis iuxta opinionem illius temporis gesta referuntur, non iuxta quod rei veritas continebat." E.F. Sutcliffe, S.J., "Jerome," in The Cambridge History of the Bible: The West from the Fathers to the Reformation, ed. G.W.H. Lampe (Cambridge: 1969), 2:80-101 is an excellent survey of Jerome's life and biblical works.

42. Foscarini correctly cited Summa theologiae p. 1, q. 70, ar. 1 ad. 1 at A. Franco, "P. Paulus Antonius Foscarini," 501. For this passage in Latin and English see Thomas Aquinas, Summa theologiae, ed. and trans. W.A. Wallace (New York: 1964), 10:112-115.

43. In the Latin Vulgate Genesis 1:16 reads as follows: "Fecitque Deus duo luminaria magna: luminare maius, ut praeesset diei: et luminare minus, ut praeesset nocti: et stellas."

44. B. Pererius, S.J., Commentariorum et disputationum in Genesim, tomi quatuor (Cologne: 1601), 1:61.

45. A. Williams, The Common Expositor, 20-21.

46. Foscarini correctly cited the Summa theologiae Ia I, 10, ad. 3 where Aquinas defined the two-fold literal sense. For Foscarini's citation, which varies slightly from the numbering of this passage in the modern edition consulted, see A. Franco, "P. Paulus Antonius Foscarini," 502 and Thomas Aquinas, Summa theologiae, ed. and trans. T. Gilby, O.P. (New York: 1964), 1:40-41. Aquinas' theory and its reception among later exegetes are treated in the following works: R.E.

Brown, S.S., "Hermeneutics," in The Jerome Biblical Commentary, ed. R.E. Brown, S.S., J.A. Fitzmyer, S.J. and R.E. Murphy, O. Carm. (Englewood Cliffs: 1968), 2:605-623; K. Froelich, "'Always to Keep the Literal Sense in Holy Scripture Means to Kill One's Soul': The State of Biblical Hermeneutics at the Beginning of the Fifteenth Century," in Literary Uses of Typology from the Late Middle Ages to the Present, ed. E. Miner (Princeton: 1977), 20-48; J.S. Preus, From Shadow to Promise: Old Testament Interpretation from Augustine to the Young Luther (Cambridge, MA: 1969), 46-149; B. Smalley, "The Bible in the Middle Ages," in The Church's Use of the Bible: Past and Present, ed. D.E. Nineham (London: 1963), 60-71.

47. K. Froelich, "'Always to Keep the Literal Sense'," 47.

48. A. Franco, "P. Paulus Antonius Foscarini, " 503: ". . .non ergo cum Scriptura nominat Dei brachium est literalis sensus quasi in Deo sit brachium huiusmodi corporale, sed illud quod per membrum significatur, scilicet virtus operativa, et idem dicendum est cum dicitur Deum descendere. . ., scilicet quod non est sensus literalis quod Deus moveatur aliquo modo, sed quod. . .providentiam suam rebus inferioribus applicando. . . ."

49. This passage in Thomas Aquinas' Summa theologiae was well-known to Foscarini as it is the same passage from the Summa cited in n. 46, above. Augustine's ideas on literal and figurative interpretations of biblical passages are discussed in J.S. Preus, From Shadow to Promise, 13-14.

50. A. Franco, "P. Paulus Antonius Foscarini," 503.

51. M. D'Addio in his "Considerazioni sui processi a Galileo," 27 sees the ecclesiastical approvals given to the printing and reprinting of Zuñiga's Commentary on Job as a sign that the Church at that point accepted the principle that scriptural passages could be interpreted according to the Copernican theory. This also seems to be the position of F. Barone, "Diego de Zuñiga e Galileo Galilei: Astronomia eliostatica ed esegesi biblica," Critica storica 19(1982):328-329. However, this is not an altogether convincing argument. The Copernican section of Zuñiga's work was a very small part of the whole and it is not at all certain that the ecclesiastical authorities who issued the imprimatur for the original printing and the reprinting

noticed the Copernican section.

52. A. Williams, The Common Expositor, 189.

53. B. Pererius, S.J., Commentariorum et disputationum in Genesim, tomi quatuor, 3:962.

54. B. Pererius, S.J., Commentariorum et disputationum in Genesim, tomi quatuor, 1:92.

55. Pererius' lengthy discussion of the status of the earth can be found in his Prior tomus commentariorum et disputationum in Genesim, Book 1, Chapter 1, 66-67. Pererius used references to, among other works, Aristotle's De caelo and Psalms 92, 103, 118 and Ecclesiastes 1:4 to uphold his positions. The length of Pererius' section on the centrality and immobility of the earth may very well reflect his knowledge of, and opposition to, the Copernican theory.

56. Z. Wardeska, Teoria heliocentryczna, photoreproductions 22 and 23 are extracts from Lorinus' biblical commentaries.

57. N. Serarius, S.J., Iosue, ab utero ad ipsum usque tumulum, . . ., Tomus prior gesta eius usque ad bella, tomus posterior bella omnia ab eo gesta, ... (Paris: 1610), cols. 1004-1006.

58. J. Brodrick, S.J., The Life and Work of Blessed Robert Francis Cardinal Bellarmine S.J. 1542-1621 (London: 1928), 2:352-353.

59. H. Grisar, S.J., Galileistudien (Regensburg: 1882), 264 and Z. Wardeska, Teoria heliocentryczna, photoreproduction 31 provide references to Piñeda's 1597 and 1600 commentaries on Job. For the later commentaries by Pineda on Job and on Ecclesiastes see J. Piñeda, S.J., Commentariorum in Iob libri tredecim tomis duobus distincti (Antwerp: 1612), 415-417; Commentarii in Ecclesiasten (Antwerp: 1619), f. 128, entire discussion from ff. 128-131; Commentarii in Ecclesiasten (Antwerp: 1620), ff. 111-114.

60. J. Piñeda, S.J., Commentarii in Ecclesiasten, f. 128 and f. 111. The words "perspicue hallucinatus est" have been translated as "was clearly deluded" following the advice of P. Zambelli, "Introduction: Astrologers' Theory of History," in 'Astrologi hallucinati': Stars and the End of the World in Luther's Time, ed. P. Zambelli (Berlin: 1986), 1, n. 1. Zambelli states

that in Renaissance Latin "hallucinari" meant simply "to be wrong" and that the verb carried less weight in the Renaissance than in classical antiquity.

61. J. Piñeda, S.J., Commentarii in Ecclesiasten, f. 128 and f. 111.

62. J. Piñeda, S.J., Commentarii in Ecclesiasten, f. 131 and f. 114. In defense of his geocentric and geostatic cosmology, Piñeda cited Clavius' Commentary on the Sphere of Sacrobosco and the work of Christopher Scheiner, S.J., whom Piñeda took to be the author of the Disquisitiones mathematicae (Ingolstadt: 1614). C. Martini, "Gli esegeti del tempo di Galileo," in Nel quarto centenario della nascita di Galileo Galilei (Milan: 1966), 119-121 is an excellent summary of Piñeda's exegesis and a briefer notice can be found in R. Fabris, Galileo Galilei e gli orientamenti esegetici del suo tempo (Rome: 1986), 39.

Although the first edition of his Commentary on Ecclesiastes was printed in 1619, Piñeda made no mention of the Condemnation of 1616. Martini argued that Piñeda was probably unaware of the ruling or he would have cited it. This may or may not have been the case. It is quite interesting to note that Piñeda, an exegete extremely hostile to the Copernican cosmology, was the author of the Spanish version of the Index which should have contained the emended version of the De revolutionibus required by the Condemnation of 1616. As O. Gingerich, in "The Censorship of Copernicus' De Revolutionibus," Annali dell'Istituto e Museo di Storia della Scienza di Firenze 6(1981):57-59, has shown, it appears that no changes were required in Copernicus' masterpiece according to the Index printed in Seville in 1631. Gingerich argues that Piñeda and other Spaniards took the Condemnation of 1616 to have been a purely Italian affair seemingly not binding on Catholics in other countries. Consequently, the fact that Piñeda made no mention of the Condemnation in his Commentary on Ecclesiastes does not mean that he was unaware of the ruling. The independence of the Spanish Inquisition from that of Rome is attested to by the fact that by the 1620s the Spanish Inquisition refused to recognize Roman condemnations of many books and approved or disapproved of books on its own. Because of this independence, and the conflict of the Spanish Inquisition with that of Rome at the time of Galileo's personal condemnation in 1633, the Dialogo never appeared on any Spanish Index of Prohibited Books. H.C. Lea, A History of the Inquisition of Spain (New York: 1966), 3:533-539.

63. S. Drake, Discoveries and Opinions, 212 and, on the dating of the Lettera a Madama Cristina, S. Drake, Galileo At Work: His Scientific Biography (Chicago: 1978), 250.

64. J.D. Moss, "Galileo's Letter to Christina: Some Rhetorical Considerations," Renaissance Quarterly 36(1983):573.

CHAPTER FOUR: FOSCARINI'S LETTER TO GALILEO AND THE PHYSICAL PROBLEMS SURROUNDING THE COPERNICAN THEORY

Bellarmine's answer to Foscarini was contained in a letter of April 12, 1615, a letter famous in the history of the reception of Copernicanism. In a respectful tone, Bellarmine firmly rejected Foscarini's and Galileo's claims concerning the epistemological status of the heliocentric theory and its compatibility with Scripture.

Bellarmine began by advising Foscarini and Galileo to satisfy themselves when speaking of heliocentrism "hypothetically ["ex suppositione"] and not positively ["assolutamente"], as I have always believed Copernicus did."[1] He continued by asserting that the assumption that the sun stands still saves all the astronomical appearances better than eccentrics and epicycles and to speak in this manner "is to speak well."[2] To assert the superiority of heliocentrism as an astronomical hypothesis which can be used to "better save the appearances...has no danger in it, and it suffices for mathematicians."[3] Similar cautionary advice had already been given to Galileo's friends in Rome by both Bellarmine and Maffeo Cardinal Barberini (1568-1644), the future Urban VIII.[4] Indeed, in the short discussion on the nature of Copernicanism as a scientific theory contained in the letter to Foscarini,

Bellarmine increased the superiority of heliocentrism by repeating Foscarini's error in interpreting Copernicus as an astronomer who did away with epicycles and eccentrics.[5]

Galileo himself noted this error. In notes on Bellarmine's letter, notes seemingly intended to be sent to Foscarini for use in revising his Lettera, Galileo explained: "Copernicus assumes eccentrics and epicycles; not these, which indubitably exist in heaven, but other excesses [such as the equant] were his reasonn for rejecting the Ptolemaic system."[6]

Bellarmine concluded the first paragraph of his letter by warning Foscarini of the twin dangers of arousing the hostility of "all the philosophers and scholastic theologians" and of "injuring our holy faith and making the Sacred Scripture false."[7] In this regard, Bellarmine remonstrated with Foscarini that, although he had demonstrated many different ways of expounding Scriptures, he had not applied these in specific cases and Bellarmine doubted whether Foscarini could apply his methods of exegesis successfully to all the biblical passages cited in the Lettera.[8]

Having raised the spectre of biblical objections to the Copernican theory, Bellarmine turned his attention to exegetical and theological questions. Here, Bellarmine also cited the decree of the Council

of Trent on following the unanimous consent of the Fathers.

