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Wittenberg Reforms in the University and the Early Reaction to Copernicus

For Professor Cahan

By

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In her 1973 contribution to *The Scientific World of Copernicus*, Barbara Bienkowska wrote,

> In view of the all-encompassing authority that the Scriptures exercised on the consciousness of the population at the time, any discussion or thought about the motion of the Earth was totally inadmissible. It was principally in this context that, earlier than the representatives of the Catholic Church, the leaders of the Reformation (Luther and Melanchthon) condemned the heliocentric theory as blasphemous.[1]

[2]

These sentences are merely recent representatives of a pedigree long and popular contributing to the Copernican story of scientific hero versus sixteenth century religion, those early biblicist Lutherans in particular. Although such claims have a popular appeal and, it must be admitted, some basis in fact, they largely misrepresent the historical situation as understood by those who participated. This suggests then that one should reconsider first, how far and in what manner such ideas are congruent with the primary source material and, secondly, how far and in what ways they diverge from the facts. Such a consideration will reveal, I believe, that the early reception and use of Copernicus' work in Germany depended heavily upon the Wittenberg reforms of the form and function of natural philosophy in the early modern university, which were set in motion by Martin Luther and Philip Melanchthon. The following will first examine the medieval precedent upon which the Wittenberg ideas regarding the cosmos depended. Secondly, we will turn to the educational reforms, which Luther and Melancthon began within the University of Wittenberg and, finally, we will examine the results of these reforms upon the reception of Copernicus' heliocentric theories.

THE INTELLECTUAL INHERITANCE: GREEK EAST AND LATIN WEST

In the first centuries after Christ, the Greek East saw the publication of works by such recognized authors as Hero of Alexandria, Nicomachus, Menelaus, Galen and, most pertinent to the present work, Ptolemy (the *Almagest* and the *Tetrabiblos*). Further, a tradition of commentaries and handbooks concerning Plato's *Timaeus* and Aristotle's natural philosophy developed. These works continued the efforts of the classical authors and in many ways represent the pinnacle of Greek scientific learning. The Roman Latin West, on the other hand, had a practical frame of mind and never contributed significantly to scientific theory. However, the West appreciated Greek creativeness. Authors such as Seneca (*Natural Questions)* and Pliny (*Natural History*) depended heavily upon the Greeks in their discussions of natural phenomena, amasing quotations from Greek authors. This sort of encyclopedia technique formed a tradition in the Latin West and became more derivative in nature as the middle ages progressed. But it was able to keep alive at least rudimentary knowledge of some Greek authors through the efforts of writers such as Macrobius, Boethius (c. 480 – 524), Cassiodorus (c. 488 – 575), Isidore of Sevile (c. 560 – 636), and the Venerable Bede (c. 673 – 735). In regard to astronomy in particular, Boethius explicitly recalls his contemplation of the sun, moon, and stars, and the calculation of their movements by the use of numbers. Likewise, Isidore of Seville considered astronomy as "meditation upon things on high."[3] This tradition, combined with an influence of Neo-Platonism, kept a small amount of natural philosophy in general, and astronomy in particular, alive in the Christian medieval West, but only as an application of Greek ideas to a Christian contemplation of the creator and his creation. This bit of inherited science was applied to education in the West, at least at a popular level, in the traditional *quadrivium* of arithmetic, geometry, astronomy, and music.[4]

The Middle Ages in the Latin West thus reflected the general poverty of Roman thought in regard to theoretical matters. The barbarian invasions did not improve matters. [5] And the general skepticism of the early Latin church toward pagan philosophy had further inhibited any intellectual inheritance which might have been received from a Christian Greek-speaking East.[6] In other words, the church spanned across the cultural boundaries of East and West with a fairly unified world view based upon a common faith. Potentially, the Christian scholars of the West could have received from their Eastern brethren that which cultural boundaries inhibited. But natural philosophy was not the main concern of the church and the differences of language of the Latin West and Greek East were as fundamental to the church as to society at large. Thus no exchange of any extent occurred.

However, at two isolated points there was an ongoing need for the Western theologians to make use of natural philosophy, and in these matters there was exchange with the East. This occurred in the ongoing debates over the calculation of the date of Easter and in the exegesis of the book of Genesis where the doctrine of creation was treated. In this way a limited tradition of such a use of astronomy developed which spanned East to West through such authors as Basil (c. 331-379), Ambrose (c. 339-397), Augustine, and others.[7] In part this limited tradition was focused upon a discussion and calculation of the movements and positions of the heavenly bodies in order to calculate correctly the calendar and the date of Easter and, further, in order to explain certain aspects of the Genesis account of creation.[8] In regard to the later, it was especially Augustine, having written an influential commentary on Genesis, who was so important in the Latin West.[9]

In this way, scientific knowledge was of very limited scope in the early Middle Ages in the West, consisting of a couple of specific applications of a Christianized natural philosophy based on partial information received through the very incomplete Latin inheritance of Greek learning.[10] This was to change dramatically in the late Middle Ages under the influence of Arabic learning from Spain. The first contact with Islamic astronomy was at the end of the tenth century and had tremendous implications for the future of European learning.[11] This contact introduced new astronomical ideas to the West and brought with these ideas the first observational instruments to be used by Latin astronomers.[12] But these earliest astronomical ideas were influenced by Arabic and received by Latin astrological interests.[13] The influence of the Arabic astrological works brought with them the association between this astrology and Aristotle. According to Lemay, this association at once introduced to the Latin West a curiosity and rudimentary knowledge of Aristotle's works on nature and also gave Aristotle a bad reputation among those who agreed with the church's official repudiation of astrology. It was this first reception of Aristotelian ideas, wrapped up in Arabic astrology, which paved the way for the full acceptance of Aristotle's natural philosophy in the next century.[14]

This meager introduction of Aristotle to the Latin West was soon superseded by a surge of translations of actual works from antiquity. The twelfth and the thirteenth centuries saw Gerard of Cremona alone translate such important works as Galen's *Tegni*, Ptolemy's *Almagest*, and many of Aristotle's works such as *Physics*, *On the Heavens and World*, *On Generation and Corruption*, and the *Meteorology*. Other translators of the period such as Eugene the Emir translated works as important as Ptolemy's *Optics*.[15] As a result, this period saw Latin Europe infused with new books and ideas from antiquity. The result was the rise of the university system and scholasticism based on Aristotle's logic.

The organization and the culture of the medieval university are important to understand in order that the reforms undertaken in Wittenberg have a standard against which to be measured. First, the university itself was divided into several faculties which granted the various degrees which could be obtained. The lower degrees were obtained through the faculty of arts. The higher degrees were obtained through the faculties of medicine, law, and theology.[16] Or from the student's perspective, the programs of study in the medieval universities were broken down into an undergraduate degree, a master of arts degree, and higher degrees of law, medicine, and theology.[17] The undergraduate and the master of arts student spent most of his time studying subjects included in the seven liberal arts, which were divided into the *trivium* (grammar, dialectic, rhetoric) and the *quadrivium* (geometry, arithmetic, astronomy, and music). Persuing a master of arts degree usually included study of natural philosophy through consideration of works like Aristotle's *Physics* or *On the Heavens* and works such as Ptolemy's *Almagest*. Thus in order to pursue one of the higher degrees of law, medicine, or theology, the student first formed foundational skills in language and logic upon which was built a knowledge of natural philosophy and other advanced studies in the arts. Therefore, it is important to note, natural philosophy was intended to be a subject which applied directly to the study of problems existing in areas of law, medicine, and theology.[18]

A second important point to consider is the role of the mathematician and astronomer within the university. The chair of astronomer and mathematician was often a combined post in the medieval university. This chair would be a part of the faculty of arts, teaching students who were pursuing a master of arts or undergraduate degree. In general, in the German medieval universities those who taught the arts were, interestingly, either a student, who had earned a master of arts degree and was pursuing a degree in one of the higher faculties, or possibly a professor of the one of the higher faculties. The chair of mathematics was no different. As a result, this chair was often held by a student studying for a degree in medicine or by a professor holding a chair in the faculty of medicine.[19] The reasons for this were twofold.

