Essays on the Origins of Western Music

by

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Essay Nr. 2: On the Music of the Spheres

To thee, the heaven and its stars make music,
Sun and moon sing praises to thee,
The whole earth is making music for thee.[1]
"Hymn to Hathor"
Temple of Dandera

This ancient Egyptian hymn suggests that some form of the concept of "music of the spheres," the notion that musical sounds are produced by the movements of the planets, was known in Egypt long before the beginning of European literature. If there were logic supporting this concept, for the ancients it would have proceeded something like this: [1] music tones are created by vibration, [2] vibration is caused by movement, hence [3] the movement of the planets must *ipso facto* create sound. But there was a problem because no one could hear these sounds. The ancients did not yet understand the role of air in carrying the sounds of music, nor did they understand there was no air in space. They only knew they could not hear the music of the spheres and the efforts of those who felt obligated to explain this makes for interesting reading.

The basic concept of the music of the spheres had much to recommend for itself to the ancient Greeks, who were always very interested in the relationship of man and nature. Surviving ancient Greek literature tends to associate this concept with Pythagoras (c. 6th century, BC) and his discovery of the numerical ratios of the lower part of the overtone series. Again, believing everything in nature must be related, they presumed that the ratios representing the separation of the lower tones of the overtone series must be the same ratios as those representing the distances separating the planets.

[1] Quoted in Lise Manniche, Music and Musicians in Ancient Egypt (London: British Museum Press, 1991), 12. Hathor was a dual god, an Egyptian god of love and music.

But there are problems with Pythagoras, to whom we will address a separate essay, beginning with the fact that there are no extant writings by him. All we have are the ideas attributed to Pythagoras by his followers and students. Nevertheless, even Aristotle seemed to identify the notion of the music of the spheres with Pythagoras and his school.

> **The so-called Pythagoreans, who were the first to take up mathematics, not only advanced this study, but also having been brought up in it they thought that its principles were the principles of all things. And since of these principles *numbers* are by nature the first, and in numbers they seemed to see many resemblances to the things that exist and come into being -- more than in fire and earth and water...since again, they saw that the modifications and the ratios of the musical scales were expressible in numbers -- since, then, all other things seemed in their whole nature modeled on numbers, and numbers seemed to be the first things in the whole of nature, they supposed the elements of numbers to be the elements of all things, and *the whole heaven to be a musical scale* and a number.**[2]

According to Porphyry (3rd century AD), Pythagoras claimed to be the only person who could hear the music of the spheres, his students not being developed enough to be able to do so.

> **He himself could hear the Harmony of the Universe, and understood the universal music of the spheres, and of the stars which move in concert with them, and which we cannot hear because of the limitations of our weak nature....**
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> **Pythagoras affirmed that the Nine Muses were constituted by the sounds made by the seven planets, the sphere of the fixed stars, and that which is opposed to our earth, called the "counter-earth." He called Mnemosyne, or Memory, the composition, symphony and connection of them all, which is eternal and unbegotton as being composed of all of them.**[3]

Perhaps Pythagoras could hear the music of the spheres, but Aristotle could not and as a result for him this subject never made sense. In the following passage he points out that the difficulty is in the absence of proof.

> **Some think it necessary that noise should arise when so great bodies are in motion, since sound does arise from bodies among us which are not so large and do not move so swiftly; and from the sun and moon and from the stars in so great number, and of so great size, moving so swiftly, there must necessarily arise a sound inconceivable great. Assuming these things and that the swiftness has the principle of harmony by reason of the intervals, they say that the sound of the stars moving on in a circle becomes musical. And since it seems unreasonable that we also do not hear this sound, they say that the reason for this is that the noise exists in the very**

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[2] Metaphysics, quoted in Giovanni Reale, A History of Ancient Philosophy (Albany: State University of New York Press, 1987, 61.
[3] Porphyry, Ibid.

nature of things, so as not to be distinguishable from the opposite silence; for the distinction of sound and silence lies in their contrast with each other, so that as blacksmiths think there is no difference between them because they are accustomed to the sound, so the same things happen to men. What occasions the difficulty and makes the Pythagoreans say that there is a harmony of the bodies as they move, is a proof. For whatever things move themselves make a sound and noise; but whatever things are fastened in what moves or exist in it as the parts in a ship, cannot make a noise, nor yet does the ship if it moves in a river.[4]

In the end, Aristotle stated his belief without qualification: this concept is not true.

> **It is clear that the theory that the movement of the stars produces a harmony, ie., that the sounds they make are concordant, in spite of the grace and originality with which it has been stated, is nevertheless untrue.**[5]

Aristotle was, of course, one of the most brilliant and rational minds of all time, a man who's thought had enormous influence on the following centuries. Nevertheless, even with his clear rejection, the music of the spheres was an idea apparently too attractive to let die.

Plutarch (1st century, AD), one of the last of the ancient Greek philosophers and a writer with a keen ear for good stories, provides some additional information on the beliefs regarding the music of the spheres held among the followers of Pythagoras. It appears that many new claims had been superimposed on the original concept of Pythagoras during the four centuries after Aristotle.

> **For some there are who seek these proportions in the swift motions of the spheres of the planets; others rather in the distances, others in the magnitude of the stars; others, more accurate and nice in their inquiry, seek for the same proportions in the diameters of the epicycles; as if the Supreme Architect, for the sake of these, had adapted the soul, divided into seven parts, to the celestial bodies. Many also there are, who hither transfer the inventions of the Pythagoreans, tripling the distances of bodies from the middle. This is done by placing the unit next the fire; three next the Antichthon, or earth which is opposite to our earth; nine next the Earth; 27 next the Moon; 81 next to Mercury; 243 upon Venus; and 729 upon the Sun. The last (729) is both a tetragonal and cubical number, whence it is, that they also call the sun a tetragon and a cube.**
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> **.....**
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> **Others there are, who fancy the earth to be in the lowest string of the harp, called proslambanomenos; and so proceeding, they place the moon in hypate, Mercury and Venus in the diatoni and lichani; the sun they likewise place in mese,**

[4] "De Caelo," II, quoted in Milton C. Nahm, Selections from Early Greek Philosophy (New York: Appleton-Century-Crofts, 1964), 58.
[5] "De Caelo," 290b.13.

as in the midst of the diapason, a fifth above the earth and a fourth from the sphere of the fixed stars.

But neither doth this pleasant conceit of the latter come near the truth, neither do the former attain perfect accuracy. However, they who will not allow the latter to depend upon Plato's sentiments will yet grant the former to partake of musical proportions; so that there being five tetrachords, and in these five distances they place all the planets; making the first tetrachord from the Moon to the Sun and the planets which move with the Sun, that is, Mercury and Venus; the next from the Sun to the fiery planet of Mars; the third between this and Jupiter; the fourth from thence to Saturn; and the fifth from Saturn to the sphere of the fixed stars. So that the sounds and notes which bound the five tetrachords bear the same proportion with the intervals of the planets.

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So it is most probable that the bodies of the stars, the distances of spheres, and the swiftness of the motions and revolutions, have their sundry proportions, as well one to another as to the whole fabric, like instruments of music well set and tuned, though the measure of the quantity be unknown to us.[6]

Plutarch's Roman contemporary of the 1st century, Pliny the Elder, also mentions the music of the spheres but he does not take it seriously since he cannot hear these sounds.

The world thus shaped then is not at rest but eternally revolves with indescribable velocity, each revolution occupying the space of 24 hours: the rising and setting of the sun have left this not doubtful. Whether the sound of this vast mass whirling in unceasing rotation is of enormous volume and consequently beyond the capacity of our ears to perceive, for my own part I cannot easily say -- any more in fact than whether this is true of the tinkling of the stars that travel round with it, revolving in their own orbits; or whether it emits a sweet harmonious music that is beyond belief charming. To us who live within it, the world glides silently alike by day and night.[7]

Nevertheless, we are indebted to Pliny the Elder for providing us with information not found in earlier literature on Pythagoras, the latter's correspondence of the ratios of the tones of the scale with the order of the planets. Pliny cannot help observing that he found this more entertaining than believable.

But occasionally Pythagoras draws on the theory of music, and designates the distance between the earth and the moon as a whole tone, between Mercury and Venus the same, between her and the sun a tone and a half, between the sun and

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[6] "Of the Procreation of the Soul" Plutarch, himself, in "Conjugal Precepts," carried the logic of the overtone series into the domestic environment.