> And if Your Reverence would read not only their works but the commentaries of modern writers on Genesis, Psalms, Ecclesiastes, and Joshua, you would find that all agree in expounding literally that the sun is in the heavens and travels swiftly around the earth, while the earth is far from the heavens and remains motionless in the center of the world.[9]

After this piece of exaggeration concerning the exegetical unanimity regarding the geocentric and heliokinetic theory, Bellarmine turned to the critical matter of whether the position and motion of the earth were matters of the faith or not.[10]

In this regard, Bellarmine explicitly proclaimed that the geostatic and geocentric cosmology <u>was</u> a matter of the faith, if not in terms of the subject matter ("ex parte obiecti") then in terms of those who are speaking ("ex parte dicentis").[11] "Thus that man would be just as much a heretic who denied that Abraham had two sons and Jacob twelve, as one who denied the virgin birth of Christ, for both are declared by the Holy Ghost through the mouths of the prophets and apostles."[12]

At this point in his letter, Bellarmine propounded a strange interpretation of the Council of Trent's decree of April 8, 1546. In the Jesuit Cardinal's interpretation, <u>all</u> biblical statements are matters of

the faith because of their divine inspiration and he thus put on the same level simple historical statements such as the number of Abraham's sons with other passages more difficult to interpret, such as those belonging to the prophetic or poetic books of the Bible.[13]

In point of fact, Bellarmine's statements flew in the face of the facts that neither the Church nor the Fathers had designated the motion of the sun and the immobility of the earth as matters of the faith. As Galileo and Foscarini were fond of reminding their readers, St. Augustine had pointedly argued that these questions were definitely not matters of the faith.[14]

Bellarmine also appears to have misread the major issue dividing the Copernicans from the anti-Copernicans in terms of biblical exegesis. His words lead one to believe that Foscarini and, by extension, Galileo had questioned or denied the divine inspiration of Scriptures. This was most definitely a false issue as Foscarini and Galileo always argued for a divine inspiration of the books of the Bible. The question was not the divine inspiration of the words of Scriptures but the correct meaning of those words.

A remarkable devotion to the words of Scriptures is demonstrated in certain of Bellarmine's theological works where he contended that "not the propositions

alone, but each and every word pertains to the faith. We believe that no word in Scripture is unnecessary, nor is it incorrectly placed."[15] This statement, coupled with other affirmations that every biblical passage has a simple, literal interpretation but all do not have a "figurative" or "spiritual" interpretation, leads to the conclusion that "at least some of the passages implying geocentrism had a simple ("simplex") literal sense and were, therefore, explicit divine teachings."[16]

However, Bellarmine did not completely reject Copernicanism on biblical grounds. He did admit that if a true demonstration of Copernicus' theory were presented, then a reinterpretation of the biblical passages would be in order.[17] This call for a "true demonstration" was probably inspired by conversations with Father Christopher Grienberger, Clavius' successor at the Collegio Romano.[18] Bellarmine did not expect such a call to be answered.

Bellarmine was quite willing to accept the fact that the heliocentric theory "saved the phenomena of the heavens" but not that heliocentrism corresponded to the physical truth of the cosmos. As he explained:

> To demonstrate that the appearances are saved by assuming the sun at the center and the earth in the heavens is not the same thing as to demonstrate that in fact the sun is in the center and the earth in the heavens. I believe that the

> first demonstration may exist, but I have very grave doubts about the second; and in case of doubt one may not abandon the Holy Scriptures as expounded by the holy Fathers.[19]

At this juncture Bellarmine referred to Ecclesiastes 1:5 which not only spoke of the motion of the sun but was also written by Solomon, the wisest of all men in the human arts and sciences, "which wisdom he had from God."[20]

Against Foscarini's and Galileo's argument that Ecclesiastes 1:5 could be read as speaking according to appearances, Bellarmine countered that in this particular case there is no danger of mistaking appearance for reality. Therefore, "no sage has needed to correct the error, since he clearly experiences that the earth stands still and that his eye is not deceived when it judges the sun to move, just as he is like wise not deceived when it judges that the moon and the stars move."[21] Ironically, the same devotion to the literal interpretation of the words of Scriptures which led Bellarmine to reject Aristotelian cosmological conceptions such as the "incorruptibility" of the heavens also led him to hold fast to other cosmological traditions, such as geocentrism.[22]

This negative response did not end Foscarini's part in the struggle over the new heliocentric cosmology. Soon after the April letter of Bellarmine,

Foscarini left Rome and returned to Naples, there to work on a revised version of the Lettera. As early as March 1615 there is evidence that he was planning such a revision. Monsignor Ciampoli reported to Galileo on March 28 that, on a visit to Foscarini's residence in Rome, he had found the Carmelite Father collecting more references from the sacred writings and speaking of perfecting his book and reprinting it in order to defend himself from all opponents.[23]

Immediately after the receipt of Bellarmine's letter of April 12, Foscarini must have shown it to Galileo's circle of friends in Rome as a copy of it was included in a letter sent to Galileo by Piero Dini on April 18. The same letter by Dini also contained the first reference to what would become a series of communications between Galileo and Foscarini. Dini informed Galileo that he had given Foscarini Galileo's letter which had been written in recompense for Foscarini's kindness towards him. This letter apparently contained some sensitive material as Dini promised Galileo that, save for Cesi, no other had seen this piece of correspondence.[24]

On May 2, Dini wrote Galileo that Foscarini had left Rome with the intention of reprinting the Lettera. He commented that Foscarini was not in any great danger because of his high rank in the Carmelite Order and his

exceptional intelligence. At the same time, he added the significant information that Foscarini need not worry since he was under the protection of Giovanni Cardinal Millini, a most powerful member of the Roman Curia.[25] Millini had been made a Cardinal by Pope Paul V in 1606 and held a number of important positions, such as Vicar of the Pope and member of the Congregations of Rites, of Bishops, and of the Inquisition. Indeed, Millini was held in such high esteem by Paul V that a contemporary sources spoke of him "governing" the Pope.[26]

Millini's name will appear again in the official acts of the Condemnation of 1616, for he was Secretary as well as member of the Congregation of the Inquisition. Unfortunately, it is only possible to speculate about whether his role as "protector" of Foscarini prevented any harsher personal treatment befalling the Carmelite Father, beyond that of the condemnation of his printed book.

By May, Galileo's Roman circle of friends was awaiting the revised version of the Lettera and both Dini and Prince Cesi were acting as conduits of information between Galileo and Foscarini. As Cesi informed Galileo in a letter of May 15, Foscarini was no longer in Rome, having already returned to his province. Consequently, Cesi had personally forwarded

to Foscarini a document Galileo had enclosed for him in an earlier letter. This document may, in fact, have been a version of Galileo's famous notes and comments on Bellarmine's letter to Foscarini.[27] Obviously, the four men (Dini, Cesi, Galileo, Foscarini) were engaged in a joint campaign in defense of Copernicanism.

The most important testimony from Cesi can be found in a letter of June 20, 1615 to Galileo. Cesi first reported how the envious maligners of Galileo in Rome had been repressed, partly due to the good effects of Foscarini's Lettera.[28] In point of fact, Cesi remarked that "neither the principal author [of this opinion, Copernicus], nor the Lettera of the Father, nor the opinion itself run any danger (if required precautions are taken)."[29]

Of more importance than this estimate of the political situation in Rome was the strategy Cesi laid down for continuing the struggle in favor of Copernicus. These words should be quoted in full for they cast light on the manner in which Cesi wished others, including Foscarini, to couch their arguments. As Cesi counseled:

> Until the said Father [Foscarini] has completed his task, which will be a full and extensive treatise in the Latin language, necessary caution requires the exercise of silence here, not treating further of that opinion [Copernicanism], and elsewhere treating it little as well, in order not to vex in this in between time the passions of

> the most powerful Aristotelians; and treating it for others in whatever manner, to say that one does not treat it in terms of the truth and reality of the thing, but, leaving that to one side and submitting oneself to the judgment of superiors, to treat of the matter ex hypothesi, in order to save more commodiously and simply all the appearances, as the principal author [of this opinion, Copernicus] already did: in sum not to contest anything concerning the truth of it, nor to hold to anything as true.[30]

Cesi concluded this important communication with words of eager expectation concerning the arrival of Foscarini's answer to all his critics and with another offer to pass Galileo's written comments on these matters to his Carmelite ally.[31]

Cesi's endorsement of Bellarmine's advice that one should argue about Copernicus only ex suppositione (ex hypothesi) is helpful in intepreting an anonymous letter to Galileo. The anonymous letter, which outlined the design for a work comparing the Ptolemaic and Copernican systems, was first printed by Berti. Although the authorship of the letter could be assigned to Foscarini, Berti personally doubted such an ascription.[32] Other Galilean experts concurred in this opinion. Antonio Favaro placed this letter in the national edition of Galileo's works with only a tentative ascription to Foscarini[33] and Emil Wohlwill, in his Galilei und sein Kampf für die Copernicanische Lehre, stated that one was entitled to have doubts concerning the authorship of the anonymous epistle.[34]

Such doubts were unneccessary. The physical character of the document alone speaks to Foscarini's authorship. It is an unsigned letter, undoubtedly meant for Galileo, concerning an ongoing project of a work comparing and contrasting the Ptolemaic and Copernican systems. Written in a seventeenth-century hand, according to the expert opinion of Favaro,[35] it would seem to belong to the events of 1615-1616. It most certainly predates the decree of March 1616 as there are no mentions or even allusions to existing ecclesiastical restrictions on the discussion of Copernicanism.