The first reason for the connection between medicine, mathematics, and astronomy was the ancient and medieval synergy between medicine and astrology. Whereas astronomy was the study of the motion and position of the heavenly bodies, astrology was the belief and study of the influences of those heavenly bodies upon the elements in the sub-lunar sphere, namely, upon people and things on earth. The belief in astrological influences upon people dates back to antiquity and the pre-Christian philosophical debates over Fate and Chance. Although the church actively rejected the concept of astrological fate, nevertheless, astrological ideas, which were expressed in such fundamental astronomical books as Ptolemy's *Tetrabiblos,* affected society and its institutions. Theories of an influential force from the heavenly bodies were debated and even supported from arguments taken from Aristotle's physics. When the great medical scourges came upon Europe, such as the plague or syphilis, it was commonplace for a debate to take place as to whether the disaster was a punishment sent from God or whether it was a natural phenomenon, that is, an event caused by the influences of the heavenly bodies.[20] Astrology, therefore, served the medics of the day as a tool of diagnosis. Being able to predict the position of the heavenly bodies, a physician could predict the influential forces and, therefore, the outcome of an ailment. It was not even unknown for a common chair of "medicine and astrology" to be found within the walls of the university.[21]

The second reason for the connection between the faculty of medicine and mathematics was an economic one. Since the chair of medicine was part of the higher faculties, "it was not only more prestigious but it was also more lucrative. At Wittenberg and Marburg, for example, a professor of medicine could earn twice as much as a professor of mathematics."[22] Since the chair of mathematics or astronomy was so closely aligned with the chair of medicine, it was a rather obvious career path for a professor of mathematics to continue his studies and pursue the higher degree, which would enhance his social and monetary status.

In addition to being connected with the faculty of medicine, the chair of mathematics and astronomy was important to another of the higher faculties: that of theology. It continued in the traditional functions served from antiquity in that it was able to shed light on the doctrine of creation and help calculate a more accurate ecclesiastical calendar. In addition, since the subject matter of astronomy (and the accompanying mathematics) was nature, it formed a part of the teaching of natural philosophy even apart from its astrological applications. And natural philosophy played a role in such theological controversies as the nature of the Eucharist. This put the chair of astronomy into a relationship with theology, which was similar to that which it had with medicine. And this had implications for the social role and value of medieval mathematics and astronomy. In the end, mathematics usually served in a service role to these other areas of knowledge. As a result, that which was considered an improvement to mathematics was generally some type of practical improvement, better astrological predictions or a better ecclesiastical calendar.[23]

This aspect of defining mathematics and astronomy's role within the faculty of arts in terms of practical calculation for natural philosophy, which in turn serviced theology and also astrology's role in medicine, derives from the more basic relationship between mathematical and philosophical astronomy. This relationship derives from Aristotle's own view of mathematics and the historical relationship of Aristotle's description of the heavens to the work of the Hellenistic astronomers.

First, Aristotle divided theoretical science into three categories, namely, metaphysics, mathematics, and physics. According to Aristotle natural philosophy is essentially the study of physics, a study of nature and the causes of change in nature. Mathematics, on the other hand, dealt with non-natural things such as circles, planes, points, and numbers themselves.[24] Thus from Aristotle's point of view, mathematics was conceived as an abstraction from nature but not as a tool to describe and explain nature.

Secondly, and in accordance with the previous point, Aristotle did not deal with the heavens in terms of accurate observation, mathematical explanation, and future prediction as had other ancient thinkers. Instead, he applied his ideas of physics and logic to the heavens in order to explain what is seen there in terms of causes. In this way he constructed his cosmological model of the earth in the center of a cosmos of rotating spheres and elements. This was an intellectual model for natural philosophy, which in turn could be applied toward the logical solution of many other problems in nature. Unfortunately, it did not account very well for the actual movement of the planets. Therefore, the Hellenistic astronomers, such as Ptolemy, applied mathematics in an attempt to patch up Aristotle's model so that it might accurately describe the motion of the planets. This was done by applying geometrical constructs, such as deferents and epicycles, to the paths of uniform circular motion proposed by Aristotle. The result was a mathematical description, which could describe and predict the motion observed in the sky more accurately but offered no reason why the heavenly bodies should travel in such strange ways. This astronomy was therefore observationally accurate but violated some of the basic principles of Artistotle's speculative physics offering no physical explanation as to why the planets move in this manner.[25] This rather embarrassing situation would continue to influence the relationship between mathematics and natural philosophy even in Latin Europe's period of rediscovery of ancient astronomy and natural philosophy during and after the twelfth century.

This basic disconnect between physics, that is, natural philosophy, and observed phenomena joined with other intellectual movements of the late Middle Ages to move natural philosophy more and more from a study of observable nature to an abstract intellectual exercise in finding solutions to imaginary problems. "In a very important way natural philosophy was not about nature."[26] In these exercises, mathematics was often a tool in the description or solution of a problem, which was merely a formal exercise based on arbitrary assumptions. The solution was not even intended to represent any particular physical reality.[27]

All of these intellectual and social factors left mathematics and astronomy confined within well-defined practical and functional roles for what were considered to be higher subjects of learning in the medieval university. Although some mathematicians claimed a greater role in being able to give physical descriptions of the cosmos on the basis of the accuracy of their own calculations, the philosophers countered such claims.[28] And further, the mathematicians' continuous efforts to patch up and correct even Ptolemy's astronomy made their own models complex, unwieldy, and unconvincing as a true description of the 'real' world. Thus Aristotle's cosmological model was the *de facto* intellectual model and little to no effort was expended to improve upon it during the late Medieval period.

REFORM OF NATURAL PHILOSOPHY AT WITTENBERG

It was in the midst of this medieval intellectual and social context that the University of Wittenberg was founded in 1502. The University was the newest of the German universities such as Heidelberg (1386), Köln (1388), Erfurt (1392), Leipzig (1409), Rostock (1419), Greifswald (1456), Basel (1460), Freiburg (1460), Ingolstadt (1472), Trier (1473), Mainz (1477), and Tübingen (1477).[29] It was founded, like Leipzig, after the 'Parisian archetype' of a university of masters. And the proper Imperial and Papal charters were procured. In its teaching format Wittenberg followed Tübingen. The statutes of the faculty of arts, from 1504, were copied from Tübingen and state that all bachelor's degree students must study Porphyry's *Isagoge* and *Predicamenta*, Aristotle's *Priora analytica, Posteriora analytica, Sophistici elenchi* and *Topica.* Work also had to be done in Aristotle's *Physica,* and *Parva logicalia.* For the master's degree lectures were heard on Aristotle's *Physica*, *De caelo et mundo, De generatione et corruptione, De anima, Metaphysica, Ethica,* and *Parva naturalia* and other work was to be done such as participation in the disputations. Thus, for a bachelor's degree a mastery of logic was essential and knowledge of Aristotle as a whole was necessary for a master's degree.[30] Wittenberg was founded as a traditional scholastic university based on Aristotle's works with no hint of the massive changes that would occur in less than two decades.