> As in musical concords, when the upper strings are so tuned as exactly to accord, the base always gives the tone; so in well-regulated and well-ordered families, all things are carried on with the harmonious consent and agreement of both parties, but the conduct and contrivance chiefly redounds to the reputation and management of the husband.

[7] Pliny the Elder, Natural History, II, iii.

Mars a tone, between Mars and Jupiter half a tone, between Jupiter and Saturn half a tone, between Saturn and the zodiac a tone and a half; the seven tones thus producing the so-called diapason, i.e. a universal harmony; in this Saturn moves in the Dorian mode, Jupiter in the Phrygian, and similarly with the other planets -- a refinement more entertaining than convincing.[8]

Another 1st century Roman, Quintilian (30-96 AD), also mentions the music of the spheres and the school of Pythagoras. One gets the feeling he was not prepared to contest six centuries of commentary on the music of the spheres, as he confesses he is "ready to accept the verdict of antiquity."

Pythagoras and his followers popularized the belief, which they no doubt had received from earlier teachers, that the universe is constructed on the same principles which were afterwards imitated in the construction of the lyre, and not content merely with emphasizing that concord of discordant elements which they style harmony, attributed a sound to the motions of the celestial bodies.[9]

During the early years of the Christian Era the credibility of the concept of music of the spheres increased, especially by the 4th century or so when most of the works of Aristotle were now unknown to Church philosophers.[10] **St. Ambrose described the music of the spheres not only as something real, but as something he could hear.**

By the impact and motion of these spheres there is produced a tone full of sweetness, the fruit of consummate art and of the most delightful modulation, inasmuch as the air, torn apart by such artful motion, combines in even and melodious fashion high and low notes to such a degree that it surpasses in sweetness any other musical composition.[11]

An important book on music by a "pagan" philosopher of the 5th century is the allegorical description of "The Marriage of Philology and Mercury," by Martianus Capella. This work is a defense of the importance of the seven liberal arts, which were by this time established in the Roman schools. These were the Trivium, consisting of Grammar, Dialectic, and Rhetoric, and the Quadrivium, consisting of Geometry, Arithmetic, Astronomy, and Music.[12] **The book was written at a time when Christianity**

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[8] Ibid., II, xx.
[9] Quintilian, The Education of an Orator (*Institutio Oratoria*), trans., H. E. Butler (London: Heinemann, 1938), I, x, 12.
[10] In its effort to rid the world of pagan ideas, the new Church, among other things, made a determined effort to burn the books of the ancient philosophers, including Aristotle.
[11] Saint Ambrose, "Six Days of Creation: Two," in Hexameron, Paradise, and Cain and Abel, trans., John J. Savage (New York: Fathers of the Church, 1961`), 50.
[12] Capella used the word, "Harmony," but his meaning was music.

had not yet won its final battle against the "pagans" and might well be thought of as an attempt to fight back against the efforts of the new Church to shut down traditional education and knowledge. Thus this book represents one of the efforts which helped keep the liberal arts alive during the "Dark Ages." Music for its own sake had been rejected by the Church and it could only find its place in the Church schools as a branch of mathematics. This is what Capella refers to when he writes,

> **Having long since taken her departure from earth, music has rejected mortals and their desolated academies....**[13]

Capella makes reference to the music of the spheres after "Harmony" [music] has sung at the allegorical wedding which his book describes. Some of the guests wondered at the "pains and labor involved in the production of the music and the effort and unabated concentration that must have gone into the mastery and attainment of harmonies so soft and caressing as to enthrall the innermost emotions of their hearts." It was a subject much discussed in ancient literature. The answer provided by "Harmony" begins with reference to the disinterest by the Church and mentions the music of the spheres.

> **A loathsome and detestable creature to earthborn mortals, I have been striking against the star-studded heavenly spheres, where I am forbidden to discourse on the precepts of my art -- this despite the fact that the swirling celestial mechanism, in the swiftness of its motion, produces a harmony which it recognizes as concordant with the gamut of all proportions.**[14]

Cassiodorus (480 - 573 AD), one of the great philosophers of the 6th century mentions the music of the spheres in a letter to the famous Boethius (475 - 524 AD). He recalls that earlier philosophers had found the lyre in the constellations and points out that while Nature has not prepared us to hear the music of the spheres, Reason assures us it must exist. In any case, he offers the consolation that we will finally hear this music in Heaven!

> **Yet, the harmony of heaven cannot be fittingly described by human speech, as nature has not revealed it to human ears, but the soul knows it through reason only. For they say that we should believe that the blessedness of heaven enjoys those pleasures which have no end, and are diminished by no interruption. They maintain, indeed, that things above are absorbed by that same perception, that**

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[13] Martianus Capella and the Seven Liberal Arts, trans., William Harris Stahl and Richard Johnson (New York: Columbia University Press, 1977), 349.
[14] Ibid., 356ff.

heavenly beings enjoy those same pleasures, and that those who are engrossed by such contemplations are constantly enfolded in blessed delights.[15]

His great contemporary, Boethius, in <u>De institutione musica</u>, divided music into three kinds, in an apparent descending order of importance: Cosmic Music (which included the music of the spheres), Human music (meaning vocal music) and Instrumental Music. It was a definition which would be followed for centuries, as we can see, for example, in the <u>Musica Disciplina</u> by Aurelian of the 9th century who faithfully copies the three divisions of music by Boethius. While Aurelian admits that man cannot actually hear the music of the spheres, he finds evidence for it in a mistranslation of a passage from the Old Testament book, Job 38:37, "...or who can make the harmony of heaven to sleep."[16]

A 10th century nun, Hrotswitha, also carries on the three divisions of music by Boethius in a very interesting play, <u>Paphnutius</u>. The character of the title is a monk, a teacher, who carries on an extensive dialog on the subject of music with a group of students, who have asked, "What *is* music?"[17] **Paphnutius answers with a brief description of the place held by music among the liberal arts. The Disciples beg for more information and Paphnutius relents, "since it is knowledge which monks don't have."**

Paphnutius, following the definition by Boethius, begins by telling the students that music is divided into three species: the celestial, the human, and that made with instruments.

> ***Disciples*. What does celestial music consist of?**
> ***Paphnutius*. Of the seven planets and the celestial sphere.**
> ***Disciples*. How do you mean that?**
> ***Paphnutius*. Because, you see, they produce the same harmonious music as the strings of stringed instruments; For just as in the case of instruments, we find the same concordances and intervals of like number and length.**
> ***Disciples*. And what are these "intervals" you speak of?**
> ***Paphnutius*. They are the distances which exist between the planets, as between the notes of strings.**

Upon further questions about the "notes" just mentioned, Paphnutius begins to speak in the complex mathematical language of Boethius. The students object to this

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[15] Letter to Boethius, in <u>Variae</u>, trans., Thomas Hodgkin (London: Frowde, 1886), II, xl.

[16] Modern translations, such as the Revised Standard Version, make no inference to music.

> Who has put wisdom in the clouds, or given understanding to the mists?
> Who can number the clouds by wisdom?

conceptional language and respond, "What has this got to do with *music*?," implying, we presume, that music has instead to do with feelings and emotions, not mathematics. The teacher's answer, like that of so many theory teachers today, is, "But that is how you *talk* about music!"

After some discussion of music theory, the students now ask the difficult question, "Why can't we hear the music of the spheres?" Of all early philosophers, this monk, Paphnutius, now gives the most complete answer, indeed four possible explanations.

> ***Disciples*. Well, why can't we hear them, then?**
> ***Paphnutius*. Many different reasons are given to explain why we can't hear the music of the heavenly spheres. Some assert it can't be heard because the music never stops, and we become accustomed to its sound. Others say it is the density of the air, while there are some who claim that a sound of such grand volume cannot physically be taken in by the narrow passages of our human ears. And there are some who say that the spheres give forth a sound so sweet, of such great joy, that if men ever heard it, they would all join together, of one common accord, forget about themselves and any other interest, and be intent only on following this sound as it led them from the East to the Western regions.**

The now well-known Hildegard, of the 12th century, mentions the music of the spheres briefly in the context of a description of the voices of the angels in heaven. She appears to have understood the necessity of air to hear musical sounds and seems to suggest it was the wind of earth which made possible hearing the music of the spheres. After describing the host of angels as having "a richer harmony than all the sounds living creatures have ever produced," she concludes,

> **More wonderful is this sound than the music of the spheres that arises from the blowing of the winds that sustain the four elements and are well adjusted to them.**[18]

The 13th century, French poem, "Romance of the Rose," mentions the music of the spheres in a passage reflecting the ancient Greek emphasis on the unity of man and nature. Moreover, the poem maintains that the music of the spheres is the source of all earthly music.

