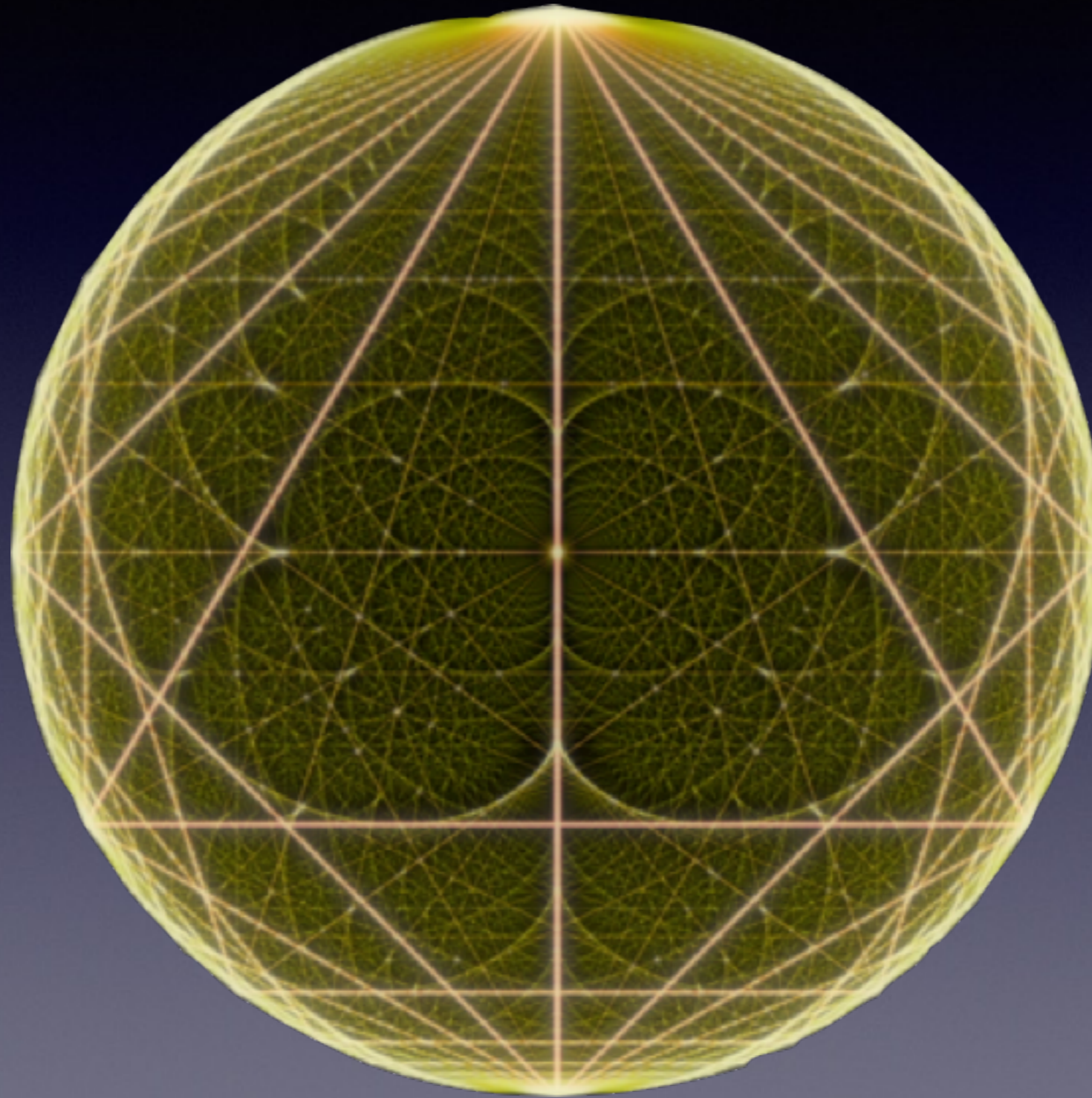


TIME in *Harmonia*



TIME in *Harmonia*

- Origin of *Harmonia*
- Pythagoras
 - the Tetractys
 - Pythagorean view of Time
 - the paradox of Time and Eternity
- Harmonics
 - The Monochord
 - Audible Harmonics
 - Visual Harmonics and the division of the Circle
- Conclusion
 - Modern Number Mysticism
 - *Harmonia* attempts to express the paradoxical relationship of Time and Eternity