Martin Luther was born in 1483 in Eisleben. In 1501, he matriculated at the University of Erfurt where he graduated with his bachelor's degree in 1502, and later with his masters degree in February, 1505. The faculty at Erfurt at that time was influenced by a humanism which, in turn, was reflected even in the philosophy faculty. Two of Luther's main professors, Jodocus Trutvetter and Bartholomaeus von Usingen, while not humanists themselves, were under its influence and "frequently quoted the classics to support the points they wished to establish."[31] Trutvetter deplored "hair-splitting" scholasticism and apparently influenced Luther at this point. He taught that the earth was a sphere, thunderstorms were due to natural causes, and, importantly, that "while astrology might have some basis in fact, it did not so affect the lives of human beings that they could not resist its influence."[32] Usingen made a distinction between Aristotle and the Bible as authorities in religious matters and again influenced Luther at this point.

Unexpectedly, in July, 1505 Luther was admitted to the chapter house of the Hermits of St. Augustine, a mendicant order of friars, in Erfurt. In the spring of 1507, he was ordained a priest and started his studies for a doctoral degree in theology. While pursuing this degree Luther was called to Wittenberg to lecture on moral philosophy (1508), and then was later called back to Erfurt and sent on his famous trip to Rome. Then in 1511, he was again called back to Wittenberg to lecture and was appointed to the chair of *lectura in Biblia* for life before getting his doctorate in October, 1512.[33] Luther would quickly make his presence felt at the university and in the town of Wittenberg. In 1512, he was appointed the sub-prior of the Augustinian convent and the chief preacher of the convent. In 1514, in addition, he was appointed preacher of the city church in Wittenberg. Thus Luther was involved in almost every aspect of public life in Wittenberg, among the university, the Augustinians, and the laity.

The first period to be considered is the period from 1514 until the arrival of Philip Melanchthon as a member of the faculty of arts in the chair of Professor of Greek. In this period Luther already started pushing for serious reform of the university curriculum in accordance with his developing theological views. Luther, in his new post, lectured on parts of Genesis from 1512 to 1513, and the Psalms from August 1513 to October 1515. He was starting his studies of the original Biblical languages, Greek and Hebrew, and these, along with other materials from the humanists, were beginning to affect his thoughts concerning the standard scholastic methods of lecturing in theology. In his lectures on Romans from November 1515 to September 1516, Luther greatly changed the use of the *Glossae* and *Scholia* methodology, and in his lectures on Galatians, from October 1516 to March 1517, he abandoned them altogether. He rejected the standard medieval use of four senses of the biblical text, the literal, allegorical, tropological, and anagogical and replaced them simply by a literal and spiritual sense.[34]

Luther's increasingly critical opinion of medieval theology, both sources and methods, can be observed at this time. With a humanistic spirit, he was now turning to more ancient authorities, the Scriptures and the church fathers.[35] This is reflected in minor matters as well as major. For example, in a letter of August 24, 1516, Luther, who was looking for information on the Apostle Bartholomew, wrote that more recent works were filled with "nonsense and lies" and that Jerome's fifth century work, *On Famous Men*, should be consulted instead.[36] Luther praised the "outstanding fathers" such as Cyprian, Gregory of Nazianzus, Irenaeus, Hilary, Ambrose and, especially, Augustine. He praised Augustine above Jerome in theology and indicated that his reading of the esteemed father had helped him in his study of St. Paul and the question of what the Apostle meant by righteousness based "upon the Law" or "upon deeds." And even as he praises Paul and Augustine, Luther criticizes Aristotle, who believes that we are "made righteous by the doing of just deeds."[37]

At the beginning of 1517, Luther stated that some of the things he was writing were seen by some as "blasphemies and revilings against Aristotle." His criticism of Aristotle was also a criticism of contemporary theology, which made so much use of the philosopher's logic, natural philosophy and other ideas. Luther felt the use of Aristotle as an authority in theological studies was wrong. But even worse, according to Luther, the scholastic theologians used Aristotle and other ancient authors by means of commentaries (*Glossae* and *Scholia*) upon the original text, which were intended to explain terminology and interpret the meaning of the original author. This resulted in the medieval commentaries obscuring and dominating the classical authors and their original intent.[38] And so Luther disdains "Aristotle, Porphyry, [and] the masters of the *Sentences*" together and depicts the scholastic work dealing with these authors as "the hopeless studies which characterize our age."[39] There was great pressure simply to accept the authority of this Aristotelian theology in silence, says Luther, but Aristotle, "this chief of all charlatans, insinuates and imposes on others, things which are so absurd that not even an ass or a stone could remain silent about them!"[40] Thus, concludes Luther, "it is false to say that without Aristotle one cannot become a theologian. The opposite is true, no one becomes a theologian unless it be without Aristotle, for the whole of Aristotle is related to theology as darkness is to light."[41]

This vigorous criticism of Aristotle, rooted in Luther's theological development and humanistic leanings, had tremendous implications for the university, as Luther already realized. Luther led a reform of Wittenberg's curriculum between 1517 and 1518. The question that immediately presented itself was what should be the focus of theological studies if not Aristotle? Apparently the first model Luther had in mind was a biblical humanism built upon the languages, Scripture, and the church fathers, especially Augustine.[42] By the spring of 1518, the style of the Aristotelian classes in the *Physics, Metaphysics,* and *Logic* had been altered to a humanistic approach and new classes in the classical authors were being offered.[43] In May, Luther requested that the university be allowed to establish a chair in Greek and a chair in Hebrew.[44]

In August of 1518, Philip Melanchthon, grand-nephew of famed humanist John Reuchlin, came to Wittenberg to fill the new post of professor of Greek in the University's faculty of Arts. Philip Melanchthon would work side by side with Luther throughout the Lutheran reform of theology and education. Together, Luther and Melanchthon greatly altered the way Wittenberg taught its students. Luther wanted to eliminate Aristotelian studies, which he considered a waste of good students' time, from the curriculum, excepting perhaps only the philosopher's writings that supported basic learning such as the *Logic, Rhetoric,* and *Poetic,* and only if these were taught without all the scholastic commentaries and notes.[45] Melanchthon supported Luther's arguments.[46] During the 1520's, Melanchthon worked with Luther in regard to the reforms of the medieval curriculum. He agreed concerning the exclusion of Aristotelian philosophy from theology and its subjection to theology.[47] However, Melanchthon, as important as he was to Lutheran theology and to Luther personally, was not at heart or by profession a theologian. He was an educator and spent the majority of his career working to improve education at Wittenberg and in Germany. After the late 1520's, it was Melanchthon who was most responsible for the reforms in curriculum at the University of Wittenberg because Luther had already accomplished that which he desired, the diminution of Aristotle in theological studies.