> **Sweet harmonies they make,**
> **Which are the source of all the melodies**
> **And divers tunes that we in concord set**
> **In all our sorts of song. There is no thing**

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[17] The Plays of Hrotswitha of Gandersheim, trans., Larissa Bonfante (New York: New York University Press, 1979), 108ff.
[18] "Vision Six: 4," in The Book of Divine Works, ed., Matthew Fox (Santa Fe: Bear & Company, 1987), 181ff.

That would not chant in unison with them.[19]

Johannes de Grecheo, in his De Musica (c. 1300) proves himself to be a man far ahead of his time. He was the earliest philosopher, in our view, whose descriptions regarding the nature of music seem to ring true with readers of our own time. Taking up the traditional classification of music into Music of the Spheres, Human Music and Instrumental Music, a classification which theorists had accepted without comment for half a millennium, Grocheo now blasts Boethius into oblivion. He courageously attacks the faulty logic, the pseudo-science, the beliefs of the Church and the nonsense which Boethius had put forth.[20]

> **Those who make this kind of division either invent their opinion or they wish to obey the Pythagoreans or others more than the truth, or they are ignorant of nature and logic. First of all, they say universally that music is a science concerning numbered sound. Nevertheless, celestial bodies in movement do not make a sound, although our ancestors believed this....**[21]

During the early Renaissance there were two Italian intellectuals who took the characteristics of the music of the spheres and transposed them onto the soul. Marsilio Ficino (15th century), for example, in his commentary on Plato's "Timaeus," carries over the concept of circular motion.

> **Musical consonance occurs in [air] and reaches the ears through motion, spherical motion: so that it is not surprising that it should be fitting to the soul, which is both the mean of things, and the origin of circular motion. In addition, musical sound, more than anything else perceived by the senses, conveys, as if animated, the emotions and thoughts of the singer's or player's soul to the listeners' souls; thus it preeminently corresponds with the soul.**

Similarly, another 15th century Italian, Franchino Gaffurio, in his De harmonia, finds the soul organized in correspondence with the ratios of sound and the planets.

> **The intellective part corresponds to the octave, the sensitive to the fifth, and the habitual to the fourth. The species of fourth are analogous to the motions of the habitual soul -- increase, stasis, and decrease; the species of fifth, to the powers of the sensitive soul -- sight, hearing, smell, and taste; the species of octave, to the**

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[19] Guillaume de Lorris and Jean de Meun, "The Romance of the Rose," trans., Harry Robbins (New York: Dutton, 1962), LXXXI, 187.
[20] Grocheo substitutes a new division of music into Civic, Regular and Church.
[21] Johannes de Grocheo, De Musica, trans., Albert Seay (Colorado Springs: Colorado College Music Press, 1967), 10.

function of the intellective soul -- imagination, intellect, thought, reflection, opinion, reason and knowledge.[22]

The above mentioned Ficino, who was also founder of the famous Florentine Academy, contributed a new definition of the purpose of music. Music, he believed, served man's "spirit" in the same way medicine serves the body and theology the soul. The music one hears provokes a memory in the soul of the divine music found in the mind of God and in the music of the spheres. He also found correlations between the music of the spheres and the signs of the zodiac and with the tones of the scale.

The great 15th century theorist, Tinctoris, followed the lead of Aristotle and declared that the heavenly spheres do not make sound. Music, he says, is of the earth, not the heavens.

> **But although, as Boethius says, some assert that Saturn is moved with the deepest sound and, taking the remaining planets in proper order, the moon with the highest, while others, however, conversely attribute the deepest sound to the moon and the highest to the stars in their movement, I adhere to neither position. On the contrary, I unshakably agree with Aristotle...together with our more recent philosophers, who most clearly prove that there is neither real nor potential sound in the heavens. For this reason I can never be persuaded that musical consonances, which cannot be produced without sound, are made by the motion of heavenly bodies.**
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> **Concords of sounds and melodies, therefore, from whose sweetness, as Lactantius says, the pleasure of the ears is derived, are brought about, not by heavenly bodies, but by earthly instruments with the cooperation of nature.**[23]

Leonardo da Vinci declared that the spheres moving through the heavens do not make a sound. In his ever inquiring way, he also wondered if, in Pythagoras' famous story, it were the hammer or the anvil which created the pitch.[24]

The two best-known English writers of the early Renaissance were poets, and for poets it was much nicer to cling to the imagery of the past. Chaucer (14th century) finds the music of the spheres to be the original source for melody and harmony in the world.

> **And after shewede he hym the nyne speres,**
> **And after that the melodye herde he**
> **That cometh of thilke speres thryes thre,**

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[22] Quoted in Claude V. Palisca, Humanism in Italian Renaissance Musical Thought (New Haven: Yale University Press, 1985), 177.
[23] The Art of Counterpoint, trans., Albert Seay (American Institute of Musicology, 1961), 14.
[24] Stuart Isacoff, Temperament (New York: Vintage Books, 2001), 86.

That welle is of musik and melodye
In this world here, and cause of armonye.[25]

Lydgate (15th century) also concludes that the planets are, "the mother of music."

How the seuene planetes in ther cours hem dresse,
Meuyng of sterris, sparklyng in ther brihtnesse,
With reuolociouns of the speeris nyne,
Moodres of musik, as auctours determyne.[26]

During 16th century Italy we also find writers who are still willing to believe in the music of the spheres. The great theorist, Gioseffo Zarlino, in his Le Istitutioni Harmoniche, takes the position that we may not hear the music of the spheres but we can understand it on the basis of Reason.

> **Every reason persuades us to believe at least that the world is composed with harmony, both because its soul is a harmony (as Plato believed), and because the heavens are turned around their intelligences with harmony, as may be gathered from their revolutions, which are proportionate to each other in velocity. This harmony is known also from the distances of the celestial spheres, for these distances (as some believe) are related in harmonic proportion, which, although not measured by the sense [of hearing], is measured by the reason.**[27]

This relationship between the music of the spheres and the soul, mentioned by Zarlino, is found again in Castiglione's famous book, The Courtier. Here Signor Gaspare questions whether music is something appropriate to "real" men and the Count answers,

> **Do not say that, or I shall launch into oceans of praise for music and remind you how greatly it was honored in the ancient world, and held to be sacred, and that the wisest of philosophers held the opinion that the universe was made up of music, that the heavens make harmony as they move, and that as our own souls are formed on the same principle they are awakened and have their faculties, as it were, brought to life thorough music.**[28]

Among the 16th century French writers we find two more explanations why we cannot hear the music of the spheres. First, the important theorist, Pontus de Tyard, in his book, Solitaire second, a character named "le Curieux," speaks of the ancient Greek notion of the universe being a kind of harmony, in which all of its parts have some comparable

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[25] "The Parliament of the Birds," 59ff.
[26] John Lydgate, Fall of Princes, ed., Henry Bergen (London: Oxford University Press, 1967), IV, 1166ff.. This work is ostensibly a translation of Giovanni Boccaccio's De Casibus Virorum Illustrium, although Lydgate freely engages in his own commentary and philosophy.
[27] Quoted in Palisca, Op. cit., 179.

relationship with the harmony found in music. He mentions the music of the spheres, offering the explanation for man's inability to hear it that, taken together, its effect is that of silence. Then he contends that the basic elements of the earth are related as the tones of the tetrachord, earth being as the lowest pitch, then water, air and fire.

For Montaigne, it is the constant, never ending quality of the music of the spheres which makes them unnoticeable to us.

> **...that those solid material circles rub and lightly play against each other and so cannot fail to produce a wondrous harmony (by the modulations and mutations of which are conducted the revolutions and variations of the dance of the stars) yet none of the creatures in the whole Universe can hear it, loud though it is, since our sense of hearing has been dulled by the continuity of the sound.**[29]

This is comparable, he says, to how blacksmiths become able to tolerate the noise of their shops.

Francisco de Salinas (1513-1590), an important Spanish writer, rejected the Boethius division of music into Cosmic, Human and Instrumental and instead divided music into that which moves only the sense, the intellect, or both. With regard to the music of the spheres, Salinas took the position that God would not have wasted his time on anything superfluous.