The fact that this document is part of the "Copernican dossier" in the Lincean files is another argument for Foscarini's authorship. It can be found in the Lincean manuscript collection, Volpicelliano A, at cc. 169r-171v. The very same manuscript collection contains the anonymous Judicium of Foscarini's Lettera, the third version of Foscarini's Defensio, a copy of Bellarmine's April letter to Foscarini, and Galileo's written comments on Bellarmine's response. In addition, many statements by Dini and Cesi that they were acting as the transmitters of information between Galileo and Foscarini confirm the likelihood that the unsigned letter is by Foscarini. Unfortunately, since there have been no paleographical examinations of this

document comparing it with authenticated specimen's of Foscarini's own hand, it is not possible to say whether the document is an autograph or a copy.

The content of the unsigned letter also points to Foscarini as the author. The first part of the letter deals with the author's strategy concerning his forthcoming work. The second part poses certain physical questions related to the mobility of the earth, questions hopefully to be answered by Galileo.

At the beginning of the letter, the writer revealed himself as someone who had spoken out in favor of Copernicus and had been reprimanded for it. Consequently, he intended, in the future, to follow a more prudent policy when speaking of the Copernican theory. As he stated:

> Having to write my advice on this opinion [Copernicanism] with all due circumspection, it does not seem good to me that at present I show myself so inclined to the said opinion, that others may judge that (so to speak) I have placed an act of the will before one of the intellect; and being able to dress myself in some way in this controversy in the gown of a judge, I ought not to dress myself in that of a contestant.[36]

These words seem to reflect both the accusation of temeritas (rashness, willfulness) levelled at Foscarini by the author of the theological Judicium and the advice given by Cardinal Bellarmine to speak of the Copernican theory only ex suppositione and not assolutamente. Similar advice was probably given to

Foscarini by Cesi who was counselling all concerned to argue for the Copernican universe only ex hypothesi. From the very beginning of the letter, the veil of anonymity seems lifted and Foscarini appears as the most likely author.

The details which follow concerning the nature of the proposed work confirms Foscarini as the author. It was to be a work which would cover the same cosmological questions as were treated in the Lettera and which would uphold the same positions. However, in accordance with the cautionary words at the beginning of the letter, Foscarini decided to change the literary form of the Lettera from that of an essay to that of a dispute or discussion. He had determined that:

> my little work [shall be] a dispute or discussion, in which, proceeding in an orderly fashion, I ought at first to begin to separate those things more certain and acknowledged from all those things more uncertain and controversial, I mean [those things] separating the followers of Ptolemy and Copernicus, or the Peripatetics and the Pythagoreans; and coming to the Copernican opinion, I shall distinguish in this way that which is more probable from that which appears less probable, and what in all these matters (whether they be philosophical or astronomical) are those [matters] which are themselves seen to be antecedents or consequents or concomitants or those which are themselves to be conceded with the establishment of the world system.[37]

What has been said of Galileo's later use of the dialogue form could easily be applied to Foscarini: "Galileo's decision to treat Copernicanism in dialgoue

form was in itself a brilliant rhetorical move. The form underscores his stance as an objective inquirer after truth. The work could be regarded then not as a treatise but as a tentative probing of the issues in literary form."[38] By adopting the literary form of a dispute or discussion for his future work, Foscarini would dress himself "in the gown of a judge" in this scientific controversy, although there is no doubt that this particular judge would not be an impartial one.

Foscarini's first concern, in his new work, was to be with those cosmological questions which touched on the material constitution of the universe. He proposed to treat of the form of the cosmos, its parts, the number of the elements and the controversial matters of the existence of the sphere or region of fire, and the existence of the heavenly spheres.[39] To quote Foscarini's intentions:

> In these discussions I ought to establish (how it is true, although contradictory to the sect of the Peripatetics), that the integral parts of the cosmos are none other than heaven, of which there is no more than one, and the elements, although four, nevertheless are different in no way either from heaven or from that regulate site which holds them commonly together, and consequently that the matter of heaven and the elements is the same, and thus subject to generation and corruption and to all forms of mutation, heaven not being other than a space, so to speak, spherical, full of matter of the same shape, tenuous and airy, in which the earth and the other planets move, save for the sun, which is not a planet, but the center of all that corporeal and spherical space (immobile at that place, but mobile in that place) around which

> sun, as around their proper center, with different periods (displaying an indescribable harmony and wisest distribution of things, created by the supreme Architect) move all the globes of the planets and of the fixed stars in the aforementioned space which I call heaven. . . .[40]

This polemic against the common notions concerning the heavens concluded with the expected denial of a fifth, heavenly element, corresponding "to the fifth body or regular solid of mathematicians."[41] Once again Foscarini associated the qualities of inalterability and incorruptibility, "promiscuously" attributed by the Aristotelians to the physical heaven, with the Empyrean, a body of a supreme and different nature from all other bodies and devoid of all sensible, physical qualities. As in the Lettera, the spiritual heaven (Empyrean) was sharply distinguished from the physical heaven, which is mutable, as the appearance of comets and other unspecified "impressions and spectacles" demonstrate.[42]

These contradictions of Aristotle and the "common philosophy" reveal the true way to teach the method and manner of reasoning. Philosophy must not adhere to the teachings of any one author and school but must investigate the "naked truth" wherever that investigation leads.[43]

After this general treatment of the elements and their qualities, Foscarini planned to move on to an

appraisal of the various cosmic schemes, "rejecting everything in them which seems to me less probable, and approving the parts of them which, in my judgment, are more probable."[44] In this contest of cosmic schemes, pride of place would be given to Copernicanism.

When outlining his approach to heliocentrism and geokineticism, Foscarini abandoned his "probabilistic" language and for the first time spoke of those "necessary demonstrations" and physical proofs of Copernicanism requested by Father Grienberger and Cardinal Bellarmine. In speaking of these demonstrations, Foscarini promised that:

> through the Copernican system, and particularly through the mobility of the earth, on which it appears that it principally depends, I will combine a very great number of reasons and arguments, of which I already find I have a sizeable harvest, incluidng many observations made by me; among which are not lacking some reasons of my own invention, which perhaps will have not a little force of demonstration and of necessary argument, together with other likely ones. . . .[45]

Relying upon the popular concept of an ancient theology which had preceded and paralleled the Christian revelation, Foscarini sought to recover likely arguments:

> from the profound allegories hidden in the most ancient fables of the first and oldest poets, from which all philosophy had its beginning, from the oracles of the pagan Gods and from the sybils and from others, from many hieroglyphic messages of the Egyptians, and from many mysterious images and other attributes of the pagan Gods.[46]

Beyond these sources he sought support from many ancient and modern philosophers includings certain Peripatetics, "as was Nicholas Cardinal Cusa [1401-1464], a most excellent mathematician, Celio Calcagnino [1479-1541], a universal man, and Andrea Cesalpino [1519-1603], a modern philosopher, and other worthy authors."[47] All were felt to offer something to bolster the new cosmology, as all had argued, in some way, for a moving earth.[48]

After pillaging the literary, religious and philosophical remains of Western civilization for Copernican arguments, Fsocarini intended to turn to the sensitive and interrelated matters of thexegetical and theological problems surrounding the acceptance of Coeprnicanism. He planned to treat in a more extensive manner the scriptural mysteries which lend themselves to a Copernican interpretation and the many authorities who had touched on these matters, "among them. . .that sent to me by Your Lordship [Galileo] on Job, Ch. 9, interpreted by that Augustinian Father Diego Astunica [Didacus à Stunica, Diego de Zuñiga] of Salamanca."[49] Next he would treat the rules for interpreting Scriptures:

> when reasoning or factual evidence persuade one of the opposite of what the authority appears to indicate in the outward appearance of the words, and for what reason new opinions in learned and philosophical matters which do not transcend

> natural limits and which depend entirely on the senses, but [which] are contrary to the authorities in matters pertaining to the Faith, ever ought to be followed more quickly and adhered to.[50]

The reference to Foscarini's recent acquaintance with Zuñiga's pro-Copernican commentary is sufficient evidence to disprove Caroti's recent suggestion that the letter to Galileo could have pre-dated the printed Lettera.[51] If Foscarini had known of Zuñiga's work surely he would have employed it to strengthen his own case as presented in the Lettera and the Defensio. As Zuñiga's name does not appear in either work, this letter must be dated after the Lettera and the Defensio, that is in the period between the spring of 1615 and the Condemnation of March 1616.

In conclusion, Foscarini fearlessly planned to issue the same warning to the Church that was contained in the Defensio. He hoped to deal with the risk to the "sacrosanct authority of the Vicar of Christ to decide and determine whether something is of the Faith or not in natural matters and those dependent upon the senses" when time may eventually decide the contrary.[52] All of the same themes and ideas which had previously appeared in the Lettera and the Defensio were to reappear in this ambitious dispute in favor of Copernicus.

The second part of the letter is by far the more intriguing. Foscarini there raised questions and

proposed answers which were all related to an acceptance of the earth's motion as a physical reality. The first area touched upon in this section of the epistle was that of meteorology and the phenomenon of the winds.

The phenomenon of the winds and the apparent lack of a tremendously strong east wind, supposedly required by an axial rotation of the earth from West to East, was raised continually by critics of Coeprnicus.[53] Foscarini turned to the winds and, in particular, to the Trade Winds in order to answer implicitly this criticism and in order to demonstrate explicitly the earth's mobility.

The Trade Winds which blow steadily from the east in the Tropics, i.e. in the "Torrid Zone," have been called by one student of early modern metereology "the most important discovery made by the early explorers" of the Renaissance.[54] Citing the Relazioni universali (first ed., Rome: 1591-1595) of the seicento cosmographer and political thinker Giovanni Botero (1544-1617)[55] as his authority on this matter, Foscarini attempted to incorporate the Trade Winds into a geokinetic cosmology. Against the contemporary Aristotelian explanation that the Trade Winds were caused by the motion of the primum mobile from east to west which is transmitted down to the sphere of the

air, Foscarini offered a new explanation.[56] He argued that he could "demonstratively prove" that the Trade Winds were not due to the rapid motion of the primum mobile but rather to the motion of the earth. His theory ran as follows:

> I have adjudged that the accident of the perpetual easterly wind under the equinoctial line [equator] is nothing other than a certain amount of resistance of the air to the motion of the earth which. . .moves itself from West to East, making night and day. And that this may be the truth, it is observed that the said wind as much as it is removed from the equinoctial line, so much is it weakened, and finally below the tropics and other minor circles it is divided into various portions, which is impossible unless the phenomenon is due to the impetus [force] of the air that resists it [the motion of the earth] and therefore in some manner goes against the motion of the earth. One notices more [force of the air]: for the earth makes a greater impetus in the major circles [of latitude] than in the minor ones, because of the greater space passed through in the major than in the minor circles. Therefore it is not a surprise that under the equinoctial circle there is perceived such a uniform and perpetual wind, the more so where the impediments of islands, mountains, reefs, valleys, canals, promontaries and similar things, which elsewhere cause the same wind to be in various ways broken and ragged and. . .thus not of such force and vigor.[57]

This theory was both an attempt to supply that east wind demanded by the critics of Copernicus and an attempt to supply a physical proof for Copernicus' theory.