Melanchthon felt it was shameful that in his times the sciences were so poorly known, and he was especially interested in improving education in this regard.[48] With this beginning point, and within the context of the developing theology articulated by the Lutheran theologians, Melanchthon the humanist spent a career changing the educational landscape of Germany and thereby gained for himself the title *Praeceptor Germaniae*. Toward this end, after 1530, Melanchthon lectured on many works concerning natural philosophy and published many works of his own. In this process, Melanchthon developed a corpus of works, later known as the *Philipus,* which concerned varied topics from grammar to natural philosophy to theology, which were used for years in Germany's schools and universities. He gathered a dedicated group of students, who would influence education in Germany for decades to come as teachers and professors all over Germany.[49]

More specifically, Sachiko Kusukawa has shown that as part of his amazing career, Melanchthon developed a distinctive new presentation of natural philosophy that fit within the context of the Lutheran theological system. Luther approved of the study of those things that provided a true knowledge of nature, such as the medics wrote, but he was of the opinion that "in (Aristotle's Physics) there is no real knowledge of the world of nature."[50] Luther's early rejection of Aristotle was the period during which Luther exorcised Greek philosophy from theology. And in Luther's theologically centered world, one could not even have a right knowledge of nature without first having at least some correct theological knowledge. Luther was restricting natural philosophy back into its ancient role of explicating the doctrines of creation and divine providence.[51] And, according to Luther, Aristotle was of limited use even toward that end.[52] However, in principle, Luther and Melanchthon were not against natural philosophy as long as it did not assert a place of arbitration in regard to articles of faith.[53] But this did not really bring about a positive action until the more radical reformers presented an example of what Wittenberg considered as going too far.

Just as the Swiss and other radical reformers gave impetus to a certain counter reaction and, therefore, a balance within Luther's theology, the same occurred within Lutheran education. The Wittenberg chaos of 1521, the peasant unrest in the mid 1520's, and the encounter with the Swiss theologians were part of a process that brought a change of perspective to Wittenberg. In 1526, Luther wrote,

> We should not follow the imaginations of the interpreters who suppose that the knowledge of nature, the study of astronomy or of all philosophy, is being condemned here and who teach that such things are to be despised as vain and useless speculations. For the benefits of these arts are many and great, as is plain to see every day. In addition, there is not only utility, but also great pleasure in investigating the nature of things. Holy Scripture also points to things to show their properties and powers. … The Scriptures are all so full of such metaphors and parables taken from the nature of things that if someone were to remove these things from the Holy Scriptures, he would remove a great light.[54]

Melanchthon, too, began to point out that St. Paul's warning against philosophy did not mean that philosophy was bad, merely, that one should not be misled by philosophy. In fact natural philosophy should be respected because it investigates those things implanted in nature by God.[55] This change in attitude, which came about in the later 1520's, opened the way for the rest of Melanchthon's later efforts at developing a Lutheran natural philosophy. This was a philosophy which differed from medieval scholastic natural philosophy in method, content, and in its being subjected to theology, that is, restricted to investigating nature within the context of the doctrine of divine creation and providence. This was a Lutheran natural philosophy that would have great influence in German education for decades to come. And it was this natural philosophy and its first generation of students that largely determined the early reaction to Copernicus' ideas in Germany. Mathematics, astronomy, and astrology were a part of this new natural philosophy taught at Wittenberg. Now we must consider in more detail Luther and Melanchthon's opinions of these celestial matters.

ASTRONOMY AND ASTROLOGY AND THE REACTION TO COPERNICUS

In the earliest period Luther's attitude toward mathematics seems to be that of mild interest combined with limited yet useful useful knowledge. As we have already seen, mathematics was a part of the Wittenberg's curriculum even before Melanchthon's arrival. In this early period, Luther occasionally makes comments in his works which draw upon mathematical ideas. But, while Luther gives no negative comments about mathematics itself, he thoroughly reflects the medieval Aristotelian mindset, which treats mathematics as an abstraction from reality and as representing nothing truly real.[56] He clearly contrasts speaking "according to mathematics" (of abstractions from reality) and "according to physics" (of things which physics discusses, real objects). Accordingly, he states that the scriptures do not speak of the "end" of God's kingdom "*mathematice*" (mathematically) but rather "*physice*" (physically) as that "*quod durat aliquandiu vel ineternum*."[57] Likewise, Luther makes use of objects of geometry as abstractions in order to make a contrast with reality. For example, the Christian is to live such that he rejoices in sadness and is humble in great joy. This is some sort of middle point between excessive sadness or depression and overconfidence or boasting. Since it is impossible for a Christian always to live so perfectly, this "*medium*" is "*mathematicum, non physicum*", that is, a theoretical middle point.[58] To Luther this is an apt description since, as is well known, no such "*medium indivisible*", as mathematics posits, exists.[59] Accordingly, the word "mathematical" can even be used as an adjective to describe an abstraction. Thus when the scholastics define the action of loving as "to wish the good for someone," Luther rejects this definition, declaring such a love to be a "mathematical love."[60] Instead, he suggests, love must be "to serve" or else it is not love. Finally, this abstract nature of mathematics allows Luther to use its language to describe divine actions in order to emphasize their divine character.[61]

What has been demonstrated above is that Luther and Wittenberg inherited and shared the medieval concept of mathematics as a profession that worked with abstractions, which, in turn, were useful to relate to reality for precision of communication.[62] There is no concept of "laws of nature" which follow certain mathematical models. Wittenberg did not change the medieval concept of mathematics or the mathematician. Mathematics remained a part of natural philosophy. But philosophy itself had received a new role at the University. Natural philosophy was explicitly excluded from theology and given the role of describing and investigating the creation and God's providence over it, a role it had served in the early church. Within this natural philosophy, physics continued to be the causal description of real objects and their movements or changes, and mathematics remained a description and use of abstract objects in service of the other disciplines. One way this continued to be applied was in the calculation of the positions and movements of the heavenly bodies.

Luther was well aware of the astronomical function of the mathematicians. In many and various texts it is clear that the titles mathematician and astronomer were all but synonymous. Luther did not condemn or oppose astronomy. On the contrary, he gives it great praise saying,

> With the support of the mathematical disciplines – which no one can deny were divinely revealed – the human being, in his mind, soars high above the earth; and leaving behind those things that are on the earth, he concerns himself with heavenly things and explores them. … Therefore man is a creature created to inhabit the celestial regions and to live an eternal life when, after a while, he has left the earth. For this is the meaning of the fact that he can not only speak and form judgments (things which belong to dialectics and rhetoric) but also learns all the sciences thoroughly.[63]

While he gives such strong praise, as has already been seen, Luther subjects astronomy, too, to the authority of theology and revelation. Luther saw the world in theological terms and the heavens were no exception. Thus, he understood astronomy especially in terms of Genesis 1:14, which states that God made the sun and stars for "signs and times, days and years." In this way, he came to understand celestial events as signs of God's anger and wrath, especially eclipses and great conjunctions.[64] And although he understood the claims and predictive abilities of the mathematicians, he responded, "let it be, as the mathematicians say, that these things happen naturally. Nevertheless, it is true that signs of this kind always portend a future evil."[65] The sun and stars were made to give light and when they cease to do so it is a "divine sign."[66] And when, in 1531, a comet appeared in the skies over Wittenberg, Luther took note of the position of its tail in relation to the constellations and concluded that it signified "nothing good."[67] Although Luther interpreted the heavens in this fashion, he understood them in terms of divine indications of wrath and anger, not as objects that influence the earth through some type of physical force. For he firmly rejected this basic supposition of astrology.