> **We do not believe that celestial motions yield any sounds at all, whether as subject or as efficient cause, as it pleases the physicists. Now aside from the reasons of Aristotle, which we did not wish to translate here, lest we seem to want to teach physics rather than music, it appears certainly probable that the creator of the universal framework would not have made anything superfluous any more than he would have failed to provide the necessities. For such would have been that celestial sound which could not be heard by anyone....**[30]

One of the most curious philosophical books of 16th century Germany which is worthy of some attention is Henry Agrippa's three volume De occulta philosophia,[31] **written in 1509-1510 before the appearance of Luther on the German scene. In spite of the title, "Occult Philosophy," Agrippa was at this time a philosopher in the old mold of Catholic Scholasticism. In a chapter, "Concerning the Agreement of them with the Celestial Bodies,**

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[28] The Courtier, trans., George Bull (New York: Penguin Books, 1967), I, 94ff.
[29] Essays, trans., M. A. Screech (London: Penguin, 1993), I, xxiii, 123.
[30] "De musica libri septem," I, 1, p. i, quoted in Palisca, Op. cit., 186.
[31] Henry Cornelius Agrippa, De occulta Philosophia, I, x. The best modern edition, which is highly recommended, is Donald Tyson, Three Books of Occult Philosophy (St. Paul: Llewellyn Publications, 1993).

and what Harmony and Sound is Correspondent of every Star," he goes far beyond any earlier philosopher by adding emotional qualities to the celestial sounds. This can only be understood as being the result of Humanism thought.

> **But understand now, that of the seven planets, Saturn, Mars, and the Moon have more of the voice than of the harmony. Saturn hath sad, hoarse, heavy and slow words, and sounds, as it were pressed to the center; but Mars, rough, sharp, threatening, great and wrathful words; the Moon observeth a mean between these two.**
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> **But Jupiter, the Sun, Venus and Mercury, do possess harmonies; yet Jupiter hath grave, constant, fixed, sweet, merry, and pleasant consorts; the Sun venerable, settled, pure and sweet, with a certain grace; but Venus lascivious, luxurious, delicate, voluptuous, dissolute and fluent; Mercury hath harmonies more remiss, and various, merry and pleasant, with a certain boldness: but the tone of particulars, and proportionate consorts obeys the nine Muses. Jupiter has the grace of the octave, and also the quinte, viz. the diapason with the diapente: the Sun obtains the melody of the octave voice, viz. diapason: in like manner by fifteen tones, a disdiapason: Venus keeps the grace of the quinte or diapente: Mercury has diatessaron, viz. the grace of the quarte.**

Then quoting some unnamed "ancients," he associates particular pitches with the planets, as well as the "humors" and the modes.

> **Moreover, they that followed the number of the elements, did affirm, that the four kinds of music do agree to them, and also to the four humors, and did think the Dorian music to be consonant to the Water and phlegm, the Phrygian to choler and Fire, the Lydian to blood and Air, the mixed-Lydian to melancholy and Earth: others respecting the number and virtue of the heavens, have attributed the Dorian to the Sun, the Phrygian to Mars, the Lydian to Jupiter, the mixed-Lydian to Saturn, the hypo-Phrygian to Mercury, the hypo-Lydian to Venus, the hypo-Dorian to the Moon, the hypo-mixed-Lydian to the fixed stars....**
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> **Moreover there are some who find out the harmony of the heavens by their distance one from another. For that space which is between the Earth and the Moon, viz. an hundred and twenty-six thousand Italian miles,[32] makes the interval of a tone; but from the Moon to Mercury being half that distance, makes a half-tone; and from Mercury to Venus another half-tone; but from there to the Sun, as it were three tones and a half, and that makes a diapente; but from the Moon to the Sun, a twofold diatessaron with a half; again from the Sun to Mars is the same space as from the Earth to the Moon, making a tone; from there to Jupiter half of the same making a half tone; so much likewise from Jupiter to Saturn, consisting of an half tone; from whence to the starry firmaments is also the space of an half tone.**

He concludes,

[32] Or about 116,000 English miles, whereas the correct distance is 240,000 miles.

> **Hence there are not any songs, sounds, or musical instruments more powerful in moving man's affections, or introducing magical impressions, than those which are composed of numbers, measures, and proportions, after the example of the heavens.**[33]

Agrippa makes no attempt to explain why we cannot hear any of this music of the spheres, but in Book III, he offered a unique explanation for the source of music's ability to soothe. He begins with a discussion of "divine frenzy," which is so often mentioned by the ancient poets. This comes from the Muses, he says, and the Muses, in turn, are the souls of the separate planets. Of these only the Sun is given a musical soul.

> **The fourth degree belongs to the sphere of the Sun; this possesses voices, words, singing and harmonic sounds, by the sweet consonance whereof it drives forth of the mind any troublesomeness therein, and cheers it up.**[34]

Johannes Cochlaeus, in his Tetrachordum Musices of 1511, keeps the division of music into Cosmic, Human and Instrumental, after Boethius, but he expands the Cosmic to now include the calendar, the seasons and the phases of the moon as well.

Andreas Ornithoparchus, in Musice active micrologus, of 1517, begins by dividing music into Mundane, Human and Instrumental Music. Mundane music, he finds in the "harmony caused by the motion of the stars and the violence of the spheres," which he also relates to elements and climate. Here he quotes a nice phrase, from a lost work by the philosopher, Dorilaus, "The world is God's organ." Even, as he admits, if we cannot hear the music of the spheres, one has to admit that God has created in all things number, weight, and measure. Since these are also the principal properties of music, therefore it is reasonable to believe that the music of the spheres exists.

Heinrich Glarean, in Dodecachordon, of 1547, mentions the theory of the music of the spheres as argued by Servius, that the planets existed in an order of decreasing volume, ranging from Saturn, Jupiter, Mars, the Sun, Venus, Mercury to the moon which was the softest. Glarean expresses some doubts about this, adding that his mention of the music of the spheres is necessary only because so many great early writers had discussed it. As for himself, he agrees with Aristotle that there is no basis in fact for this theory.

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[33] De occulta philosophia, Op. cit., II, xxvi.
[34] Agrippa, De occulta philosophia, III, xxxii.

But this indulgence is allowed to antiquity, which has thought that the human mind must be raised in every possible way to the contemplation of heavenly objects.[35]

In Elizabethan England we find the poets still calling upon the imagery of the music of the spheres. Humphrey Gifford doubts that we could live without this music.

The planets and celestial parts
Sweet harmony contain,
Of which if creatures were deprived
This world could not remain.[36]

His contemporary, Fulke Greville, in his romance, "Caelica," makes a lovely reference to the music of the spheres.

Atlas upon his shoulders bare the sky,
The load was heavy, but the load was fair;
His sense was ravished with the melody,
Made from the motion of the highest sphere.[37]

Shakespeare also seems to have been well read with respect to earlier theories on music, as we can see in his several references to the ancient Greek notion of the "music of the spheres." The most extended of these is found in <u>The Merchant of Venice</u>, where Lorenzo reflects,

How sweet the moonlight sleeps upon this bank!
Here will we sit, and let the sounds of music
Creep in our ears; soft stillness and the night
Become the touches of sweet harmony.
Sir, Jessica: look, how the floor of heaven
is thick inlaid with [patinas] of bright gold:
There's not the smallest orb which thou behold'st
But in his motion like an angel sings,
Still choiring to the young-eyed cherubins;
Such harmony is in immortal souls;
But, whilst this muddy vesture of decay
Doth grossly close it in, we cannot hear it.[38]

Finally, we should mention that Thomas Nashe, in his famous fictional work, <u>The Unfortunate Traveller</u> (1594), claims to have visited an estate in Rome where there was a

[35] Trans., Clement Miller (American Institute of Musicology, 1965), I, 136ff.
[36] Humphrey Gifford, "In the praise of music."
[37] Fulke Greville, "Caelica," XLVII.

banquet house with a mechanical illustration of the music of the spheres and in this case it was music which could be heard!