Origin of *Harmonia*

- concept - Christos Hatzis, 1981
 - orchestral version, never performed
- background
 - - harmonic music of the '60s avant-garde - K. Stockhausen, *Stimmung*
 - harmonic singing (Mongolian, Tibetan)
- the score embodies a Pythagorean view of musical time
- 2010, computer realization

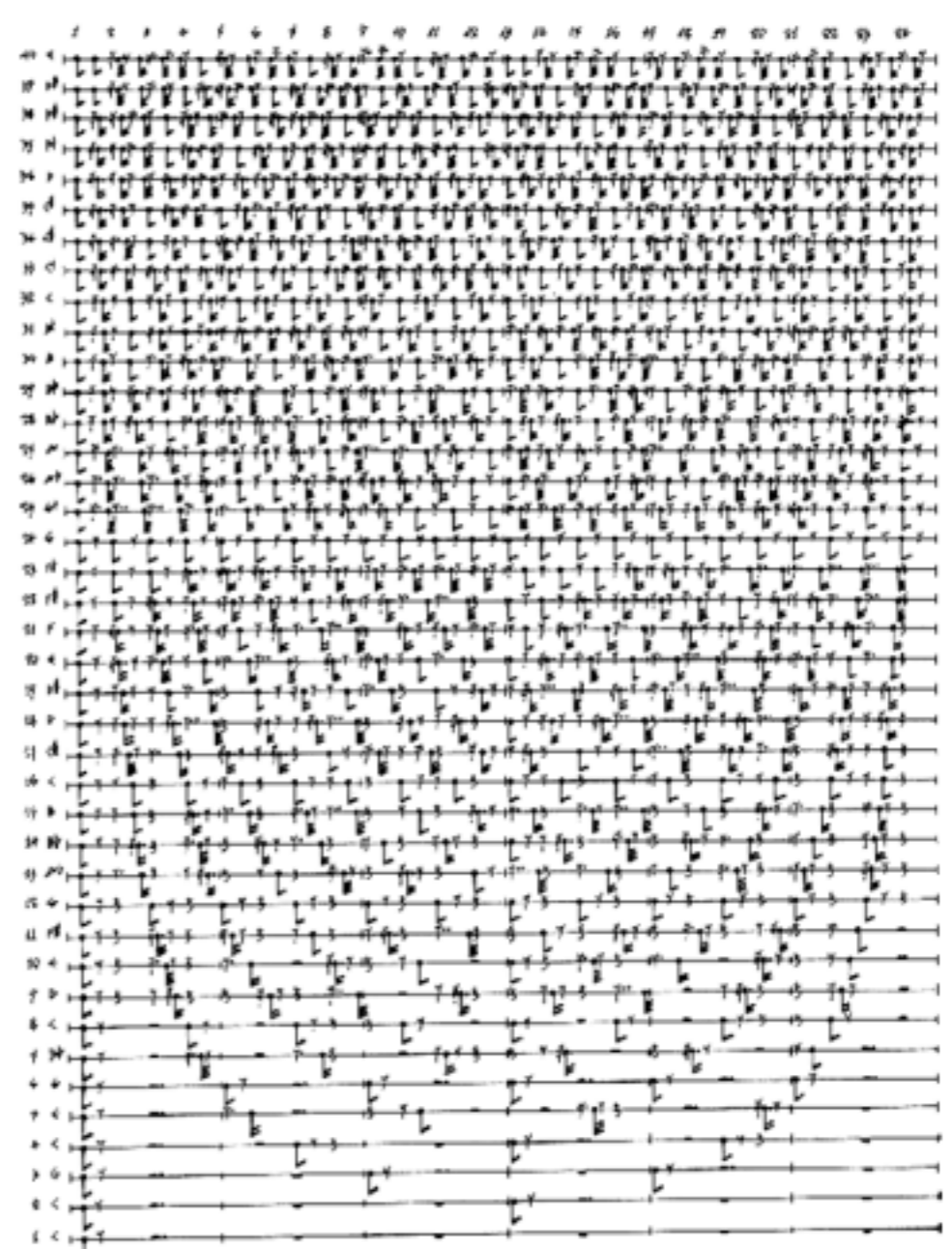
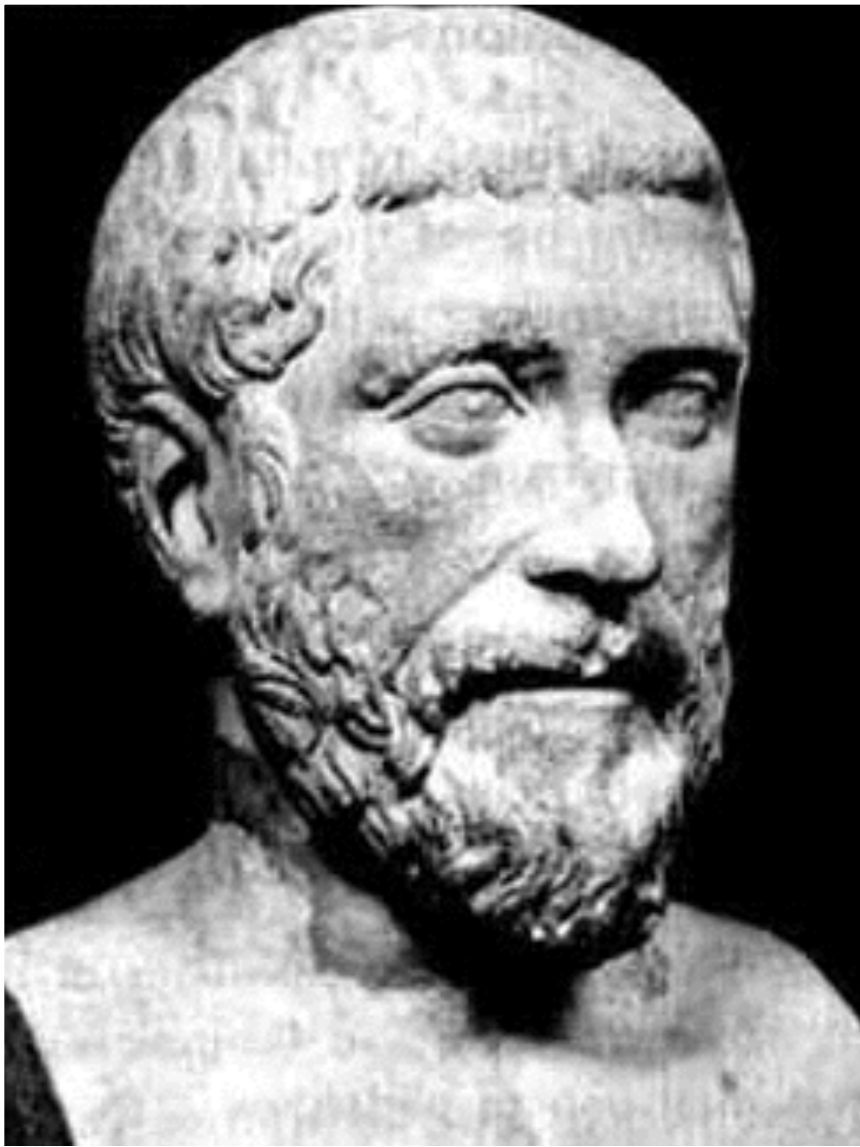
The image shows a complex musical score for 40 parts, arranged in a grid. The horizontal axis represents time, with measures numbered from 1 to 49 at the top. The vertical axis represents the 40 individual parts, numbered on the left side. Each part is represented by a staff with rhythmic notation, including stems, beams, and flags, indicating precise timing for each partial. The notation is dense and intricate, reflecting the Pythagorean view of musical time mentioned in the text.