Such a theory of the Trade Winds bears a striking resemblance to that presented by Galileo. The first version of this theory was formulated by Galileo while

in Rome in the winter of 1615-1616[58] and was then incorporated in the Dialogo of 1632. In the Fourth Day of the Dialogo, Galileo placed in the mouth of his spokesman Salviati the idea that the air, being more tenuous and fluid than the earth, seems to have no need to follow the earth's motion "except in so far as the roughness of the terrestrial surface catches and carries along with it that part of the air which is contiguous to it, or does not exceed by any great distance the greatest altitude of the mountains."[59] However:

> where the cause for motion is lacking-that is, where the earth's surface has large flat spaces and where there would be less admixture of earthy vapors-the reason for the surrounding air to obey entirely the seizure of the terrestrial rotation would be partly removed. Hence, while the earth is revolving toward the east, a beating wind blowing from east to west ought to be continually felt in such places, and this blowing should be most perceptible where the earth whirls most rapidly; this would be in the places most distant from the poles and closest to the great circle of the diurnal rotation.[60]

This "philosophical argument" is confirmed, according to Galileo, by the actual experiences of voyagers and sailors who have discovered an east wind where such a theory of the earth's rotation requires it to be.

Both theories of the Trade Winds were primitive attempts at an understanding. Neither mentioned nor explained facts about the wind currents known to European sailors and commented on by a number of

writers, for example, that the Trade Wind in the northern hemisphere does not blow from the east but from the northeast and that the equator is a belt of calms, known as the "doldrums," rather than a belt of the strongest winds.[61] In addition, neither theory incorporated those concepts of differing atmospheric pressures and levels of atmospheric heat which were to be such important parts of later, more accurate theories formulated by scientists such as Edmund Halley (c. 1656-1743) and Edmé Mariotte (d. 1684).[62] Unsatisfactory though they were, Foscarini's and Galileo's theories of the Trade Winds were significant as first attempts to meld the mass of new meteorological observations with the acceptance of the axial rotation of the earth, the latter being one of the pieces of the puzzle of terrestrial wind currents.[63]

Foscarini's next step in this section of his letter was to unload on Galileo certain doubts and questions concerning the impact of the motion of the earth on the four traditional elements (earth, water, air, fire) and their respective spheres. His first question dealt with the existence of the sphere of fire, a conception earlier denied by Copernicus in the De revolutionibus[64]:

First, I doubt that there is any need to concede

> the sphere of fire: since it does not appear to me very reasonable that the said sphere has either a daily or an annual motion; for the reason that. . .in a short time it [the sphere of fire] would be obliged to pass through such immense spaces that the imagination can scarcely comprehend them and as the sphere of fire is so tenuous and dispersible, it would be impossible, because of its rare nature and scant resistance, to maintain itself in its spherical consistency. . . .[65]

If one did not accept the idea that the aggregate of the elements move themselves with the motion of the earth, because the sphere of fire is not accepted, then the globe of the earth and the water moves as a perfectly united sphere [the terraqueous sphere]. This option, if accepted, led Foscarini to make some fascinating adjustments to the traditional cosmological scheme as far as it related to the elemental spheres.

Postulating that the earth and the water move themselves as one united whole, Foscarini raised the question whether "the air will not be the element which itself moves with the motion of earth and water, but will be that immovable body in which the motion of the earth and water is itself received over immense spaces. . . ."[66] This view led Foscarini to a dual conception of the air:

> it appears to me more reasonable that the element of fire is not placed over that of air, and that the air must be put above and below, below as an elemental sphere and above as the immovable and all-encompassing body surrounding all the planetary bodies and stars, together with their motions.[67]

Here Foscarini was groping in new directions towards the conception of the "air" as, on the one hand, the atmosphere and of the "air", on the other hand, as an immovable and all-encompassing body in which all celestial bodies move, i.e. space. This conception of space appears identical to that proposed by Gianfrancesco Pico della Mirandola, one of Foscarini's favorite authorities, and he may simply have adopted it from the works of Pico.[68]

These speculations concerning the nature of air led to the expression of doubts concerning certain meteorological phenomena and their relationship to the motion of the earth. If we accept the latter sense of the air as the immovable container and we accept the daily rotation of the earth every twenty-four hours, called after Copernicus the "nictimerino" motion, then the velocity of the earth must be so great that it does not appear possible that it could be insensible.[69] Furthermore, "the clouds, which are not moving themselves by the same motion, if we do not also wish that the air near to us moves itself together with the earth by the self-same motion, should be required to give a sign of it [the earth's rotation]. . . .[Yet] this is not seen."[70]

However, if we argue that the air, containing the clouds, moves itself by the same rotational motion of

the earth, why then don't the clouds, as well, move by that motion. If we aduce as a reason the wind, then we should say that the force of the natural motion of the air plus the earth is greater than that of any wind because the circumference of the air is larger than that of the earth. Indeed, if the earth moves, in Foscarini's estimation, at a speed of 800 miles per hour or more, the air will move at perhaps 1500 miles per hour, a speed no wind can match.[71] Foscarini attempted, in fact, to demonstrate that the air is not itself moved by the motion of the earth by pointing once again to Botero's observation of the uniformity of the "levantine wind" (Trade Wind) in the Pacific Ocean and by explaining this observation as a spot of resistance which the surrounding air makes to the extremely fast motion of the earth.[72]

Once again, Foscarini raised the problem of the apparent "insensibility" of the earth's motion in terms of the atmosphere and the clouds. He was sure that Galileo would supply a solution to all these problems.

Notes

1. S. Drake, ed. and trans., Discoveries and Opinions of Galileo (Garden City: 1957), 162-163. U. Baldini has argued, in "L'astronomia del cardinale Bellarmino," in Novita celesti e crisi del sapere, ed. P. Galluzzi (Florence: 1984), 295-296 and n. 18, that Bellarmine knew that Copernicus held his thory to be physically true. Indeed, Baldini argues that the usual interpretation of this passage is erroneous and he contends that, according to the rules of Italian syntax, it would be more natural to relate the words "as I have always believed" to the antecedent assolutamente and not ex suppositione. On this matter also see U. Baldini and G.V. Coyne, S.J., eds., The Louvain Lectures (Lectiones Lovanienses) of Bellarmine and the Autograph Copy of his 1616 Declaration to Galileo (Vatican City: 1984), 29, n. 19.

However, as astute a reader and writer of seventeenth-century Italian as Galileo took this passage to be expressing Bellarmine's belief that Copernicus did not hold his theory to be physically true. In his notes on Bellarmine's letter to Foscarini, Galileo presented a sustained discussion to prove that Copernicus did beleive in the truth of heliocentrism and terrestrial mobility. Galileo Galilei, Opere, ed. A. Favaro (Florence: 1929-1939), 5:354-363, the partial translation in S. Drake, Discoveries and Opinions, 167-168 and the commentary in W.A. Wallace, Galileo and His Sources: The Heritage of the Collegio Romano in Galileo's Science (Princeton: 1984), 293-294.

2. S. Drake, Discoveries and Opinions, 163.

3. S. Drake, Discoveries and Opinions, 163. Bellarmine's position was very similar to that adopted by Thomas Aquinas. In Aquinas' De caelo, he asserted that "even a system that saved the astronomical appearances might not be physically real." E. Grant, "Eccentrics and epicycles in medieval cosmology," in Mathematics and its applications to science and natural philosophy in the Middle Ages: Essays in honor of Marshall Clagett, ed. E. Grant and J.E. Murdoch (Cambridge: 1987), 192.

4. S. Drake, Discoveries and Opinions, 158-160.

5. S. Drake, Discoveries and Opinions, 163.

6. Galileo Galilei, Opere, ed. A. Favaro, 5:367. The

text reads as follows: "1°. Il Copernico pone gli eccentrici e gli epicicli; ne questi sono stati cagione di rifutare il sistema Tolomaico (essendo loro indubitamente in cielo), ma altre essorbitanze." For a translation of this passage, which omits Galileo's assertion concerning the "reality" of epicycles and eccentrics, see S. Drake, Discoveries and Opinions, 168.

A. Carugo and A.C. Crombie, "The Jesuits and Galileo's Ideas of Science and Nature," Annali dell'Istituto e Museo di Storia della Scienza di Firenze 8(1983):22-23, see in Galileo's assertion of the "reality" of epicycles and eccentrics the influence of Clavius and his "realist" position concerning planetary models. However, Clavius' position was not equivalent to that of Galileo. Whereas Clavius seems to have believed in the physical reality of epicyclic orbs to which the planets were attached, Galileo, in his notes on Bellarmine's letter, specifically denied this idea. Such a denial on the part of Galileo went back at least to 1612. What Galileo meant by the "reality" of epicycles and eccentrics was that the planetary bodies actually followed these paths in the heavens. Galileo Galilei, Opere, ed. A. Favaro, 5:360 and S. Drake, Galileo At Work: His Scientific Biography (Chicago: 1978), 188-189.

7. S. Drake, Discoveries and Opinions, 163.

8. S. Drake, Discoveries and Opinions, 163.

9. S. Drake, Discoveries and Opinions, 163.

10. J.J. Langford, Galileo, Science and the Church (Ann Arbor: 1971), 62-63. Bellarmine appears to have been ignorant of the Commentary on Job by Zuñiga.

11. S. Drake, Discoveries and Opinions, 163 and Galileo Galilei, Opere, ed. A. Favaro, 12:172 for the Latin terms used by Bellarmine.

12. S. Drake, Discoveries and Opinions, 163.

13. This point was well made by A.M. Dubarle, O.P., "Les principes exégétiques et théologiques de Galilée concernant la science de la nature," Revue des sciences philosophiques et théologiques 50(1966):76.