> **The heaven was a clear overhanging vault of crystal, wherein the Sun and Moon and each visible Star had his true similitude, shine, situation, and motion, and, by what enwrapped art I cannot conceive, these spheres in their proper orbits observed a kind of soft angelical murmuring music in their often windings and going about; which music the philosophers say in the true heaven, by reason of the grossness of our senses, we are not capable of hearing.**[39]

With the dawn of the 17th century we still find persons who express belief in the music of the spheres. The poet, Giambattista Marino, writes that whoever does not feel the power of the "charming melody" of voices and the lyre,

> **must have a spirit dissonant, that for**
> **the music of the spheres is out of tune.**[40]

The Spanish playwright, Molina, in <u>Tamar's Revenge</u> has Amnon rhapsodize,

> **Break forth, celestial harmony**
> **that kindles love and voice alone....**[41]

One of the most important studies on music of the 17th century was the monumental <u>Harmonie universelle</u> (1636), in five treatises, by Marin Mersenne. Mersenne begins his discussion of this subject by stating that he will not attempt to prove the existence of the music of the spheres, and then devotes many pages to doing precisely that.[42] **First he offers some possibilities why we cannot hear this music,**

> **Of course, we shall not be able to show whether the planets and stars make any sound. If the air extends as far as the firmament or infinity, as some people believe, having no doubt that God created it infinite....**
>
> **It is probable that the stars and planets make some sound, inasmuch as they do move in the air. We do not hear the sound, for we are accustomed to it from the wombs of our mothers. Sometimes the sound is too far from us, too low, too high, or too great to be heard, as happens with certain other phenomena. We are, for example, unable to hear the sound or noise which ants and other little animals make when they walk, run, crawl, or fly, inasmuch as the sound is too little and too feeble.**

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[38] <u>The Merchant of Venice</u>, V, i, 61ff. Additional references to the "Music of the Spheres," can be found in <u>As You Like It</u>, II, vii, 6; <u>Henry VIII</u>, IV, ii, 85ff and <u>Twelfth Night or What You Will</u>, III, i, 109.

[39] <u>The Works of Thomas Nashe</u>, ed., Ronald McKerrow (Oxford: Blackwell, 1966), II, 282ff.

[40] Giambattista Marino, <u>L'Adone</u> (1623), trans., Harold Priest (Ithaca: Cornell University Press, 1967), VII, 1-2, 10. Athanasius Kircher (1601-1680) also discusses the music of the spheres in Vol. 10 of his <u>Musurgia Universalis</u>.

[41] <u>Tamar's Revenge</u>, I, lines 649ff. Molina was a nom de plume for Fray Gabriel Tellez.

[42] Most of his discussion is found in Book II, v.

It may be concluded that sound has too imperceptible extremities. It may be too strong or too violent. It may be too feeble or too small. It may be made by too slow movement or too small movement. It may be made by a too swift, too large, or too precipitous movement. Both extremities exceed the sphere which the ear has for its activity and understanding.

Now, if the celestial bodies do make sounds, one may ascertain what their qualities are by considering the size and movement of the celestial bodies.

Mersenne next paraphrases the conclusions of the ancient Greek Pythagorean school of philosophy (not a single word of which is extant in the writings of Pythagoras himself).

The seven planets contain not only the consonances, but also the dissonances. Orpheus invented his heptachord or lyre of seven strings, each of which represented one of the planets, but the Pythagoreans added the *Proslambanomenos* from the Earth up to the Moon in order to create their lyre with eight strings. There was a whole-tone from the first acquired string up to the principal, which they called *Hypate*; there was a semitone from *Hypate* to *Parhypate*, which represented the distance from the Moon to Mercury. From *Hypate* up to *Lichanos* there was a whole-tone, which represented the distance from Mercury to Venus. From *Lichanos* to *Mese*, or from Venus to the Sun, there was another whole-tone. From there to Mars, or from *Mese* to *Paramese*, there was a semitone. Finally, from the *Paranete* or from Jupiter there was a whole-tone, and from Jupiter to *Nete* or Saturn there was another whole-tone. Consequently they placed the octave from the Earth to Saturn, the perfect fifth from the Earth to the Sun, the perfect fourth from the Moon to the Sun, the perfect fifth from Venus to Saturn, and the perfect fourth from the Sun to Saturn. Thus they based their music on planetary movement from east to west, for the movement of the lowest planets is the slowest, and that of the highest planets is the quickest, since the latter make a greater journey in the same time.

If, however, we tune a lute according to planetary movement from west to east, it is necessary to change the order of the names and give the *Proslambanomenos* to Saturn, the *Hypate* to Mars, etc.

Mersenne quotes at length another contemporary who believed in the music of the spheres, the German astronomer Johann Kepler (1571-1630), from whom he borrows the notion that,

...if the planets produce harmony, "it would be necessary to make Saturn and Jupiter the bass, Mars the tenor, the Earth and Venus the alto, and Mercury the soprano, because Mercury has a greater range and is livelier than the others."

In another place, Mersenne cites Gosselin and Guy Aretin relative to their theories that the musical intervals and the voice can be related to the planets, concluding that

Jupiter is the root, Saturn is the second, the Moon is the third, Mercury is the fourth, Venus is the fifth, the Sun is the sixth, Mars is the seventh and Jupiter again the octave. Mersenne, however, finds this knowledge not necessary for practical musicianship, although he observes that if there really is music of the spheres, the musical instruments should be tuned to these pitches.

One of the greatest continental scientists of the 17th century, Christian Huygens, left a treatise entitled, The Celestial Worlds Discovered: or, Conjectures Concerning the Inhabitants, Plants and Productions of the Worlds in the Planets (1698). We remind the reader that even by the 17th century telescopes were not powerful enough to determine if there were life on the moon, not to mention the other planets. Assuming they were all inhabited, and noticing that the same animals are found, generally, in both America and Europe, Huygens speculates on the nature of the music to be heard on the other planets and concludes it would be about the same as on Earth.

The English physicist and physician, Robert Flud (1574-1637) imagined that the Earth and the other planets constituted a cosmic musical instrument, which he called a Mundane Monochord. His book devoted to this, De Musica Mundana (1617), includes the following.

> **But it is to be considered that in this mundane monochord the consonances, and likewise the proper intervals, measuring them, cannot be otherwise delineated than as we divide the instrumental monochord into proportional parts; for the frigidity, and also the matter itself, of the earth, as to the thickness and weight thereof, naturally bears the same proportion to the frigidity as the matter of the lowest region, in which there is only one fourth part of the natural light and heat, as 4 to 3, which is the sesquitertia proportion; in which proportion a diatessaron consists, composed of three intervals, namely, water, air, and fire; for the earth in mundane music is the same thing as the fundamental in music, unity in arithmetic, or a point in geometry; it being as it were the term and sound from which the ratio of proportional matter is to be calculated. Water therefore occupies the place of one tone, and the air that of another interval more remote; and the sphere of fire, as it is only the summit of the region of the air, kindled or lighted up, possesses the place of a lesser semitone. But in as much as two portions of this matter are extended upwards as far as to the middle heaven to resist the action of the supernatural heat; and the same number of parts of light, act downwards against these two portions of matter, these make up the composition of the sphere of the sun, and naturally give it the attribute of equality, and by that means the sesquialtera proportion is produced, in which three parts of the lower spirit or matter of the middle heaven are opposed to the two parts of the solar sphere, producing the consonant diapente: for such is the difference between the moon and the sun, as there are four intervals between the**

convexity of this heaven and the middle of the solar sphere, namely, those of the entire spheres of the moon, Mercury, and Venus, compared to full tones, and the half part of the solar sphere, which we have compared to the semitone....

The great Francis Bacon hardly mentions the music of the spheres, but one sardonic comment speaks for itself.

> **The heavens turn about in a most rapid motion, without noise to us perceived; though in some dreams they have been said to make an excellent music.**[43]

In a catalog of projected histories, Bacon includes an "History of Sounds in the Upper Region (if there be any)."[44] **Finally, we might mention that in his History of Dense and Rare, Bacon, while discussing "motion of dilatation and contraction in the air by heat," mentions without further identification a musical instrument "played by the rays of the sun."**[45]

Christopher Simpson, in his Division-Violist (1654) finds significance in the number seven, there being seven pitch names, seven days of the week, creation fulfilled in seven days, the seven strings of the lyre of Orpheus and the (then known) seven heavenly bodies.

> **Within the circumference of this great universe, be seven globes or spherical bodies in continual motion, producing still new and various figures, according to their diverse positions one to another. When with these I compare my seven gradual sounds, I cannot but admire the resemblance of their harmonies, the concords of the one so exactly answering to the aspects of the other; as an unison to conjunction, an octave to an opposition; the middle consonants to a diapason, to the middle aspects of an orb; as a third, fifth, sixth, in music, to a trine, quartile, sextile in the Zodiac.**[46]

The English poet, John Donne, suggests the music of the spheres cannot be heard but can be felt.