Astrology in antiquity was built upon the idea that the heavenly bodies wield a type of influence upon earthly inhabitants. In its strongest pagan forms, this yielded a doctrine of unavoidable fate. In its milder forms, this force from the heavens was seen as influencing the health and lives of people on earth. Luther, however, rejected the idea of any type of impeding influence. For God created the stars to serve the wise. And if they are to serve, how can they dominate?[68] Accordingly, Luther also rejected the practice of astrology, particularly the idea of a celestial fate.[69] His early works show an especially strong rejection of this common feature of daily life among medieval people. In the sermons mentioned above, Luther at length decried "those splendid things of astrology and mathematics, which want so badly to be a science, but which can not escape inborn foolishness." And he equates the "dreams of the astrologers" with the philosophers' "glosses on Aristotle."[70] But his rejection was, again, tied to a theological argument. For Luther, natural philosophy had to be excluded from theology and the idea latent in astrology was that the stars by necessity caused us to sin. This was unacceptable. The counter argument of the more moderate astrology, that the stars merely incline us to sin and do not cause us to sin by necessity, was just as unacceptable because "every evil inclination is not outside of us but in us, as Christ says."[71]

Luther's judgment of astrology did not change, but on the other hand, it was not nearly so harsh once astrology was completely out of the way of theology. In the middle of the 1530's, lecturing on Genesis 1:14 at the University, he stated that, "I shall never be convinced that astrology should be numbered among the sciences. And I shall adhere to this opinion because astrology is entirely without proof. The appeal to experience has no effect on me."[72] Importantly, Luther was not speaking here of astrology in general, but instead specifically of the manner in which astrology, now excluded from theology together with all natural philosophy, was being included among the sciences of natural philosophy by Philip Melanchthon at the university. Luther's criticism was mild, but as long as the astrological ideas remained out of theology, Luther did not interfere with Melanchthon and his development of a new natural theology.

Within his overall emphasis on the sciences, Melanchthon specifically stressed the study of mathematics and the heavens. He and his students held disputations at the university not only on philosophy in general but on mathematics, geometry, and astronomy.[73] Although it was felt that the mathematical studies were useful to all parts of life, it was especially in the study of the heavens that mathematics was necessary for "there is no way into the studies of the heavens except through arithmetic and geomethry."[74] Melanchthon's main argument for the study of the heavens was that it taught about God's providence over the world. And astronomy was part of natural philosophy's investigation and explaination of the creation. Interestingly, Melanchthon continued to understand the cosmos in terms of Aristotelian physics. And physics included the idea of the influential force emanating from the heavenly bodies and affecting the earthly elements. For Melanchthon, a physical characteristic of the cosmos, identified by the ancients, was astrology, and this astrological interest would prove important in the early reception of Copernicus.

Melanchthon knew that Europe had inherited much of its contemporary study of the stars from the Arabs. But he rejected their curiosity into sorcery, astrology based on fate, and other predictions that were not based on a proper causation.[75] Nevertheless, Melanchthon found a proper logical astrology taught by Ptoloemy, Aristotle (*Meteora*), and Hippocrates (*Airs Waters Places*). And this was based on causation as taught by Aristotelian physics.[76] Thus, within the reformation of Wittenberg's natural philosophy, astrology was intended to be a part of physics not just a tool of the medical faculty. And there was a fair amount of effort put forward to accomplish this inclusion of astrology into natural philosophy such that it should be considered to be within the jurisdiction of the faculty of arts, which taught natural philosophy, as well as the medical faculty.

At Wittenberg in 1535, Melanchthon's student Jacob Milich held a disputation on the dignity of astrology.[77] Importantly, he notes that astrology is seen as distinct from common medical predictions based on observation of symptoms; but, he argues, astrology is in no way dissimilar from these. This reflects that the Wittenberg faculty was including astrology, which previously had been used by medics but otherwise was seen as a superstition outside of the university, within natural philosophy. Milich argues that this astrology is useful to life in many ways, just as the medical diagnoses are. And astrology should not be rejected just because it cannot foresee everything because Medical diagnoses do not foresee everything either. He claims that since the "stars have some effects" it is to be conceded that astrology is a part of physics, just like medical predictions.[78]

These arguments, proposed by a student of Melanchthon, reflect the very same arguments presented by Melanchthon himself in many places. In Melanchthon's mind he was altering the landscape of natural philosophy by the inclusion of astrology as a logical consequence of physics.[79] In part of his influential and fundamental book *initia doctrinae physicae*, which was used in Germany for years, Melanchthon discussed physics and its application to the movement of the stars. He then goes on to ask whether all divination or astrology is prohibited by the scriptures, which he answers in the negative. For he distinguishes between those predictions which have physical causes and those which have no causes.[80] Astrological predictions based on physical causes are the same as "such signs as the medics observe, as when they make a judgment from a fast or slow pulse of the arteries."[81] In other works, such as his *Interpretatio* *operis quadripartiti Claudii Ptolemaei de praeditionibus astronomicis*, he goes on at length to discuss specific effects of the stars upon the earth and people.[82] These ideas in the early works of Melanchthon continued for many years to wield influence in the class room upon the students who studied at Wittenberg.

Among the students who gathered around Melanchthon in the later years of the 1530's was Joachim Rheticus. He came to Wittenberg in 1532 as a student, and in 1536 was elected to a new chair of lower mathematics at the university. Rheticus was very interested in astronomy and in 1539 he took a leave of absence to visit the aged astronomer Copernicus to learn of his rumored ideas.[83] He brought with him a new Greek edition of Ptolemy (Basle 1538), which helped Copernicus continue his work. Rheticus became a believer in Copernicus' new heliocentric ideas and wrote a summary of the astronomer's work in the now well known *Narratio Prima*, published in 1540. Finally, in 1541, Rheticus and others had convinced a hesitant Copernicus to publish his *magnum opus,* now known as *De revolutionibus*. Rheticus left the astronomer's company and returned to Germany. But on account of Melanchthon's critical attitude toward the heliocentric theory, the paper could not be published immediately. In 1542, Rheticus took the manuscript to Nuremberg and left it with Andreas Osiander, a Lutheran theologian and amateur astronomer, for publication there. But Osiander did not publish the manuscript as he received it. In 1540, Osiander had become interested in Copernicus' work and had suggested that in order to avoid the displeasure of the theologians he could publish his work as a mathematical hypothesis useful for calculation but not as an actual description of the cosmos. Copernicus firmly refused.[84] Having the manuscript to himself, however, Osiander took it upon himself to add a forward to the work, titled *To the Reader Concerning the Hypothesis of this Work,* which placed the heliocentric theory into the category of a mathematical abstraction not a description of physics.[85] This was a convenient device, which allowed *De revolutionibus* to be categorized in such a way as not to conflict with Aristotelian physical reality and church doctrine based on Aristotle's philosophy, and yet be used as an accurate calculation tool.[86] Thus, as published, *De Revolutionibus* consisted of Osiander's preface, the important first book, which explained the new heliocentric theory, and five remaining books which contained the supporting mathematical and observational material.

Thus Copernicus' ideas were not widely accepted as a physical model of the cosmos as the astronomer intended. Westman points out that between 1543 and 1600 there are no more than ten thinkers who chose to adopt the main claims of heliocentrism.[87] But at this early date, Copernicus' ideas were not condemned outright or persecuted in the name of biblicism. The early reaction in Germany was instead one of practical usage of Copernicus' observations and mathematical models, especially in support of astrological interests, while the main thesis of heliocentrism was all but ignored. The explanation for this was not primarily a biblicism but instead the reformed natural philosophy taught at Wittenberg.