14. J.J. Langford, Galileo, Science and the Church, 63 and J. Brodrick, S.J., The Life and Work of Blessed Robert Francis Cardinal Bellarmine, S.J. 1542-1621

(London: 1928), 2:336, n. 2.

15. This passage is from Bellarmine's Prima controversia generalis de concilis, et ecclesia militante and the Latin text can be found in U. Baldini and G. Coyne, S.J., eds., The Lovain Lectures, 40, n. 92. Bellarmine here adhered to what has been called the "Theory of Dictation" of the Bible. This theory became an important one among Catholics during the sixteenth and seventeenth centuries. R.F. Smith, S.J., "Inspiration and Inerrancy," in The Jerome Biblical Commentary, ed. R.E. Brown, S.S., J.A. Fitzmyer, S.J. and R.E. Murphy, O. Carm. (Englewood Cliffs: 1968), 2:505 and B. Vawter, Biblical Inspiration (Philadelphia: 1972), 58-63.

16. U. Baldini and G. Coyne, S.J., The Louvain Lectures, 40, n. 92.

17. S. Drake, Discoveries and Opinions, 163-164.

18. Letter of Piero Dini to Galileo, March 7, 1615. Galileo Galilei, Opere, ed. A. Favaro, 12:151-152 and S. Drake, Discoveries and Opinions, 160. Grienberger thought the Copernican arguments were more "plausible" than true.

19. S. Drake, Discoveries and Opinions, 164.

20. S. Drake, Discoveries and Opinions, 164.

21. S. Drake, Discoveries and Opinions, 164.

22. U. Baldini, "L'astronomia del cardinale Bellarmino," 303. This point is demonstrated further by the contrast drawn between Pererius and Bellarmine in U. Baldini and G. Coyne, S.J., eds., The Louvain Lectures, 46, n. 103.

23. Galileo Galilei, Opere, ed. A. Favaro, 12:163.

24. Galileo Galilei, Opere, ed. A. Favaro, 12:173.

25. Galileo Galilei, Opere, ed. A. Favaro, 12:175.

26. L. von Pastor, The History of the Popes from the Close of the Middle Ages, trans. and ed. Dom E. Graf, O.S.B. (London: 1952), 25:320-321 and n. 1. Pastor remarked that this source exaggerated the influence of Millini.

27. Galileo Galilei, Opere, ed. A. Favaro, 12:180. This is the position of S. Drake, Galileo At Work, 250.

28. Galileo Galilei, Opere, ed. A. Favaro, 12: 189.

29. Galileo Galilei, Opere, ed. A. Favaro, 12:190: "nè il primo autore, nè la Lettera del Padre, nè l'opinion stessa (stando con la debita cautela), correranno alcun pericolo."

30. Galileo Galilei, Opere, ed. A. Favaro, 12:190: "Cautela necessaria sarà, sino che detto Padre habbia compita la sua fatiga, che sarà pieno e diffuso trattato in lingua latina, usar silentio qui, non trattando più oltre di questa opinione, e altrove ancora trattarne poco, per non stuzzicare in quest' interim la passione de' potentissimi Peripatetici; e trattandosene da altri in qualunque modo, dir che non si tratta della verità e realtà d'essa, ma, lasciandosi da parte e sottoponendola al giudicio de'superiori, si usa solo ex hypothesi, per salvar più commodamente e semplicemente tutte le apparenze, come già fece l'autor primo: in somma non contrastar della verità d'essa, nè dir di tenerla per vera."

31. Galileo Galilei, Opere, ed. A. Favaro, 12:190.

32. D. Berti, "Antecedenti al processo galileiano e alla condanna della dottrina copernican," Atti della R. Accademia del Lincei, 279, serie terza, Memorie della classe di scienze morali, storiche e filologiche 10(1881-1882):57, n. 3; 66; 92-96.

33. Galileo Galilei, Opere, ed. A. Favaro, 12:215-220.

34. E. Wohlwill, Galelei und sein Kampf für die Copernicanische Lehre (Wiesbaden: 1969), 1:568, n. 2.

35. Galileo Galilei, Opere, A. Favaro, 12:215.

36. Galileo Galilei, Opere, ed. A. Favaro, 12:215: "Dovendo io scrivere il mio parere in questa opinione con quella debita circospettione che si conviene, non mi pare bene ch'io per hora mostri esser talmente inclinato a quella, che altri giudichi ch'io faccia (per modo di dire) prevenire l'atto della volonta a quello dell'intelletto; e potendo vestirmi in qualche guisa in questa controversia l'habito di giudice, non devo vestirmi quello della parte."

37. Galileo Galilei, Opere, ed. A. Favaro, 12:215: ".

. .l'opra mia sia una disputa overo discussione, nella quale, ordinamente procedendo, io incominci da principio a separare le cose più certe et ammesse da tutti dalle più incerte et controverse, dico fra Tolomaici et Copernicani, over Peripatetici e Pittagorici; et venendo all'opinione Copernicana, io distingua in quella ciò ch'e più probabile da quello che pare meno probabile, e questo in tutte quelle materie (o siano filosofiche o astronomiche) le quali si veggono essere antecedenti o consequenti o concomitanti o che habbiano qual si sia connessione con lo stabilimento del sistema mondano."

38. J.D. Moss, "The Rhetoric of Proof in Galileo's Writings on the Copernican System," in The Galileo Affair: A Meeting of Faith and Science, ed. G.V. Coyne, S.J., M. Heller, and J. Życiński (Vatican City: 1985), 58.

39. Galileo Galilei, Opere, ed. A. Favaro, 12:215.

40. Galileo Galilei, Opere, ed. A. Favaro, 12:215: "Nelle qualli discussioni dovendosi stabilire (sì come è il vero, quantumque contradica alla setta de' Peripatetici), che le parti integrali del mondo non sono altro che il cielo, il quale non è più che uno, et gl'elementi, quantumque siano quattro, nondimeno nè in tutto dal cielo differenti nè con quel sito disposti che comunemente si tiene, è per consequenza che la materia del cielo et de gl'elementi e l'istessa, e cosi soggetta alla generattione et corrottione et ad ogni mutatione l'una come l'altra, non essendo altro il cielo che un spatio, per dir cosi, sferico, pieno di corpo dell'istessa figura, tenue et aereo, nel quale si muovono la terra et gl'altri pianeti, levato il sole, il quale non è pianeta, ma è il centro (immobile ad locum, ma mobile in loco) di tutto questo spatio corporeo e sferico, attorno il quale sole, come intorno a proprio centro, con varii periodi si muovono (esplicando una indicible harmonia e sapientissima distributione delle cose, fatta dal sommo Architetto) tutti i globi de'pianeti e delle stelle fisse nel predetto spacio che chiamiamo cielo. . . ."

This praise of God, the supreme Architect, parallels that in the Meditationes, preces, et exercita quotidiana (Cosenza: 1611), 145, where Foscarini spoke of God as the "Most Powerful, Wisest, and Best Architect. . .who made the universe in Number, Weight, and Measure. . . ." In the original text this passage reads as follows: "Cogitabis huius admirandae universi fabricae, tanta variarum rerum concinnitate praeditae,

Potetissimum, Sapientissimum, Optimum esse Architectum, qui omnia in Numero, Pondere, ac Mensura constituit. . . .

41. Galileo Galilei, Opere, ed. A. Favaro, 12:215-216: ". . .corrispondente al quinto corpo o figura regolare de'matematici. . . ." For discussions of the Pythagorean-Platonic tradition associating the material elements with the regular solids of mathematics, see S.K. Heninger, Jr., Touches of Sweet Harmony: Pythagorean Cosmology and Renaissance Poetics (San Marino: 1974), 107-111 and the more detailed treatment of J.V. Field, Kepler's Geometrical Cosmology (Chicago: 1988), 1-16.

42. Galileo Galilei, Opere, ed. A. Favaro, 12:216.

43. Galileo Galilei, Opere, ed. A. Favaro, 12:216. Once again, Foscarini expressed a common theme of seventeenth-century science. P. Dear, "Totius in verba: Rhetoric and Authority in the Early Royal Society," Isis 76(1985):149-151.

44. Galileo Galilei, Opere, ed. A. Favaro, 12:216: ". . .riprovando ciascuna in ciò che mi parerà meno probabile, et approvando la parte di lei che sarà più, a mio giuditio, verisimile."

45. Galileo Galilei, Opere, ed. A. Favaro, 12:216: ". . .per il sistema Copernicano, e particolarmente per la mobilità della terra, dalle quale pare ch'egli principalmente dependa, adduro una grandissima selva di ragioni e argomenti, che gia me ne trovo havere raccolti non pochi, includendovi molte osservazioni fatte da me, tra'quali non manchera alcuna ragione di mia inventione, che forsi havra non piccola forza di demonstrazione et di argomento necessario. . . ."

46. Galileo Galilei, Opere, ed. A. Favaro, 12:216: ". . .dalle allegorie profundamente nascoste nell'antichissime favole de'primi et più vecchi poeti, da'quali ogni filosofia hebbe principio, da oracoli di Dei gentili e di sibille e di altri, da molte note ieroglifiche de gl'Egittii, da molte imagini misteriose et altri attributi di Dei gentili. . . ." According to the notice by the printer Andreas Ricci, added to the end of the Meditationes, 228, Foscarini, as early as 1611, was working on a large tome entitled the De oraculis antiquis deorum gentilium, et sibyllarum. Unfortunately, the work was never printed. This work appears to have been completed by 1615. P. Foscarini,

Lettera. . .sopra l'opinione de' Pittagorici e del Copernico della mobilita della terra e stabilita del sole (Naples: 1615), 64; T. Salusbury, Mathematical collections and translations: the first tome (London: 1661), 503.

The best introduction to the idea of an "ancient theology" in the Renaissance is the introductory section in D.P. Walker, The Ancient Theology (London: 1972), 1-21.

47. Galileo Galilei, Opere, ed. A. Favaro, 12:216: ". . .come furono Nicolo Cardinal Cusano, excellentissimo mathematico, Celio Calcagnino, huomo universale, et Andrea Cesalpino, moderno filosofo, et altri degni auttori."