> **Make all this All, three Choirs, heaven, earth, and spheres,**
> **The first, Heaven, hath a song, but no man hears,**
> **The Spheres have Musick, but they have no tongue,**
> **Their harmony is rather danced than sung.**[47]

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[43] James Spedding, ed., The Works of Francis Bacon (Cambridge: Cambridge University Press, 1869) VII, 389, Section 115.
[44] "Catalog of Particular Histories," in Ibid., VIII, 374.
[45] History of Dense and Rare, in Ibid., X, 265.
[46] Christopher Simpson, Division-Violist (1654), here (London: Curwen, 1965, facsimile of 1665 edition, 1965), 23ff.
[47] "Upon the translation of the Psalmes by Sir Philip Sydney," The Complete Poetry of John Donne, Op. cit., 389. Donne also mentions the "Spheares Musick" in "Valediction of the booke," [Ibid., 117] and in his "Obsequies to the Lord Harrington" [Ibid., 260].

Richard Crashaw makes the same assertion in his Hymn, "The Name of Jesus," in which he mentions the Music of the Spheres "which dull mortality more feels than hears."[48]

The greatest English poet of the 17th century, Milton, devoted much attention to the Music of the Spheres. He mentions this frequently in his poetry, beginning with the music of creation.

> **...up he rode**
> **Followed with acclamation and the sound**
> **Symphonious of ten thousand Harps that tuned**
> **Angelic harmonies: the Earth, the Air**
> **Resounded, (thou remember'st, for thou heardst)**
> **The Heavens and all the Constellations rung,**
> **The Planets in their station listening stood...**[49]

Several poems speak of the music of the spheres being in nine-parts, representing the seven known planets, the sun and our moon. In the poem, "The Hymn," we find,

> **Ring out ye Crystal spheres,**
> **Once bless our humane ears,**
> **(If ye have power to touch our senses so)**
> **And let your silver chime**
> **Move in melodious time;**
> **And let the Base of Heavens deep Organ blow,**
> **And with your ninefold harmony**
> **Make up full consort to the Angelike symphony.**[50]

And again in "Arcades,"

> **But else in deep of night when drowsiness**
> **Hath locked up mortal sense, then listen I**
> **To the celestial Sirens harmony,**
> **That sit upon the nine enfolded Spheres....**[51]

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[48] "The Name of Jesus," in The Complete Poetry of Richard Crashaw, Op. cit., 32. Crashaw mentions the music of the spheres again in his "Upon the Kings Coronation," lines 21ff; "Hymn in the Glorious Epiphanie," lines 131ff and in "The Teare" [Ibid., 51]. Henry Vaughan refers to the music of the spheres in his "The Tempest," in The Works of Henry Vaughan, Op. cit., 461. Lovelace mentions the music of the spheres in The Poems of Richard Lovelace, ed., C. H. Wilkinson (Oxford: Clarendon Press, 1930), 26, 92, 114, 160, 187.

[49] "Paradise Lost," VII, 557, in Frank Patterson, ed., The Works of John Milton (New York: Columbia University Press, 1931-1938), II, 231. In the same poem [V, 178] there is a reference to stars that move "in mystic Dance not without Song."

[50] "The Hymn," in Ibid., I, 6.

[51] "Arcades," in Ibid., I, 74.

Why, even God listens to the music of the spheres.

> **And in their motions harmonie Divine**
> **So smooths her charming tones, that Gods own ear**
> **Listens delighted.**[52]

In several places, such as in his masque composed for a performance at Ludlow Castle in 1634, Milton refers to the music of the spheres as "the Starry Quire."[53] **One of these "starry choir" references provides the only attempt by Milton to describe the actual music, "a never-dying melody, a song beyond all describing...."**[54]

Eventually, Milton left a lengthy discussion, "On the Music of the Spheres," which appears to have been intended as his contribution to a debate on this subject. In this work he summarizes the history of comments by various philosophers and includes the following,

> **But supposing no one on earth had ever heard this symphony of the stars, does it therefore follow that all has been silent beyond the circle of the moon, and lulled to sleep by the benumbing silence? Nay rather, let us blame our feeble ears which are not able, or are not worthy, to overhear the songs and such sweet tones....**
>
> **But Pythagoras alone of mortals is said to have heard this song; unless that good man was both some deity and native of the sky, who perchance by direction of the gods had descended for the purpose of instructing the minds of men with holy knowledge and of calling upon them to improve. Certainly he was a man who combined in himself the whole gamut of virtues and who was worthy to converse with the very gods like unto himself and to enjoy the company of the celestials. Therefore, I do not wonder that the gods, loving him very much, permitted him to take part in the most secret mysteries of Nature....**
>
> **But if we possessed hearts so pure, so spotless, so snowy, as once upon a time Pythagoras had, then indeed would our ears be made to resound and to be completely filled with that most delicious music of the revolving stars....**[55]

Among the Restoration poets, Dryden mentions the music of the spheres, but cautions that upon the sounding of the trumpet on the Day of Judgment this music will end, "Musick shall untune the sky."[56]

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[52] "Paradise Lost," in V, 625ff, Ibid., II, 166.
[53] "A Masque," in Ibid., I, 89. A song in this masque also mentions "all Heaven's Harmonies." [Ibid., I,94].
[54] "Ad Patrem," line 35.
[55] "On the Music of the Spheres," in Ibid., XII, 149ff.
[56] The Works of John Dryden, ed., Edward Hooker (Berkeley: University of California Press, 1956), II, 109, 111.

James Thomson suggests that composers may find their inspiration in this celestial music.

> **O yon high harmonious spheres,**
> **Your powerful Mover sing;**
> **To Him your circling course that steers,**
> **Your tuneful praises bring.**
>
> **Ungrateful mortals, catch the sound,**
> **And in your numerous lays,**
> **To all the listening world around,**
> **The God of nature praise.**[57]

Alexander Pope, in his poem, "An Essay on Man," argues that God was wise in not making man's senses more sensitive than they are, as he would likely be miserable. Of music, he says,

> **If nature thundered in his opening ears,**
> **And stunned him with the music of the spheres,**
> **How would he wish that heaven had left him still**
> **The whispering zephyr, and the purling rill?**[58]

There are a number of references to the music of the spheres among the Jacobean playwrights, among them Marston's <u>The Insatiate Countess</u> (III, iv),

> **Let sphere-like music breathe delicious tones....**

And in Dekker's <u>Old Fortunatus</u> (I, i), Fortune says,

> **No more: curse on: your cries to me are Musicke,**
> **And fill the sacred roundure of mine ears,**
> **With tunes more sweet then moving of the Spheres.**[59]

Among the Restoration playwrights we find in George Villiers, <u>The Rehearsal</u> (V, i), a person who can hear the music of the spheres. A stage direction reads, "Soft Music," which is followed by this dialogue.

> ***King Usher*. What sound is this invades our ears?**
> ***King Physician*. Sure 'tis the Musick of the moving Spheres.**[60]

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[57] "Hymn to God's Power," in <u>The Poetical Works of James Thomson</u>, (London: Bell and Daldy, c. 1860), II, 141.
[58] "An Essay on Man," lines 201ff, in <u>The Works of Alexander Pope</u>, (New York: Gordian Press, 1967), II, 363.
[59] For additional references to the "music of the spheres" see: John Webster's <u>The Dutchesse of Malfy</u> (I, i); Thomas Dekker's <u>The Virgin Martyr</u> (V, ii) and <u>The Noble Spanish Soldier</u> (II, i); George Chapman's <u>The Blind Beggar</u> (Scene viii), a reference to the music of the spheres as a metaphor for a couple's feelings, "To echo sweetly to our celestial tunes"; Beaumont and Fletcher's <u>The Prophetess</u> (II, i), Delphia, a prophetess, gives a speech which includes "The Musick of the Spheres attending on us"; and Marston's <u>Antonio and Mellida</u>, Part II (III, i).

In George Farquhar's Comedy, Love and a Bottle (II, ii), the character, Rigadoon, comments,

> **From a prodigious great bass-viol with seven strings, that played a Jig called the *Musick of the Spheres*: The seven Planets were nothing but fiddle-strings.**[61]

In Mrs. Aphra Behn's The Emperor of the Moon (II, v) a character maintains she danced to the "Musick of the Spheres."