Luther's only known reaction to Copernicanism is in an oft-quoted passage from his Table Talk recorded in 1539, before the publication of *De revolutionibus*, by those who shared his dinner table.[88] Luther's comment is frequently used to portray Luther as a biblicist and ignoramus.[89] But as Norlind has shown, the comment is often misused and as J.R. Christianson points out, "the very silence of Luther's massive corpus of authentic works tells us more about his views on Copernicus than does this one tangential and second hand remark."[90] Luther's silence simply reflects his consistent theological world view and his intent to leave the sciences to the other faculties, as long as they remained subject to theology. It was, instead, Melanchthon's natural philosophy, which his closest students inherited, that was decisive for the early reception of Copernicus' work in Germany.

As we have seen, Melanchthon's view of the cosmos was largely a combination of Aristotelian physics submitted to the authority of Lutheran theology.[91] Melanchthon could not accept the heliocentric theory as a representation of reality mainly because it was in conflict with Aristotelian physics and it could not be sufficiently supported with enough observational evidence at the time as to be so compelling as to overcome the ancient philosopher. But this did not keep Melanchthon from accepting and appreciating Copernicus' work as a computational model, which greatly supported his astrological interests.[92] The more accurately one could predict the position and movements of the planets, the more accurate was the work of the astrologer. It is consistent with this point of view that he could support those, such as his own students, who made use of Copernicus' work.

For example, Erasmus Reinhold became a student at Wittenberg in 1530 and became a member of the faculty of arts in 1536 and was very interested in Copernicus' work from the beginning. In 1551, he published his *Preutenic Tables* which were tables indicating the movement of the planets. These soon became indespensable to astronomers and astrologers. The superiority of Reinhold's work became clear and his tables became increasingly an astronomical requisite. Since the tables were known to derive from the astronomical theory of the *De revolutionibus*, Copernicus' prestige gained ground.[93]

Caspar Peucer was also a student of Melanchthon at Wittenberg and became Melanchthon's son-in-law. He taught at the university and in 1559 was named to the chair of medicine. In 1560 he became the rector of the university. Peucer was a faithful Philipist in theology as well as in science. Up until this time Copernicus' work had been discussed and used as a computational model within the lectures and text books used at Wittenberg.[94] In this position, Peucer was able to effectively spread the Wittenberg interpretation of Copernicus to other German universities.

Westman has shown how, after 1560, Copernicus' ideas were given serious consideration along side those of Ptolemy. Peucer and other professors at Wittenberg recommended *De revolutionibus* explicitly. But, as with their beloved teacher Melanchthon, heliocentrism was not accepted. However, it was pointed out how Copernicus' mathematics could be transferred mathematically in a valid fashion to a geostationary model. Thus Ptolemy and Copernicus came to be viewed as geometrically equivalent.[95] Aristotle's physics remained the norm but the Copernican model and its accurate predictions were alive and actively used among Melanchthon's former students.

This interpretation of Copernicus became influential throughout the German universities as the influence of Wittenberg spread and as many schools were reformed under the direct model and even guidance of Wittenberg.[96] Students from Wittenberg took up chairs across Germany and beyond spreading Melanchthon's system of natural philosophy. For example at the University of Altdorf, founded in 1578, one of the two chairs of natural philosophy taught from the *Philipus*, that is, Philip Melanchthon's books. And further, the statues left it to the individual mathematician to decide whether to discuss planetary theory according to Ptolemy or Copernicus.[97] In Denmark, it was Jørgen Christoffersen Dybvad, who studied with Peucer in Wittenberg, who wrote a book and introduced Copernicus to the University of Copenhagen along with associated works like the *Preutenic Tables.*[98] Tycho Brahe, too, studied for 8 years at

Lutheran universities and in 1574, at the beginning of his career, he sounds very much like the Philipists, claiming that Copernicus

> constructed certain things contrary to the principles of physics – the sun resting in the center of the universe, … yet he admits of nothing absurd as far as his mathematical axioms are concerned. … Everything which we in our age consider to be thoroughly investigated and well known about the revolutions of the stars has been established and handed down to us by these two scholars, Ptolemy and Copernicus.[99]

But Tycho Brahe escaped the culture of the universities as a predecessor to the court astronomers, and thus was not so restricted in his thought in regard to the relationship of physics and mathematics. But he too did not ultimately accept Copernicus' main thesis. It was left to another Lutheran, Johannes Kepler, and those after him, such as Galileo, to demonstrate the physical reality of Copernicus' ideas. In the preface to his famous work, the *Mysterium Cosmographicum*, Kepler praises Copernicus and points out that he "reached the point of ascribing to this same Earth the motion of the Sun, but where Copernicus did so through mathematical arguments, mine were physical, or rather metaphysical."[100] Thus, even at this time, the perceived relationship between physics and mathematics was not fundamentally changed, but these astronomers were willing to go beyond the first step taken in Wittenberg's natural philosophy as spread by the Philipist party. They were willing to abandon Aristotle and were able to construct a new physical model of the cosmos based on ever more precise observation and measurement, and thus recognized the importance and necessity of Copernicus' heliocentric ideas.

Despite the frequent claims that the reformers of Wittenberg violently rejected Copernicus on the basis of interpretations of certain bible passages, Luther and Melanchthon played an important role in the first stages of acceptance of Copernicus' work. Melanchthon's new formulation of natural philosophy with its inclusion of a physical model of astrology allowed Copernicus’s work to be actively used and discussed even if its main thesis was not accepted. This rejection of heliocentrism, however, was not primarily on the basis of a contradiction with scripture but rather because of the conflict with Aristotle, whom Melanchthon accepted as an authority in physical matters. Luther, on the other hand, had a more indirect role in the process. By excluding Aristotle from theology and supporting humanistic reforms in general, he cleared the way for Melanchthon to construct his natural philosophy in relation to this theology and teach this natural philosophy within the university.

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End Notes

1 Bienkowska 1973, 120.

[2]

[3] Pedersen 1978, 303.

[4] See Grant's discussion: Grant 1996, 9-17. "Popular science in the Roman West was nearly coextensive with the whole of science. … There is no denying … that a scientific dark age had descended upon Western Europe.", 17.

[5] Michael Mahoney has stated: "to succeed the Romans was to succeed to nothing beyond the rudiments of computational arithmetic on the abacus and of mensurational geometry immediately applicable to surveying and architecture." Mahoney 1978, 145.

[6] This general skepticism has its roots already in the New Testament when Paul warns of being misled through "hallow and deceptive philosophy" (diaV th'" filosofiva" kaiV kenh'" ajpavth") (Col. 2:8). This warning took root especially among the Latin authors such as Tertullian: "What indeed has Athens to do with Jerusalem? What concord is there between the Academy and the Church? What between heretics and Christians?" *praescr.* 7 (ANF 3, 247).

[7] See Grant's discussion in Grant 1996, 5-7.

[8] Pedersen considers the correct calculation of Easter in accordance with the rules given at the Council of Nicea (325) as the one serious accomplishment of Western astronomy in the main part of the Middle Ages. Bede's *de temporum ratione* "became the basis of the medieval science of *compotus*, an independent mathematical discipline of high standards and immediate practical relevence." Pedersen 1978, 307.

[9] Pedersen 1978, 305.

[10] Wallace 1978, 92-94.

[11] "The first contact with Islamic astronomy was made in the last decades of the tenth century, when a few students from northern Europe crossed into Spain to study in monasteries on the southern slopes of the Pyrenees where Islamic influence could already be felt. With the return of these students to northern Europe, the schools in which they taught became centers for the dissemination of Greco-Arabic science." Pedersen 1978, 309.