Figure 2. A 1980 draft of the rhythmic matrix of *Harmonia* with 40 partials.

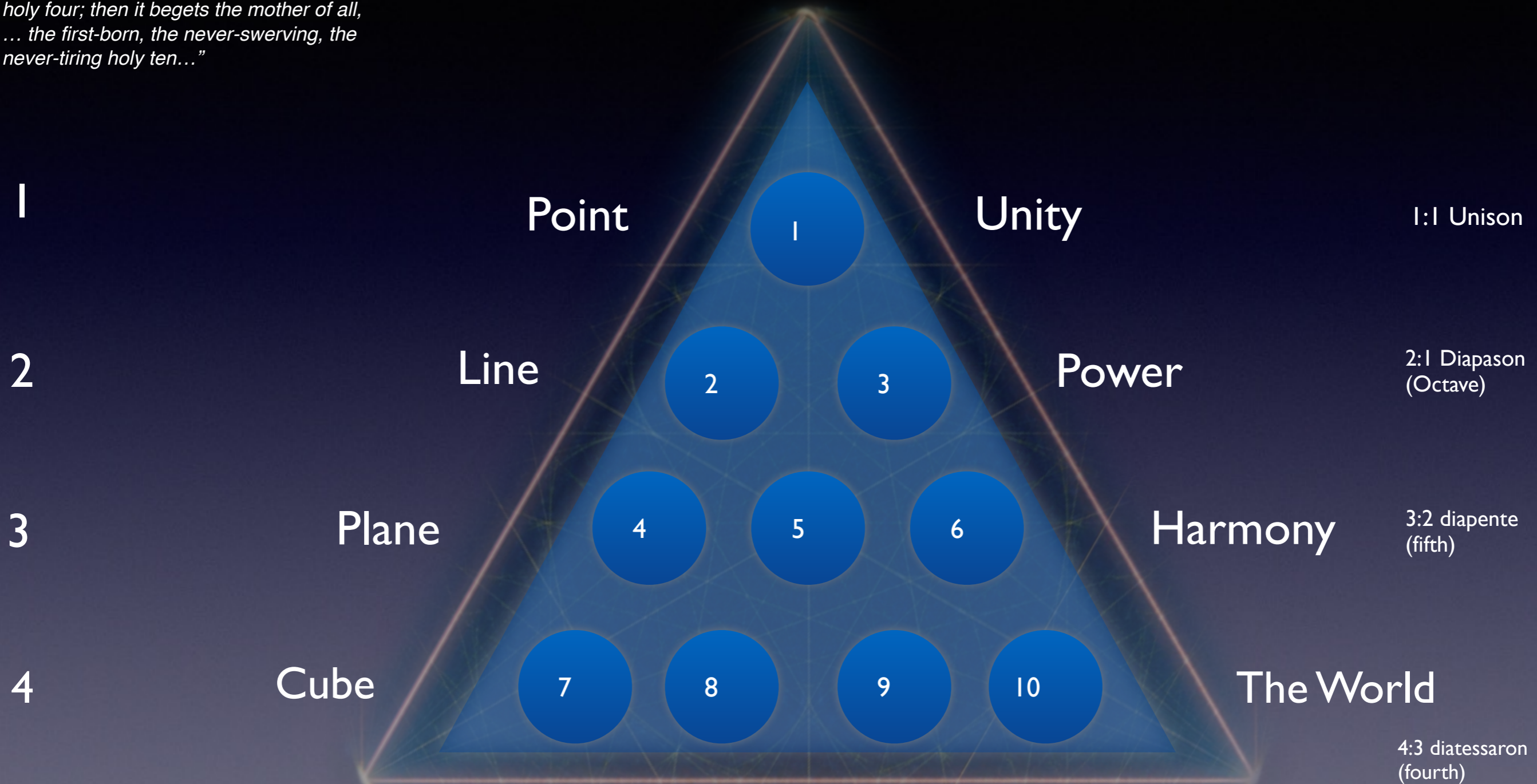
Pythagoras



- 6th Century BC philosopher & mathematician
- Philosophy was very mathematical, based on a mystical conception of Number.
- *“All things...contain Number; for it is evident that nothing whatever can either be thought or known without Number.”* - Philolaos (475 BC)
- Musical sound was the revered as the earthly embodiment of Eternal Number.

The Tetractys

"Bless us, divine number, thou who generated gods and men! O holy, holy Tetractys, thou that containest the root and source of the eternally flowing creation! For the divine number begins with the profound, pure unity until it comes to the holy four; then it begets the mother of all, ... the first-born, the never-swerving, the never-tiring holy ten..."



KOSMOS

Pythagorean View of Time

“Time is a moving image of eternity.”

*[The creator] sought to make the universe eternal, so far as might be. Now the nature of the ideal being was everlasting, but to bestow this attribute in its fullness upon a creature was impossible. Wherefore he resolved to have a moving image of eternity, and when he set in order the heaven, he made this image eternal **but moving according to number**, while eternity itself rests in unity, and this image we call time. (Timaeus, 37d)*

- Time and Eternity are a pair of opposites:
 - Eternity - Changeless - Unity
 - Time - Change - The World
- Connected through the medium of Number, especially the simple counting numbers 1,2,3,4...