And now we come to Johannes Kepler (1571 - 1630), the last astronomer to take seriously the music of the spheres. One day, when teaching a geometry class in 1595, he was drawing on the blackboard a triangle inscribed within a circle, in the center of which there was yet another circle, whereupon he experienced a sudden insight -- it seemed to him that the ratio between these two circles was the same as that between the orbits of Saturn and Jupiter. This led to a long period of study in which he attempted to prove that the organization of the planets followed basic geometric figures.

Another turning point for Kepler came when he realized that in his purely geometrical and mathematical explanations he had given no consideration to *time*. It was the realization that time must be a factor in planetary design which caused him to turn his attention to *musical* harmony (which also moves through time), eventually resulting in his Harmony of the Universe (1619).[62] **He now began to feel that music might illustrate the logic of planetary geometry, as for example in a correspondence he saw between the overtones of a vibrating string and the division of a circle into equal arcs.**

Music, Kepler contends, reveals to us an order which is the principle also of our own being. The task of the astronomer is to correlate the harmony within with the harmony without. In the same way, he believed mathematical insights are only discovered, not invented. It follows that God, when making man, implanted in him consciousness of the fundamental harmonies which served as a pattern in the creation of the world.

It is in Book Five, of the Harmony of the Universe, that Kepler summarizes his theories of the "Music of the Sphere" and the relationship of this music to planetary

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[60] In Swift's Gulliver's Travels, when Gulliver travels to "Laputa," he finds people who can hear the music of the spheres.

[61] Farquhar mentions the Music of the Spheres again in The Inconstant (IV, iii).

[62] We present only a few excerpts from this book, as the entire work is available in a fine English translation as part of the Great books of the Western world (University of Chicago, 1990) found in all libraries. The reader will need to have an extensive background in math to turn these pages!

mechanics. He begins by reflecting on the many years of study which have brought him to this understanding, not failing to pay due tribute to those past and present who deserved recognition. It is important to remember that Kepler was about to set forth in considerable mathematical detail theories which were most unorthodox, and at a time when the idea that the Earth moved, and was not the center of the universe, was as yet by no means commonly believed. It was for this reason that Kepler concludes his introductory remarks by saying that he had decided to get up his courage and publish the book anyway. It's OK, he says, if it goes neglected for another hundred years -- after all, God waited six thousand years[63] for someone [Kepler] to come along to discover the musical relationships of the cosmos.

> **As regards that which I prophesied two and twenty years ago (especially that the five regular solids are found between the celestial spheres), as regards that of which I was firmly persuaded in my own mind before I had seen Ptolemy's Harmonies, as regards that which I promised my friends in the title of this fifth book before I was sure of the thing itself, that which, sixteen years ago, in a published statement, I insisted must be investigated, for the sake of which I spent the best part of my life in astronomical speculations, visited Tycho Brahe, and took up resident at Prague: finally, as God the Best and Greatest, Who had inspired my mind and aroused my great desire, prolonged my life and strength of mind and furnished the other means through the liberality of the two Emperors and the nobles of this province of Austria-on-the-Anisana: after I had discharged my astronomical duties as much as sufficed, finally, I say, I brought it to light and found it to be truer than I had even hoped, and I discovered among the celestial movements the full nature of harmony, in its due measure, together with all its parts unfolded in Book III -- not in that mode wherein I had conceived it in my mind (this is not least in my joy) but in a very different mode which is also very excellent and very perfect. There took place in this intervening time, wherein the very laborious reconstruction of the movements held me in suspense, an extraordinary augmentation of my desire and incentive for the job, a reading of the Harmonies of Ptolemy, which had been sent to me in manuscript by John George Herwald, Chancellor of Bavaria, a very distinguished man and of a nature to advance philosophy and every type of learning. There, beyond my expectations and with the greatest wonder, I found approximately the whole third book given over to the same consideration of celestial harmony, fifteen hundred years ago.... But now since the first light eight months ago, since broad day[light] three months ago, and since the sun of my wonderful speculation has shone fully a very few days ago: nothing holds me back. I am free to give myself up to the sacred madness, I am free to taunt mortals with the frank confession that I am stealing the golden vessels of the Egyptians, in order to build of them a temple for my God, far from the territory of Egypt. If you pardon me, I shall rejoice; if you are enraged, I shall bear up. The die is cast, and I am writing the book -- whether to be read by my contemporaries or by**

[63] Until the 19th century it was believed that God created the Earth in the year 4,004 B.C.

posterity matters not. Let it await its reader for a hundred years, if God Himself has been ready for His contemplator for six thousand years.[64]

In the first three chapters, Kepler introduces and defines the terms and concepts which are fundamental to his theories which follow. Among these he finds it necessary to point out that he is working from the premise of Copernicus that it is the Earth which moves, and not the Sun. He admits this is a proposition still not generally accepted.

> **But because the thing is still new among the mass of the intelligentsia [*apud vulgus studiosortum*], and the doctrine that the Earth is one of the planets and moves among the stars around a motionless sun sounds very absurd to the ears of most of them....**[65]

He reminds the reader of his study of the relationship of the five basic geometric figures and the planetary system and admits that he could not quite make them fit. Since Kepler admits the concept of geometric figures is not sufficient to explain the planetary organization, it follows there must be other principles at work. This, of course, will turn out to be music.

In Chapter Four, "In What Things Having to do with the Planetary Movements have the Harmonic Consonances been Expressed by the Creator?," Kepler first studies the distances from the sun, the periodic times, the diurnal eccentric arcs, the diurnal delays in those arcs, the angles at the sun and the diurnal arcs apparent to those as if one's point of view were from the sun. From this study, and in particular the aphelion and perihelion of each planet, he arrives at some preliminary, if not quite satisfactory, relationships with music.

> **Therefore the extreme intervals of no one planet come near consonances except those of Mars and Mercury.**
>
> **But if you compare the extreme intervals of different planets with one another, some harmonic light begins to shine. For the extreme diverging intervals of Saturn and Jupiter make slightly more than the octave; and the converging, a mean between the major and minor sixths. So the diverging extremes of Jupiter and Mars embrace approximately the double octave; and the converging, approximately the fifth and the octave. But the diverging extremes of the Earth and Mars embrace somewhat more than the major sixth; the converging, an augmented fourth. In the next couple, the Earth and Venus, there is again the same augmented fourth between the converging extremes; but we lack any harmonic ratio between**

[64] Johannes Kepler, Harmonies of the World, V, trans., Charles Glenn Wallis, in Great Books (Chicago: Encyclopaedia Britannica, 1939), XVI, 1009ff.
[65] Ibid., 1015.

the diverging extremes: for it is less than the semi-octave (so to speak), ie., less than the square root of the ratio 2:1. Finally, between the diverging extremes of Venus and Mercury there is a ratio slightly less than the octave compounded with the minor third; between the converging there is a slightly augmented fifth.[66]

Before going farther, Kepler pauses to consider the fundamental problem which had engaged so many earlier philosophers who had written on the subject of the "Music of the Spheres," that is, if there are musical pitches produced by the planets, why can't we hear them? Of all the explanations offered by earlier philosophers, Kepler is unique in transferring the experience to another sense.

> **But whose good will it be to have harmonies between the journeys, or who will perceive these harmonies? For there are two things which disclose to us harmonies in natural things: either light or sound: light apprehended through the eyes or hidden senses proportioned to the eyes, and sound through the ears. The mind seizes upon these forms and, whether by instinct (on which Book Four speaks profusely) or by astronomical or harmonic ratiocination, discerns the concordant from the discordant. Now there are no sounds in the heavens, nor is the movement so turbulent that any noise is made by the rubbing against the ether. Light remains. If light has to teach these things about planetary journeys, it will teach either the eyes or a sensorium analogous to the eyes and situated in a definite place; and it seems that sense-perception must be present there in order that light of itself may immediately teach.**[67]

While in this formal work, written for posterity, Kepler seems to avoid admitting any possibility of hearing these pitches, in a private letter to Mastlin, in 1599, he adds, "but fill the heavens with air and in very truth music will sound forth."[68]

He now determines the pitch by the angle that the planet would appear to describe in one day as estimated by an observer located on the Sun. These angular velocities were severally divided by arbitrary powers of two so as to reduce them to the same order of magnitude and to bring the corresponding notes all within the compass of a single octave. The ratio between any two of these angular velocities, so reduced, determined the musical interval between the corresponding notes and indicated whether that interval represented one of the seven accepted concords.[69] **Now he begins to achieve more satisfactory results (if we are willing to overlook some minor problems!).**

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[66] Ibid., 1026ff.
[67] Ibid., 1030.
[68] Quoted in Angus Armitage, John Kepler (New York: Roy Publishers, 1966), 150.
[69] This summary is given in Harmony, Op. cit., 1030.