48. J.L.E. Dreyer, A History of Astronomy from Thales to Kepler, ed. W.H. Stahl (New York: 1953), 282-288, 292-293; A. Koyre, From the Closed World to the Infinite Universe (Baltimore: 1976), 5-24 and E. Grant, "In Defense of the Earth's Centrality and Immobility: Scholastic Reaction to Copernicanism in the Seventeenth Century," Transactions of the American Philosophical Society 74(1984):6-8 offer analyses of these three thinkers. All of these men argued against the immobility of the earth, although none of them proposed the Copernican theory of the earth's motions. Calcagnini came closest to the Copernican position by postulating an axial rotation of the earth. This position first appeared in print in Calcagnini's works of 1544.

49. Galileo Galilei, Opere, ed. A. Favaro, 12:216: ". . .fra la quali. . .quella di V.S. mandatami, di Iob al cap. 9, interpretata da quel Padre Agostiniano Diego Astunica di Salamanca. . . ."

50. Galileo Galilei, Opere, ed. A. Favaro, 12:216-217: ". . .quando le ragioni o l'evidenza del fatto ci persuadono l'opposito di quello che pare che l'autorità accenni nella scorza delle parole, e per qual cagione le opinioni nuove nelle cose dottrinali e filosofiche che non transcendono i limiti naturali et dependono in tutto dal senso, ma per contrario le vecchie nelle cose appartenenti alla Fede, sempre si deono più tosto seguire et abbracciare. . . ."

51. S. Caroti, "Un sostenitore napoletano della mobilità della terra: il padre Paolo Antonio Foscarini," in Galileo e Napoli, ed. F. Lomonaco and M. Torrini (Naples: 1987), 109, states that there is

insufficient evidence to work out the chronological relationship between the printed Lettera and the letter to Galileo. Also, Caroti argues that whereas the letter to Galileo seems full of real doubts about the Copernican system, the Lettera reveals Foscarini as a true adherent of the new system. His essay reveals a tendency to see Foscarini moving in a progressive direction from the letter to Galileo to the Lettera, which he sees as Foscarini's most mature statement on the subject of Copernicanism. For more discussion of this matter, see Chapter Five below.

52. Galileo Galilei, Opere, ed. A. Favaro, 12:217: ". . .del pericolo che puro apprtare autorita sacrosancta del Vicario di Christo il decidere et determinare, alcuna cosa essere di Fede o no, in materia naturale et dependente dal senso. . . ."

53. E. Grant, "In Defense of the Earth's Centrality and Immobility," 35. Even as sympathetic a reader of Copernicus as Zuñiga raised the evidence of the winds against the physical truth of Copernicanism in his Philosophiae prima pars (Toledo: 1597), Book 4, Ch. 5, 230.

54. H.L. Burstyn, "Theories of Winds and Ocean Currents from the Discoveries to the End of the Seventeenth Century," Terrae Incognitae 3(1971):15.

55. On Botero and his work see D. Lach, Asia in the Making of Europe, Vol. II (Chicago: 1977), 2:235-249.

56. H. Burstyn, "Theories of Winds," 7-13 and S.K. Heninger, Jr., Handbook of Renaissance Meteorology (Durham, NC: 1960), 3-15 and 107-108 contain discussions of earlier theories on the formation and motion of the winds.

57. Galileo Galilei, Opere, ed. A. Favaro, 12:217-218: ". . .ho giudicato questo accidente, di vento perpetuo orientale sotto la linea equinottiale, non essere altro che un poco di ristenza dell'aere, che fa egli incontra il moto della terra, la quale,. . ., si muove dall'occidente all'oriente, facendo la notte et il giorno. Et che ciò sia il vero, si è osservato, il detto vento quanto più s'allontana dalla linea equinottiale, tanto più esser debile, e finalmente sotto i tropici et altri minor circoli dividersi in varie difformità; il che non per altro si deve credere avenire, se non perche l'impeto dell'aere che resiste, e percio in alcun modo va incontro al moto della terra,

la si scorge piu, ove parimente la terra fa maggiore impeto all'incontro di lui: hor la terra maggiore impeto fa ne'circoli maggiori che ne i minori, percio che maggior spazio passa ne i circoli maggiori che ne i minori: percio dunque non è maraviglia che sotto il circulo equinottiale si scorga tale vento uniforme et perpetuo, tanto più ove cessano gl'impedimenti d'isole, monti, scogli, valli, canali, promontorii et simili cose, le quali in altre parti fanno in varii modi spezzarsi et ragirarsi il detto vento, il quale,. . ., fare altrove minori circoli, non ha tanta forza ne vigore."

58. S. Drake, Galileo At Work, 252.

59. Galileo Galilei, Dialogue Concerning the Two Chief World Systems, trans. S. Drake (Berkeley: 1967), 439.

60. Galileo Galilei, Dialogue Concerning the Two Chief World Systems, 439-440. S. Caroti, "Un sostenitore napoletano della mobilità della terra," 97, thinks that Galileo was returning, in this portion of the Dialogo, to the arguments presented in Foscarini's letter.

61. H. Burstyn, "Theories of Winds," 16-17 and W.R. Shea, Galileo's Intellectual Revolution: Middle Period, 1610-1632 (New York: 1977), 88 and 188, n. 27. Burstyn and Shea both point to the inadequacies of Galileo's theory and how Galileo had been informed of the existence of the doldrums in a letter of February 1, 1630.

62. A. Wolf, A History of Science, Technology and Philosophy in the 16th and 17th Centuries (Gloucester, MA: 1968), 1:316-320.

63. L. Watson, Heaven's Breath: A Natural History of the Winds (New York: 1984), 27-29 and 42 offers a lucid analysis of wind currents and the role of the axial rotation of the earth.

64. N. Copernicus, On the Revolutions, ed. J. Dobrzycki, trans. and comm. E. Rosen (Baltimore: 1978), Book 1, Chapter 8, 17 and the commentary on 363. N.G. Siraisi in her Avicenna in Renaissance Italy: The "Canon" and Medical Teaching in Italian Universities after 1500 (Princeton: 1987), 256-257 comments that the sixteenth-century scientific thinker Cardano also rejected the sphere of fire.

65. Galileo Galilei, Opere, ed. A. Favaro, 12:218:

"Primieramente, io dubito che non bisogna concedere la sfera del fuoco: percioche non mi pare troppo ragionevole che questa sfera habbia ne il moto nictimerino ne anco l'annua; per ciò che,..., in poco tempo bisognarebbe che passasse tanto immensi spazii che apena l'imaginazione il puo capire, et essendo il fuoco corpo tanto tenue et dissipabile, sarebbe impossibile, per la sua rarità e poca resistenza, mantenersi nella sua consistenza sferica. . . ." Foscarini here abandoned his belief in a separate sphere of fire, a belief he had upheld in his Meditationes, 137.

66. Galileo Galilei, Opere, ed. A. Favaro, 12:218: ". . .l'aere non sara elemento che si muova con il moto della terra et dell'acqua, ma sara quel corpo continente ne quale si recivera per immensi spazii il moto dell terra e dell'acqua. . . ."

67. Galileo Galilei, Opere, ed. A. Favaro, 12:218: ". . .il che mi pare più raggionevole che non e porre sopra l'aere l'elemento del fuoco, et fare ch'esso fuoco disopra e disotto habbia aere, disotto come sfera elementare, et di sopra come corpo continente et universalmente ambiente tutti i corpi planetarii et stellari, insieme con i moti loro."

68. C.B. Schmitt, Gianfrancesco Pico della Mirandola (1469-1533) and his Critique of Aristotle (The Hague: 1967), 138-144. Schmitt demonstrates how Pico's conception of space is reflected in the writings of later sixteenth and seventeenth-century Italian natural philosophers, such as Telesio, Bruno and Campanella.

69. Galileo Galilei, Opere, ed. A. Favaro, 12:218, 219. Copernicus named the axial rotation of the earth the nuchtemeron motion in On the Revolutions, Book 1, Chapter 4, 10.

70. Galileo Galilei, Opere, ed. A. Favaro, 12:218: ". . .le nubi, le quali non si muovono dell'istesso moto, se non vogliamo che anco l'aere vicino a noi si muova insieme dell'istesso moto con la terra, ne dovrebbono dare indicio,. . ., il che non si vede."

71. Galileo Galilei, Opere, ed. A. Favaro, 12:219. Modern estimates of the speed of a surface particle on the earth are 1040 miles per hour at the equator and 800 miles per hour at 40° latitude. S. P. Wyatt, Principles of Astronomy (Boston: 1964), 34-35.

72. Galileo Galilei, Opere, ed. A. Favaro, 12:219.

CHAPTER FIVE: THE CONDEMNATION OF 1616 AND THE STATUS OF THE COPERNICAN THEORY

The answers to Foscarini's questions never materialized. Galileo's personal campaign in Rome at the end of 1615 for the new cosmology and his planned trip to Naples to consult with Foscarini were both cut short by the actions of the Church in early 1616.[1] On Wednesday, February 24, the theological consultors of the Holy Office officially censured two Copernican propositions. The first proposition, that "the sun is the center of the world and completely immovable by local motion," was declared to be "foolish and absurd in philosophy and formally heretical...." The second proposition, that the earth is not the center of the world, nor immovable, but moves according to the whole of itself, and also with a diurnal motion," was declared to be philosophically foolish and absurd and "from a theological standpoint, . . . at least erroneous in the faith."[2]

The distinction between the two condemned propositions was based on contemporary Catholic theology. The first proposition was condemned as one directly contrary to the faith and the Sacred Scriptures. The second proposition was seen as opposing a doctrine of the faith according to the consensus of learned theologians, in that it opposed

the first ruling on the position and motion of the sun. The official decision of February 24 placed a more severe censure on the proposition concerning the position and motion of the sun than on that concerning the position and motion of the earth and based the censure of the latter proposition on that of the former.[3] The arguments presented by Foscarini in his Lettera and his Defensio, as well as those of Galileo, especially in his Lettera a Madama Cristina, came to naught.

In March 1616 the Congregation of the Index issued its famous decree suspending Copernicus' De revolutionibus and Zuñiga's Job commentary until corrected. At the same time, it condemned absolutely the Lettera of Foscarini and all other books which were of a similar nature. This distinction between Copernicus and Zuñiga on the one hand and Foscarini on the other has been explained in two different ways.