NUMBER



7

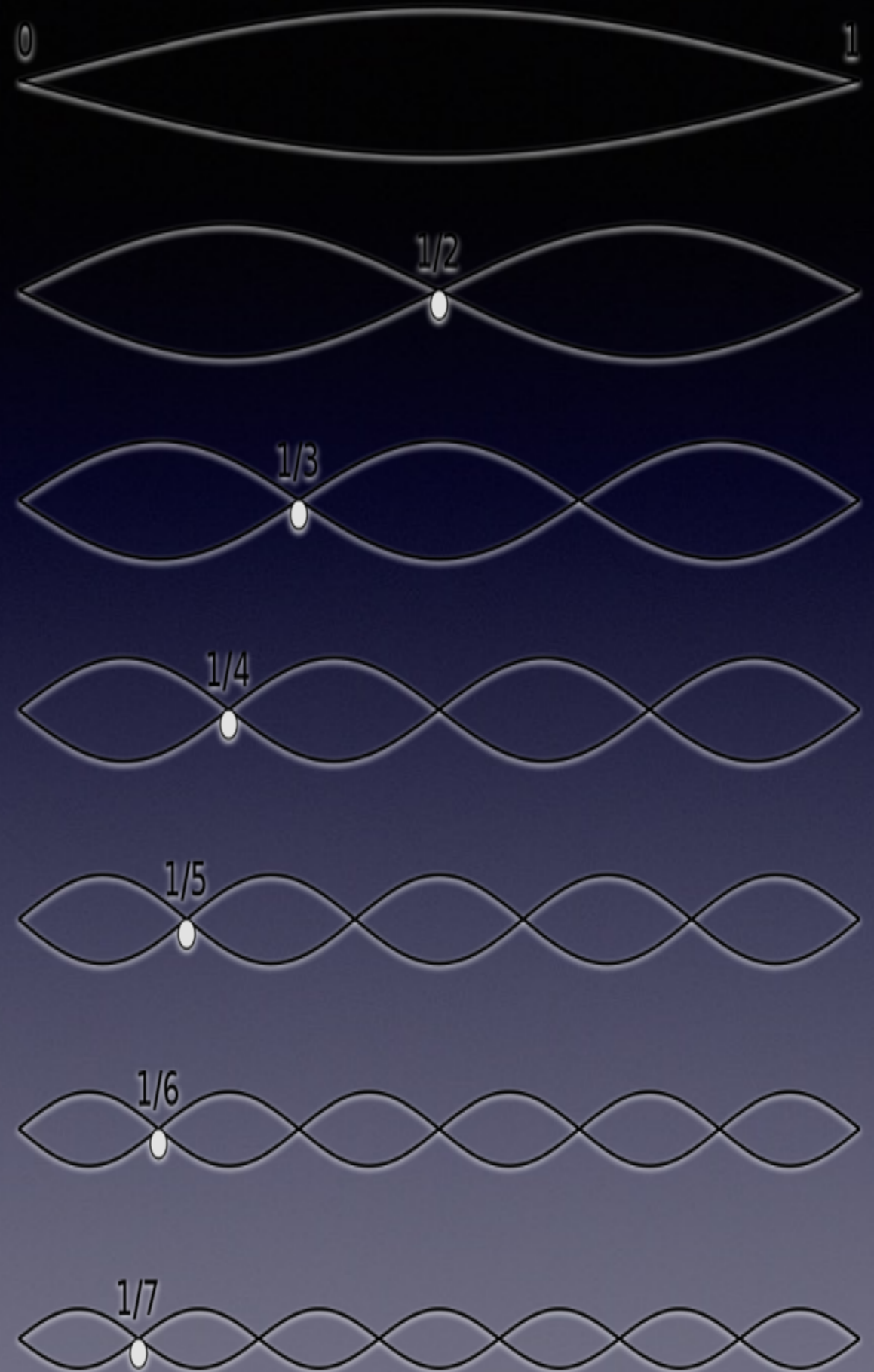
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6

1

Harmonics

- harmonics are a sonic phenomenon closely related to simple numbers - 1,2,3,4,...
- legend: Pythagoras heard a harmonious sound from a busy blacksmith's forge. On investigation he discovered that the weights of all the anvils were in simple proportions such as 1:2, 2:3, 3:4, etc. He concluded that musical harmony was based on simple numerical relationships.
- originally studied using a string instrument called the monochord



Harmonics

The Monochord

Pythagoras experimenting with weights on the end of strings, from *Theorica Musica*, 1492.