[12] On Gerbert of Aurillac see Grant, 19-20. The first instruments include the abacus, the armillary sphere, and the astrolabe. The astrolabe was a circular disk of brass or copper with a graduated circle and a sighting device (alidade). It measured the altitude of a heavenly body within an accuracy of a degree. The first recorded use of this instrument was in October, 1092 by Walcher, Abbey of Malvern. In 1108, he published an astronomical table for the period 1036 – 1112. This was the beginning of true astronomical literature in the West. In 1126, Adelard of Bath tranlated the *Astronomical Tables of al-Khwarizmi*, thus giving Western astronomers complete Arabic astronomical tables for the use of the astrolabe along with precepts for their use. By the end of the twelth century several such tables had been translated and modified for various European localities. Pedersen, 309-313.

[13] Adelard of Barth was one of the first to translate Arabic scientific works into Latin including , c. 1120, a work by Abu Ma'shar, a 9th century Arabic astronomer of great astrological reputation.

[14] "The twelfth century intellectual effervescence stirred up by Arabic learning opened a transitional period in natural philosophy based principally on the premises of astrology. Until they could grow past this necessary transition, the minds of the Latin scholars in the twelfth century were not yet prepared for the reception and full understanding of Aristotle's genuine natural philosophy." Lemay 1962, 8. Lemay has demonstrated the Aristotelian basis of the astrology of Abu Ma'shar and the influence of this astrology upon the Latin West in his book.

[15] Grant, 22-26.

[16] Not every university had each of the higher faculties.

[17] Kibre and Siraisi 1978, 126-127.

[18] An example of this is application of natural philosophy to the discussion of the real presence in the Eucharist and the resulting explanation in terms of substance and accidents, i.e. Aristotelian categories.

[19] Westman 1980, 118-120.

[20] See for example Russell 1989. And also, Esser 1997.

[21] For example Peter of Abano (d. c. 1316) was professor of "philosophy, astrology, and medicine" at Padua and claimed that "medicine, logic, astrology and natural science" are the most necessary of the arts. (Kibre and Siraisi 1978, 135)

[22] Westman 1980, 119.

[23] "… [the mathematician's] social position in the university was such as to dampen incentive toward making the mathematics professorship into a research role in problems of cosmology and theoretical astronomy; it was largely a pedagogical position for an undergraduate subject." Westman 1980, 120.

[24] "[He mentions] theology, or metaphysics, as it was usually called, which considers things that exist separately from matter or body and are unchangeable - that is, spiritual substances and god; (2) mathematics, which also treats of things that are unchangeable, but only things that are abstracted from physical bodies and therefore have no separate existence, such as numbers and geometric figures; and (3) physics, which treats of things that not only have a separate existence but are changeable and possess an innate source of movement and rest. Physics was applicable to both animate and inanimate bodies." Grant, 135.

[25] Pedersen 1978, 320-322.

[26] Murdoch 1982, 174.

[27] Grant 1996, 151.

[28] Pedersen 1978, 321.

[29] Benrath 1966, 32-33.

[30] See Kusukawa 1995, 13-15 from which this information is taken.

[31] Schwiebert 1950, 134-136.

[32] Schwiebert 1950, 136.

[33] Schwiebert 1950, 145-149.

[34] Schwiebert 1950, 280-285.

[35] Luther's letters of this time contain many references to classical literature.

[36] Aug. 24, 1516. LW 48, 17.

[37] Oct. 19, 1516. LW 48, 24-25. See also Luther's letter of March 1, 1517 (LW 48, 40) for a further comparison of Jerome and Augustine.

[38] Grant, 40-41. This was essentially a humanist idea being applied to theological studies by Luther.

[39] Feb. 8, 1517. LW 48, 37. Peter Lombard's *Sentences* was a scholastic presentation of theology making use of quotes from the church fathers. It was a fundamental text for the teaching of scholastic theology.

[40] Feb. 8, 1517. LW 48, 37. Luther, in his typically blunt fashion, continues: "if Aristotle had not been flesh, I would not hesitate to claim that he was really a devil."

[41] WA 1, 226. Schwiebert 1950, 296.

[42] In his letter of May 18, 1517 (LW 48,42), Luther says, that "our theology and St Augustine are progressing well, and with God's help rule at our University. Aristotle is gradually falling from his throne, and his final doom is only a matter of time. It is amazing how the lectures on the *Sentences* are disdained. Indeed no one can expect to have any students if he does not want to teach this theology, that is, lecture on the Bible or on St. Augustine or another teacher of ecclesiastical eminence."

[43] By March of 1518, Luther could write that, "Our University is getting ahead. We expect before long to have lectures in two or three languages. New courses are to be given in Pliny, Quintilian, mathematics, and other subjects. The old courses in Peturs Hispanus, Tartaretus, and Aristotle are to be dropped." WA Br 1, 226. Schwiebert 1950, 297.

[44] LW 48, 63.

[45] See his letters of Dec. 9, 1518 (LW 48, 95-96), Feb. 7, 1519 (LW 48, 107), and March 13, 1519 (LW 48, 111-113). Also see *To the Christian Nobility*, LW 44, 201.

[46] Kusukawa 1995, 43.

[47] "*Nec ego ignoro aliud doctrinae genus esse Philosphiam, aliud Theologiam. Nec ego illa ita misceri volo.*" CR 11, 282. Melanchthon, however, saw more agreement between philosophy and theology than did Luther. For Melanchthon adds that those who are ignorant of philosophy "*non satis videant aut quid Theologia profiteatur, aut quatenus cum Philosophia consentiat.*"

[48] Moran 1973, 6.

[49] Moran 1973, 1.

[50] Letter of March 13, 1519. LW 48, 111-113.

[51] Kusukawa 1995, 44-46.

[52] Luther concludes: "Darumb, lieber Mensch, laß natürlich Kunst faren." WA 11[1], 569.

[53] For example, in the famous Marburg Colloquiy, where Luther and Melanchthon discussed the doctrine of the Lord's Supper with the Swiss reformers, Luther repeatedly denied the applicability of mathematical considerations or philosophical definitions in deciding the correct doctrine of the Real Presence. In one place, it is reported Luther stated that "God is omnipotent and can maintain a body without a location; he is not only able to do this but in fact he actually does it. The universe, he said, is the greatest of all bodies and yet, even according to the view of science, it is not in a place because outside of the universe there is neither place nor time. Even the Aristotelians declare that the most distant planet is not in a place. Luther added: the debate concerning space and its nature belongs to the realm of mathematics; theology, however, deals, rather, with the omnipotence of God which is above all mathematics. Therefore, he did not wish to dispute about mathematical concepts in this place and in a theological argument that has to do with divine omnipotence, although he would not refuse to engage in a debate of this kind in private at some other time." LW 38, 75.

[54] LW 15, 9.

[55] Kusukawa 1995, 66. CR 12, 692-695.

[56] For an expression of the distinction between mathematics and theology see above concerning the Marburg colloquy. Also see: WA 14, 102, 35 (1524) where he declares that the principle "the number two recedes from unity" is a mathematical point which is invalid in discussing the text of Genesis. Also WA 40[II], 458, 26 where he rejects both "*Mathematica et Physica*" in explaining a text in Psalm 51. Also, the connection between Law and Gospel is so intimate, says Luther, that "*nulla Mathematica coniunctio potest dari quae esset huic similis*" WA 40[I], 527, 26.