Both Giorgio de Santillana and Stillman Drake have argued that the difference rested on a distinction between those works which dealt with Copernicanism as a scientific theory and those which dealt with the theological interpretations of the new cosmology. Copernicus and Zuñiga, according to this argument, were seen by the ecclesiastical officials in 1616 as supporting the scientific theory of heliocentrism while

Foscarini was viewed as asserting the more dangerous thesis of the reconciliation of heliocentrism with the Bible.[4]

The view of de Santillana and Drake seems to be contrary to the very words of the condemnatory decree of 1616. Foscarini's Lettera was condemned for attempting:

> to show that the doctrine of the immobility of the sun in the center of the world, and that of the earth's motion, is consonant with the truth and is not opposed to Holy Scripture. Therefore...[the Sacred Congregation] decrees that...the book of the Carmelite Father, Paolo Antonio Foscarini, be prohibited and condemned, and that all other books likewise, in which the same is taught, be prohibited as this decree prohibits, condemns, and suspends them all respectively.[5]

Foscarini's book was described as one which contended that heliocentrism was not only reconciliable with sacred texts but also was "consonant with the truth." The decree went on to condemn and prohibit all other works which argued the same two theses.

The decree of 1616 was actually drawing a distinction between heliocentrism as hypothesis and heliocentrism as fact, a view presented in J.J. Langford's Galileo, Science and the Church. The Church theologians did not feel threatened by heliocentrism presented hypothetically, but they did feel threatened by it if it were presented as a physical reality.[6] Such an interpretation is supported by the fact that

the works of Copernicus and Zuñiga were emended to remove the statements ascribing physical truth to the Copernican theory. These statements were few in number and after such changes both works were seen as innocuous. In the eyes of the theologians of 1616 such an action was impossible with the Lettera as it was a work which had inextricably intertwined the twin themes of Copernicanism as true and reconciliable with Sacred Scriptures.

This view of the decree of 1616 is further substantiated by an examination of the report written for the Congregation of the Index in preparation for the correction decree of Copernicus' De revolutionibus, officially promulgated in 1620. This report was probably written by Boniface Cardinal Caetani, who, in 1616, had helped to protect Copernicus' work from a complete condemnation.[7] This report sponsored a hypothetical reading of Copernicus' theory and made an open appeal to the "fictionalist" theory of planetary models. According to the compiler of the report:

> the subject which Copernicus is dealing with is astronomy, whose most distinctive method is to use false and imaginary principles for saving appearances and celestial phenomena, as is established by the epicycles, eccentrics, equants, apogees, and perigees of the ancients. If certain of Copernicus' passages on the motion of the earth are not hypothetical, make them hypothetical; then they will not be against either the truth or the holy writ. On the contrary, in a certain sense, they will be in agreement with them, on account of

> the false nature of suppositions, which the study ofastronomy is accustomed to use as its special right.[8]

This "fictionalism" stood behind the directions given to Cardinal Bellarmine on February 25, 1616 to order Galileo not to "teach or defend" the Copernican theory. Such an order was officially delivered by Bellarmine to Galileo on the following day.[9] According to Baldini's research into the writings of Father Grienberger and the circle of the Collegio Romano, this order was understood by Bellarmine and his fellow Jesuits as prohibiting the defense of the Copernican system in its physical aspect and as prohibiting the treatment of it in order to prove its veracity.[10]

The Church theologians of 1616 drew a sharp contrast between the "realism" of Foscarini and the "fictionalism" of Caetani. Yet, certain modern authors have seen this contrast as based on a misreading of Foscarini's intentions and his text. A. Franco, in 1911, contended that Foscarini was only arguing for Copernicanism as an "opinion" and ex suppositione (hypothetically), not absolute (unconditionally).[11] Such an idea has reappeared in the recent essays of Basile, Caroti and Westman.

Basile and Caroti see Foscarini as arguing in an equivocal manner on the Copernican issue, both perceiving an epistemological gap on this issue between

Foscarini's defense of Copernicanism as an "opinion" and Galileo's defense of it as "truth."[12] Basile has even gone so far as to put forth the thesis that the critique of Bellarmine's "fictionalism" found in Galileo's notes on the Cardinal's letter to Foscarini (the Considerazione circa l'opinione Copernicana) was a "rebellion against the equivocal terminology of Foscarini" as well.[13]

Westman has presented a nuanced interpretation in which he has related Foscarini's view of Copernicanism to the different levels of certainty developed by early modern philosophers. Westman views Foscarini as asserting that Copernicanism can claim at best "moral certainty," a level of certainty appropriate to opinionative knowledge and the world of the contingent. Consequently, in the eyes of Foscarini, the heliocentric theory could not claim the higher levels of certainty associated with the demonstrative knowledge of theology, metaphysics and the mathematical sciences.[14] If these interpretations of Foscarini are accepted, must he be separated from that quest for objective certainty and physical reality which was such an important part of the Scientific Revolution of the sixteenth and seventeenth centuries?[15]

There is a good deal of evidence to support the "probabilistic" interpretation of Foscarini's

utterances on the new astronomy. In his printed Lettera, in his theological Defensio, and in his private epistle to Galileo, Foscarini consistently referred to geokineticism as the opinion of the Pythagoreans and Copernicus. It is also true that in the Lettera, Foscarini never once applied the simple term "vero" (true) to the Copernican system. Instead, he utilized the equivocal terms of "ragionevole" (reasonable), "verisimile" and "molto verisimile" (likely and most likely) and "probabile" (probable). In the context of late Renaissance philosophy and science, terms such as "verisimile" and "probabile" implied such different meanings as approval by respected authorities or support by some degree of external evidence.[16]

At the beginning of his defense of Copernicus, Foscarini labelled the new astronomy as an opinion favored with much probability, although it is opposed to traditional physical ideas and many authorities of Sacred Scriptures.[17] After cataloguing the telescopic discoveries of Galileo, Foscarini argued that these discoveries led to the inference that the sun stands motionless in the center of the universe with all of the celestial bodies, including the earth, revolving around it. In this passage of the Lettera, one of the strongest in support of the new cosmology,

Copernicanism is described as carrying, in the Salusbury translation," a great likelihood and probability of Truth" and in the original Italian text as a cosmology carrying "not a little probability and likelihood" ("non piccola probabilitá e verisimilitudine").[18] A study of Foscarini's terminology in the Lettera supports the idea that he used the term "probabile" to signify a contention which rested on a significant evidential base.

In his personal letter to Galileo, Foscarini continued to label Copernicanism as an "opinion." At the very beginning of his letter, he also stated that his new work would no longer retain the essay form but would take the form of a debate or dispute over the respective merits of the two chief world systems, the Ptolemaic and the Copernican, in which Foscarini would distinguish matters "more probable" from those "less probable."

On the other hand, this letter was concerned with supplying Galileo with necessary demonstrations and arguments to prove the truth of the new astronomy and in the letter Foscarini did at one point speak of all of his new cosmological ideas, including heliocentrism and geokineticism, as "true."[19] How is this shift to the language of truth and of proof to be reconciled with the "probabilistic" language of the printed

Lettera and of other sections of the personal correspondence?

For Caroti, who has examined the issue in the most detail, the key to this wavering on the issue of the status of Copernicanism lies in Foscarini's epistemological uncertainty concerning the nature of astronomy as a science. Foscarini, according to Caroti, had originally conceived of astronomy as solely a mathematical science and not as one that dealt with questions of natural philosophy and physical truth. "At the moment of describing real phenomena, the mathematical descriptions of astronomy-functional and practical on the level of a geometrical description of the universe. . .become completely inadequate in evaluations which can be verified by physical truths."[20] Foscarini's views concerning the relationship between mathematics and physics had, according to this interpretation, been formed before the new links forged during the seventeenth-century Scientific Revolution. Consequently, he may have been forced to assume unexpected and improvised positions due to the complications created by the new cosmology.[21]

Caroti's interpretation is plausible; yet, certain doubts remain. In his examination of this issue, Caroti played down what can be called the politics of

Foscarini's discourse and rejected out of hand the thesis that Foscarini was more cautious in his printed work and more decisive in his private correspondence.[22]

The thesis that Foscarini was cautious in his printed Lettera makes a great deal of sense. Foscarini wrote at a time when the Copernican theory was already being openly attacked on scientific and religious grounds. The new cosmology had, before the publication of the Lettera, become the subject of discussion in Carmelite and Neapolitan circles. Such is indicated by Foscarini's mention in the Lettera of an earlier epistle to his General on the subject of Copernicanism and his statement that the Lettera itself was written in answer to the request of Vincenzo Caraffa, a Neapolitan nobleman and future General of the Jesuit Order.[23] Foscarini took pride in the fact that he was the first Catholic to present a printed reconciliation of Copernicanism with the Bible, though he must have been aware that he was travelling on a new and dangerous path.

As a monk and university professor of theology, Foscarini was especially concerned with the religious objections to heliocentrism. His concern with these objections is first revealed near the beginning of the Lettera where he stated that the seeming disagreement between heliocentrism and the Bible was far more

serious than its disagreement with commonly held physical principles, a disagreement which was not at all harmful.[24] This extreme concern with the religious and exegetical objections to the new astronomy appears later in the text of the Lettera and may hold the key to understanding Foscarini's attribution of probability to the Copernican "opinion." Caroti himself sees the probabilistic language of the Lettera as a strategic device adopted by Foscarini.[25]

In his presentation of the approach he would take in reconciling Copernicus and Sacred Scriptures, Foscarini argued that, as two truths never contradict one another, if the Copernican opinion be taken as true a reconciliation with the Bible would be quite possible:

> Being moved by these Reasons, and the probability of the said Opinion, I thought good to try whether Texts of Sacred Scripture might be expounded according to theological and Physical Principles, and might be reconciled to it, so that (in regard that hitherto it hath been held probable) it may in after times, coming without scruple to be acknowledged for true, advance it self, and appear in publick with an uncovered Face, without any mans prohibition, and may lawfully and freely hold a Sacred intelligence with holy Truth, so earnestly coveted and commended by good Men.[26]

This crucial passage of the Lettera indicates that Foscarini thought the supposed scriptural objections to Copernicanism to be the reason for treating it as only a "probable opinion." With the removal of these

objections the Copernican astronomy would pass from the level of "probability" to that of "truth" and it would be able to appear openly and publicly without any impediments to its promulgation and acceptance as truth.

The personal letter to Galileo does reveal a dichotomous approach to the Copernican cosmology, a dichotomy, however, which need not be explained in Caroti's manner. Foscarini's stated intention to prepare a "dispute" or "discussion" on the two chief world systems in which he would use the language of probability most certainly reflected the hostile reactions he had received from the author of the Judicium and from Cardinal Bellarmine, as well as the advice offered by Prince Cesi to argue for the Copernican cosmology only ex hypothesi. The form of the "dispute" and the language to be used in it were designed to protect the author and the theory he was expounding from official sanctions.