Practical Monochord ca. 1800

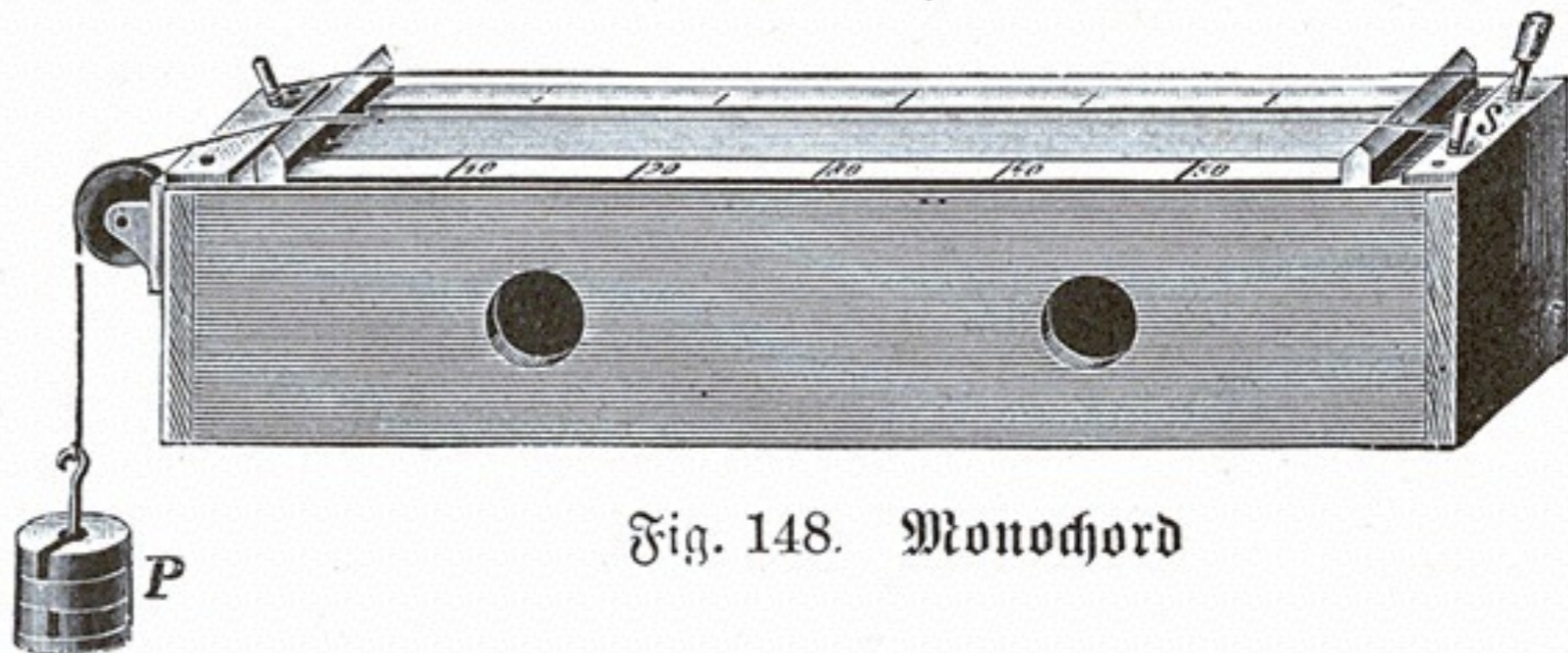


Fig. 148. Monochord

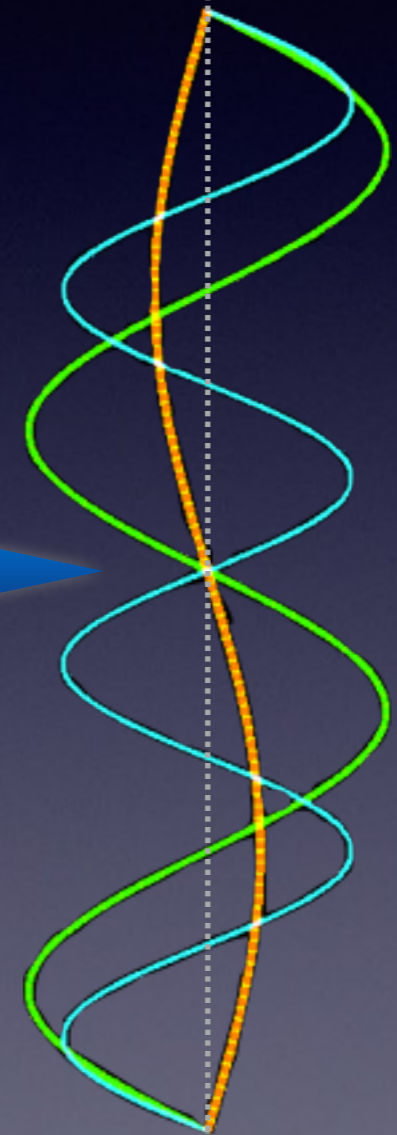
Demonstration I

String Harmonics

NODES

A **node** is a point along a wave where the **amplitude** is zero.