Accordingly, perfect consonances are found: between the converging movements of Saturn and Jupiter, the octave; between the converging movements of Jupiter and Mars, the octave and minor third approximately; between the converging movements of Mars and the Earth, the fifth; between their perihelial, the minor sixth; between the diverging or even between the perihelial, the double octave: whence...it seems that the residual very slight discrepancy can be discounted, especially in the movements of Venus and Mercury.

But you will note that where there is no perfect major consonance, as between Jupiter and Mars, there alone have I found the placing of the solid figure to be approximately perfect, since the perihelial distance of Jupiter is approximately three times the aphelial distance of Mars, in such fashion that this pair of planets strives after the perfect consonance in the intervals which it does not have in the movements.

You will note, furthermore, that the major planetary ratio of Saturn and Jupiter exceeds the harmonic, viz., the triple, by approximately the same quantity as belongs to Venus; and the common major ratio of the converging and diverging movements of Mars and the Earth are diminished by approximately the same. You will note thirdly that, roughly speaking, in the upper [most distant] planets the consonances are established between the converging movements, but in the lower planets, between movements in the same field. And note fourthly that between the aphelial movements of Saturn and the Earth there are approximately five octaves; for one thirty-second of 57'3" is 1'47", although the aphelial movement of Saturn is 1'46".

Furthermore, a great distinction exists between the consonances of the single planets which have been unfolded and the consonances of the planets in pairs. For the former cannot exist at the same moment of time, while the latter absolutely can; because the same planet, moving at its aphelion, cannot be at the same time at the opposite perihelion too, but of two planets one can be at its aphelion and the other at its perihelion at the same moment of time. And so the ratio of plain-song or monody, which we call choral music and which alone was known to the ancients, to polyphony -- called figured song, the invention of the latest generations -- is the same as the ratio of the consonances which the single planets designate to the consonances of the planes taken together.... In the following chapters, the planets taken together and the figured modern music will be shown to do similar things.[70]

Now satisfied that he had discovered a natural correspondence between planetary movement and the relationship of pitches in the overtone series, in Chapter Five Kepler turns his attention to the search for a natural cosmic scale. Before beginning to attempt to construct scale-like patterns, Kepler first makes two qualifications: he will make necessary adjustments to bring all notes into a single octave and he will ignore (for now) all pitch discrepancies less than a half-step. Working with the orbits at perihelion and aphelion,

[70] Harmonies of the World, Op. cit., 1033ff.

and turning a blind eye to some minor problems, he begins his first effort at scale building as follows,

> **Now the aphelial movement of Saturn at its slowest, ie., the slowest movement, marks *G*, the lowest pitch in the system with the number 1'46". Therefore the aphelial movement of the Earth will make the same pitch, but five octaves higher, because its number is 1'47", and who wants to quarrel about one second in the aphelial movement of Saturn? But let us take it into account, nevertheless; the difference will not be greater than 106:107, which is less than a comma. If you add 27", one quarter of this 1'47", the sum will be 2'14", although the perihelial movement of Saturn has 2'15"; similarly the aphelial movement of Jupiter, but one octave higher....**
>
> **.....**
>
> **Accordingly all the notes of the major scale...are marked by all the extreme movements of the planets, except the perihelial movements of Venus and the Earth and the aphelial movement of Mercury, whose number, 2'23", approaches the note *c* sharp. For subtract from the 2'41" of *d* one sixteenth or 10", and 2'30" remains for the note *c* sharp. Thus only the perihelial movement of Venus and the Earth are missing from this scale.**

Kepler notates the above as the pitches for a G major scale, with both a C and C-sharp. In a following effort, beginning with G at 2'15", the aphelial movement of Saturn, he arrives at a scale based on G, but with two flats. From these two efforts he concludes,

> **Accordingly you won't wonder any more that a very excellent order of sounds or pitches in a musical system or scale has been set up by men, since you see that they are doing nothing else in this business except to play the apes of God the Creator and to act out, as it were, a certain drama of the ordination of the celestial movements.**[71]

Following a third attempt at scale construction, Kepler constructs scale fragments for each planet, based on the eccentricity of the orbit. He finds Saturn produces G, A, B, A, G; Jupiter, G, A, Bb, A, G; Mars, F, G, A, Bb, C, Bb, A, G, F; Earth, G, Ab, G; Mercury, a C major scale; the Moon, G, A, B, C, B, A, G; and Venus, which produces only E's. From this it was evident to Kepler that the Church modes must have had their origin in the heavens.

If the orbits of the planets produce pitches, scale patterns and implications of mode, then, Kepler suggests, it must follow that in the interaction of these orbits, harmony is produced. But some of the harmonies can only rarely be heard, as in the case of that produced by the coincidence of the apsides of Saturn and Jupiter, which occurs only once

each 800 years. Indeed, perhaps the entire harmony was heard only at the moment of the creation of the universe. If that were the case, and one could analyze harmonically and mathematically back to this sound, one could discover the precise date of the creation.

For Kepler it followed logically that in this cosmic harmony, even if it were only an intellectual reality and not actually heard, could be found the origin of polyphony. Given this hypothesis of the origin of polyphony, it was natural for Kepler to next think of the planets in terms of the four traditional vocal ranges.

> **I do not know why but nevertheless this wonderful congruence with human song has such a strong effect upon me that I am compelled to pursue this part of the comparison, also, even without any solid natural cause. For those same properties which...custom ascribed to the bass, and nature gave legal grounds for so doing, are somehow possessed by Saturn and Jupiter in the heavens; and we find those of the tenor in Mars, those of the alto are present in the Earth and Venus, and those of the soprano are possessed by Mercury, if not with equality of intervals, at least proportionately.**[72]

Eventually Kepler provides a step by step summary of his logic and his contentions, expressed in a series of very complicated axioms. One example,

> **XXXVIII. Proposition.** ***The increment 243:250 to 2:3, the compound of the private ratios of Saturn and Jupiter, which was up to now being established by the prior reasons, was to be distributed among the planets in such fashion that of it the comma 80:81 should accede to Saturn and the remainder, 19,683:20,000 or approximately 62:63, to Jupiter.***

Finally, Kepler's concept of the "Music of the Spheres" was based on a mathematical presumption of an observer based on the Sun. Because contemporary telescopes had not ruled out life even on the moon, much less the rest of the galaxy, he could not categorically rule out the possibility that some form of life existed there capable of hearing this cosmic music. And if not, then there is still the possibility that God has merely prepared the "seats" for future listeners, for even the Earth was created and existed before it was inhabited and thus for a time *its* "seats were empty." And as if proof were needed, he quotes a verse from Psalm 19:4,[73] **"He has placed His tabernacle in the sun."**[74]

The great philosopher, Benedict Spinoza (1632 - 1677) wrote very little about music. He does mention the music of the spheres, perhaps because someone of the stature of

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[71] Ibid., 1038.
[72] Ibid., 1049.
[73] The Revised Standard Version (1952), not wishing to suggest the impossible, has changed the meaning to read, "He has set a tent for the sun."
[74] Ibid., 1080.

Kepler was still writing about the subject. Spinoza makes it quite evident that he will have nothing to do with this belief.

> **Whatsoever affects our ears is said to give rise to noise, sound, or harmony. In this last case, there are men lunatic enough to believe that even God himself takes pleasure in harmony; and philosophers are not lacking who have persuaded themselves, that the motion of the heavenly bodies gives rise to harmony....**[75]

And this is pretty much where 2,000 years of discussion ends. After the 17th century, both philosophy and science generally abandoned the concept of the "music of the spheres," relegating it to the shelf reserved for those whom Spinoza identifies as those "men lunatic enough" to be interested. One might say that the Age of Reason closed the door on this subject.

Oh, oh....

In 2002, NASA's Chandra X-ray Observatory found that a black hole in the Perseus cluster produces a Bb, 57 octaves below middle C!

[75] Spinoza, The Ethics, "Concerning God," Appendix.