However, Foscarini was by nature a daring writer and in his personal letter he allowed his actual feelings to come to the fore. The genre of the letter was the perfect medium for the transmission of scientific questions and personal beliefs and Foscarini used this letter to expose his true position on the Copernican question.[27] Consequently, he quickly

dropped the shield of probabilistic language and stated that he would prove the "truth" of Copernicanism by supplying certain "necessary demonstrations." The "necessary demonstration" par excellence offered in this letter was the existence of the Trade Winds.

If the evidence is examined from this perspective, another image of Foscarini emerges. He appears as a thinker who, by 1615, had become an adherent of the Copernican cause.[28] However, to protect himself and the Copernican positions he advanced from hostile reaction and ecclesiastical censure, in his "public" works Foscarini hid behind the language of "probability." Indeed, when the theological judges of 1616 condemned his Lettera as a work intent on reconciling Copernicanism with the Bible and demonstrating it to be "consonant with the truth," they were closer to the mark than certain recent interpreters of Foscarini's thought.

Notes

1. S. Drake, ed. and trans., Discoveries and Opinions of Galileo (Garden City: 1957), 216-220.

2. The Latin text is printed in S. Pagano, ed., I documenti del processo di Galileo Galilei (Vatican City: 1984), 99-100 and the English translation is taken from J.J. Langford, Galileo, Science and the Church (Ann Arbor: 1971), 89.

3. J.J. Langford, Galileo, Science and the Church, 89-90.

4. G. de Santillana, The Crime of Galileo (Chicago: 1955), 128, n. 8 and S. Drake, Galileo At Work: His Scientific Biography (Chicago: 1978), 255.

5. S. Pagano, I documenti del processo di Galileo Galilei, 103 and J.J. Langford, Galileo, Science and the Church, 98.

6. J.J. Langford, Galileo, Science and the Church, 98-99. The same view is expressed in O. Gingerich, "The Censorship of Copernicus' De Revolutionibus," Annali dell'Istituto e Museo di Storia della Scienza di Firenze 6(1981):50.

7. G. de Santillana, The Crime of Galileo, 123, n. 8 and O. Gingerich, "The Censorship of Copernicus' De Revolutionibus," 51.

8. O. Gingerich, "The Censorship of Copernicus' De Revolutionibus," supplies this English translation and the Latin text can be found in J. Hilgers, S.J., Der Index der Verbotenen Bücher (Freiburg im Breisgau: 1904), 541-542.

9. S. Pagano, I documenti del processo di Galileo Galilei, 100-101; G. de Santillana, The Crime of Galileo, 125-126 and S. Drake, Galileo At Work, 253-254.

10. U. Baldini, "Galileo, la nuova astronomia e la critica all'aristotelismo nel Dialogo Epistolare fra Giuseppe Biancani e i revisori romani della Compagnia di Gesu," Annali dell'Istituto e Museo di Storia della Scienza di Firenze 9(1984):34-35, 38, n. 18. Baldini has argued, in "L'astronomia del cardinale Bellarmino," in Novità celesti e crisi del sapere, ed. P. Galluzzi (Florence: 1984), 296-300 that "fictionalism" may not

be an accurate appraisal of Bellarmine's approach to astronomy.

11. A. Franco, "P. Paulus Antonius Foscarini," Analecta Ordinis Carmelitarum 2(1911):524.

12. B. Basile, "Galileo e i teologo 'copernicano', Paolo Antonio Foscarini," Rivista di letteratura italiana 1(1983):75-79 and S. Caroti, "Un sostenitore napoletano della mobilità della terra: il padre Paolo Antonio Foscarini," in Galileo e Napoli, ed. F. Lomonaco and M. Torrini (Naples: 1987), 90-92. An even harsher judgment was made in W.R. Shea, "La Controriforma e l'esegesi biblica di Galileo Galilei," in Problemi religiosi e filosofia, ed. A. Babolin (Padua: 1975), 50, when he asserted that the Lettera was limited to demonstrating that the Bible was written to be understood by all and that it utilized the language of the people.

13. B. Basile, "Galileo e il teologo 'copernicano'," 75.

14. R.S. Westman, "The Copernicans and the Churches," in God & Nature: Historical Essays on the Encounter between Christianity and Science, ed. D. Lindberg and R.L. Numbers (Berkeley: 1986), 100 and M.J. Osler, "Certainty, Skepticism, and Scientific Optimism: The Roots of Eighteenth-Century Attitudes Toward Scientific Knowledge," in Probabilty, Time, and Space in Eighteenth-Century Literature, ed. P.R. Backscheider (New York: 1979), 12 and 25, n. 30 on the different forms of certainty perceived by seventeenth-century thinkers.

15. E. Grant, "Late Medieval Thought, Copernicus, and the Scientific Revolution," in his Medieval Science and Natural Philosophy (London: 1981), XIV:197-220; B. Nelson, "Sources of 'Probabilism' and 'Anti-Probabilism' in 16th and 17th Century Science," and "The Early Modern Revolution in Science and Philosophy," in his On the Roads to Modernity: Conscience, Science, and Civilizations (Totowa: 1981), 115-151 and W.A. Wallace, "The Certitude of Science in Late Medieval and Renaissance Thought," History of Philosophy Quarterly 3(1986):281-291 all insist on this theme as crucial to an understanding of the distinctive nature of early modern science.

16. I. Hacking, The Emergence of Probability: A Philosophical Study of Early Ideas about Probability,

Induction and Statistical Inference (Cambridge: 1984), 1-48; D. Patey, Probability and Literary Form: Philosophic Theory and Literary Practice in the Augustan Age (Cambridge: 1984), 3-74, 266-273 and O.B. Sheynin, "On the Prehistory of the Theory of Probability," Archive for History of Exact Sciences 12(1974):97-141. Patey and Sheynin present considerable evidence to refute Hacking's thesis that in antiquity and the Middle Ages "probabilty" only meant backing by authority. In his brief survey of Kepler's Latin terminology, N. Jardine, The Birth of History and Philosophy of Science: Kepler's "A Defense of Tycho Against Ursus" (Cambridge: 1984), 251, has observed a wide variety of meanings attached to the term probabilis. Sometimes the term has the connotation of plausibility and is contrasted with terms such as verus or verisimilis. On other occasions, probabilis "has the connotation of worthiness, acceptability and adequate warrant, as when Kepler claims that his postulation of a magnetic power in the sun is probabilissime." P. Dear's Mersenne and the Learning of the Schools (Ithaca: 1988), 23-47 contains a discussion of seventeenth-century "probabilism" in the context of Mersenne's thought.

17. P. Foscarini, Lettera. . .sopra l'opinione de' Pittagorici e del Copernico della mobilità della terra e stabilità del sole (Naples: 1615), 4-5; T. Salusbury, Mathematical collections and translations: the first tome (London: 1661), 473-474. The actual terms used by Foscarini in this passage are "ragionevole" and "verisimile."

18. P. Foscarini, Lettera, 9-10; T. Salusbury, Mathematical collections, 476.

19. Galileo Galilei, Opere, ed. A. Favaro (Florence: 1929-1939), 12:215.

20. S. Caroti, "Un sostenitore napoletano della mobilita della terra," 91. Caroti perceives this uncertainty concerning the status of astronomy in Foscarini's Syntaxis, where astronomy is treated as a mathematical science and not as part of those sciences dealing with the physical world.

21. S. Caroti, "Un sostenitore napoletano della mobilità della terra," 91-92. N. Jardine, The Birth of History and Philosophy of Science, 225-257 and W.A. Wallace, Galileo and His Sources: The Heritage of the Collegio Romano in Galileo's Science (Princeton:

1984), 126-148 both discuss the debate over astronomy and the mathematical sciences in the late sixteenth and early seventeenth century.

22. S. Caroti, "Un sostenitore napoletano della mobilità della terra," 91.

23. P. Foscarini, Lettera, 3; T. Salusbury, Mathematical collections, 473. S. Caroti, "Un sostenitore napoletano della mobilitá della terra," 97 has identified the Vincenzo Caraffa of the Lettera as the future head of the Jesuit Order. It is also interesting that another member of the Neapolitan intellectual circle, Nicolo Antonio Stelliola (ca. 1546-1623), was, at the time of the Church decree of 1616, planning to publish an introductory work on the Copernican cosmology. Because of his heterodox religious and philosophical views, Stelliola, in the late sixteenth century, been the subject of an inquisitorial investigation. G. Baroncelli, "L'astronomia a Napoli al tempo di Galileo," in Galileo e Napoli, ed. F. Lomonaco and M. Torrini (Naples: 1987), 197-200 and P. Manzi, "Un grande nolano obliato: Nicola Antonio Stigliola," Archivio storico per le province napoletane 90(1973):287-312.

24. P. Foscarini, Lettera, 4; T. Salusbury, Mathematical collections, 473-474.

25. S. Caroti, "Un sostenitore napletano della mobilità della terra," 99-101.

26. P. Foscarini, Lettera, 13; T. Salusbury, Mathematical collections, 478. In the original Italian this important passage reads as follows: "Questo e il motivo, che m'indusse à considerare, & à cercare (stante la probabilità evidente della già detta opinione) il modo, e la strada di accordare molti luoghi della Scrittura Sacra con essa, & interpretarli (non senza fondamenti Theologici e Fisici) in modo tale, che non gli contradicano affatto; acciò quando ella si vedrà (per caso) e determinerà espressamente, e con certezza esser vera, (sicome hora per probabile è ricevuta) non se gli ritrovi intoppo alcuno, che l'impedisca, e che gli dia fastidio, privando indegnamente il mondo del Venerabile, e Sacrosanto commercio della tanto da tutti i buoni desiderata verità."

27. J.L. Pearl, "The Role of Personal Correspondence in the Exchange of Scientific Information in Early

Modern France," Renaissance and Reformation 8(1984):106-113 examines the importance of private correspondence for the transmission of scientific information and questions during the Scientific Revolution.

28. S. Caroti, "Un sostenitore napoletano della mobilità della terra," 109 concludes the text of his essay with this estimation of Foscarini's position in his Lettera. However, Caroti tends to treat Foscarini's personal letter to Galileo as full of doubts concerning the status of Copernicanism and he treats this letter as representative of an earlier stage in Foscarini's thinking. For Caroti, the Lettera is Foscarini's final and most mature statement on the new astronomy. This position is at variance with the one taken in Chapter Four, above.

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