[57] WA 4, 449, 29. So Luther is arguing that "*finis*" in Psalm 145 is not a geometrical statement, that is, not an "end" as a spacial entity.

[58] WA 40[II], 470, 6. (1532). Notice that the text of the two editions of the sermon disagree at this point, one reads as above, the other (WA 40[II], 470, 19) reads "*medium non Mathematicum sed Physicum*". But, whatever theological point Luther was making, the important matter here is that he clearly contrasts the two. Notice also WA 40[II], 75, 22 where Luther makes use of the idea of mathematical "unity."

[59] WA 40^{I}, 292, 13-15. In this text, Luther is actually criticizing the theology of the scholastic theologians, who are making use of this idea of a geometrical middle or point. This shows that in making use of these ideas and the distinction between mathematics and reality, Luther is, in general, simply reflecting medieval university culture.

[60] "*Ex Philosophia procedunt: charitas est qualitas herens in animo, qua elicior ad actum bene vele.* Das ist *nuda, macra et mathematica charitas, sed oportet charitatem esse: servat. nisi hoc, non est charitas*." WA 40^{II}, 65, 4-7.

[61] And so he claims that God "*exercet in puncto mathematico iustitiam*." WA 40^{II}, 524, 6. And in a bold contrast, Luther states that, while a moral life corresponds to a physical point, which is always to be divided, doctrine corresponds to a mathematical point, which is not able to be divided. "*In Philosophia modicus error in principio in fine est maximus. Sic in Theologia modicus error totam doctrinam evertit. Quare longissime discernenda sunt doctrina et vita. … Est enim doctrina instar Mathematici puncti, non potest igitur dividi, hoc est, neque ademptionem, neque additionem ferre potest. Contra vita, quae est instar Physici puncti, semper dividi, semper aliquid concedere potest.*" WA 40^{II}, 46, 17-28.

[62] Notice, for example, "*Quando loquimur de deo nostris vocabulis, tum fiunt aliena. Trinitas, unitas sunt vocabula mathematica, et tamen non possumus aliter loqui.*" WA 36, 184, 16-17.

[63] LW 1, 46.

[64] "Unter diesem Gesichtspunkte einer göttlichen Strafe haben allerdings alle Himmelszeichen für eine Bedeutung. Sie sind Zeichen göttlichen Zornes, auch wenn für den Augenblick keine sichtbaren Wirkungen verspürt werden können." Klingner 1912, 95.

[65] WA 17^{1}, 482, 33. Luther gives a specific example, "*ut de Cometa, quando ea apparet, quo caudam vertit, ibi malum est futurum.*" Notice, Luther repeats the contemporary idea that the stars and the moon receive their light from the sun and that an eclipse is caused by the earth getting in between the light source and its object. LW 48, 41. Also LW 22, 59.

[66] "*Ego simpliciter intelligo Eclipses qui hoc praeterito decennio frequentissime apparverunt. Non respicio ad mathematicos qui naturalem illam dicunt eclipsim. Ego dico: solis propria natura est splendere, si hunc amiserit, signum erit divinum.*" WA 17^{1}, 450, 19. See also WA 45, 338, 11ff.

[67] "*Apud nos cometa ad occidentem in angulo apparet (ut mea fert astronmia) tropici cancri et coluri aequinoctiorum, cuius cauda pertingit ad medium usque inter tropicum et ursae caudam. Nihil boni significat.*" WA Br 6, 165, 5. In 1535, he also notes another event, "*nunc altera coniunctio transiit innoxia*." WA Br 7, 244, 9.

[68]And so he explicitly rejected Ptolomeus' idea of the influence of the stars. "*Si in ministerium, quomodo in dominum? At subtiliter evadunt dicentes authoritate sui Magistri Ptolomei 'Sapiens dominatur astris, ideo praevernire et impedire postest influentias stellarum'. … Solus enim Deus timendus est in omnibus. Caetera omnia ut ministeria in bonum electis opperantia esse debemus intelligere.*" WA 1, 405, 20-40.

[69] In his lectures on Romans, Luther says in regard to the prophecies of the Old Testament: "All this has been done so that when the promise of God has been fulfilled, it should in these words be apparent that it was His plan to act thus, so that we might recognize that the Christian religion is no the result of a blind accident or of a fate determined by stars, as many empty-headed people have arrogantly assumed." LW 25, 145.

[70] "*lauta illa Astrologia seu Mathematica, quae valde cupit esse scientia, sed non potest stulticiam ingenitam exuere.*" WA 1, 404, 1. And WA 1, 494, 21.

[71] "*Omnis mala inclinatio non extra nos, sed in nobis est, sicut ait Christus: De corde exeunt cogitationes malae.*" WA 1, 404, 24.

[72] LW 1, 45.

[73] For example, see Melanchthon's disputation *De philosophia,* held in 1536. CR 11, 278-284. See the disputation by Joachim Rheticus *Praef. In arithmeticen*, held in 1536, in which he defends the usefulness of mathematics. CR 11, 284-292.

[74] "*ad doctrinam de rebus coelestibus nullus aditus patet, nisi per Arithmeticam et Geometriam.*" CR 11, 287.

[75] Kusukawa 1995, 129.

[76] In this matter Melanchthon was greatly influenced by his Tübingen professor, Johannes Stöffler. Moran 1973, 8-9.

[77] CR 11, 261-266. He defines astrology as that "*quae de syderum effectibus in natura inferiore disputat.*"

[78] CR 11, 262-264. Benrath states: "Selbst die Astrologie nahm Melanchthon ernst: sie war ihm eine Gabe Gottes an die Menschen, wie alle anderen Wissenschaften." Benrath 1966, 43.

[79] Kusukawa 1995, 141.

[80] Melanchthon points out that Ptolemy's term for these was ajnaitiolovghtoi,

[81] CR 13, 335-337.

[82] CR 18, 2-118.

[83] Kesten 1945, 263-264.

[84] For most of the above, see Dobrzycki 1973, 26-28.

[85] Westman 1980, 107.

[86] See Moran 1973, 13-16.

[87] Westman 1980, 106.

[88] There are two separate records of Luther's discussion, WA Tr 1, 412 and WA Tr 4, 412.

[89] See for example Bienkowska 1973, 123.

[90] Wilhelm Norlind shows that the form in which Luther's comments are most commonly quoted are taken from the least reliable copyist. The more reliable table talk copyist does not have Luther calling Copernicus a "fool". Norlind 1953, 275-276. Also Christianson 1973, 2-3.

[91] Moran 1973, 4.

[92] Moran 1973, 10-14. Melanchthon, in his 1549, edition of the *Initia Doctrinae Physicae* spoke critically of the heliocentric theory and pointed out that already in antiquity Archimedes had proposed such a "joke." But in subsequent editions of the *Initia*, Melanchthon toned down his criticism as he made use of Copernicus' work as a useful tool.

[93] Kuhn 1966, 188.

[94] Westman 1975, 178-180.

[95] Westman 1975, 180-181.

[96] "As part of the general expansion of the German evangelical universities under Melanchthon's administrative direction, there occurred a significant increase in the number of mathematical chairs between roughly 1530 and 1560. On of the reasons why Copernicus's theory was taken up and studied so intensively in Germany is precisley because there existed a 'critical mass' of mathematical astronomers who were equipped to understand its technicalities." Westman 1980, 121.

[97] Moran 1973, 1.

[98] Moesgarrd 1973, 117-119.

[99] Christianson 1973, 8-9.

[100] Kepler 1981, 63.