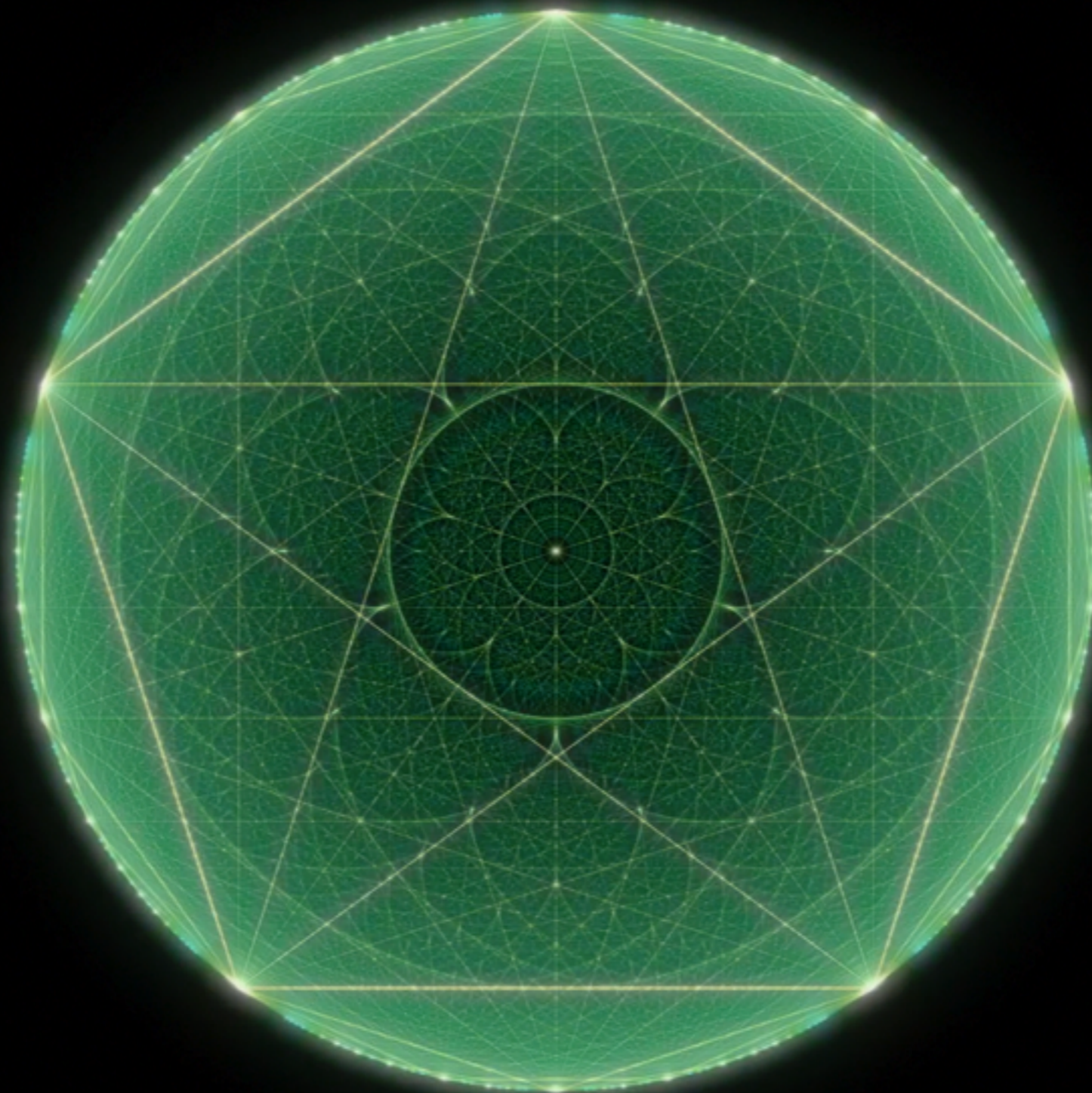
node →



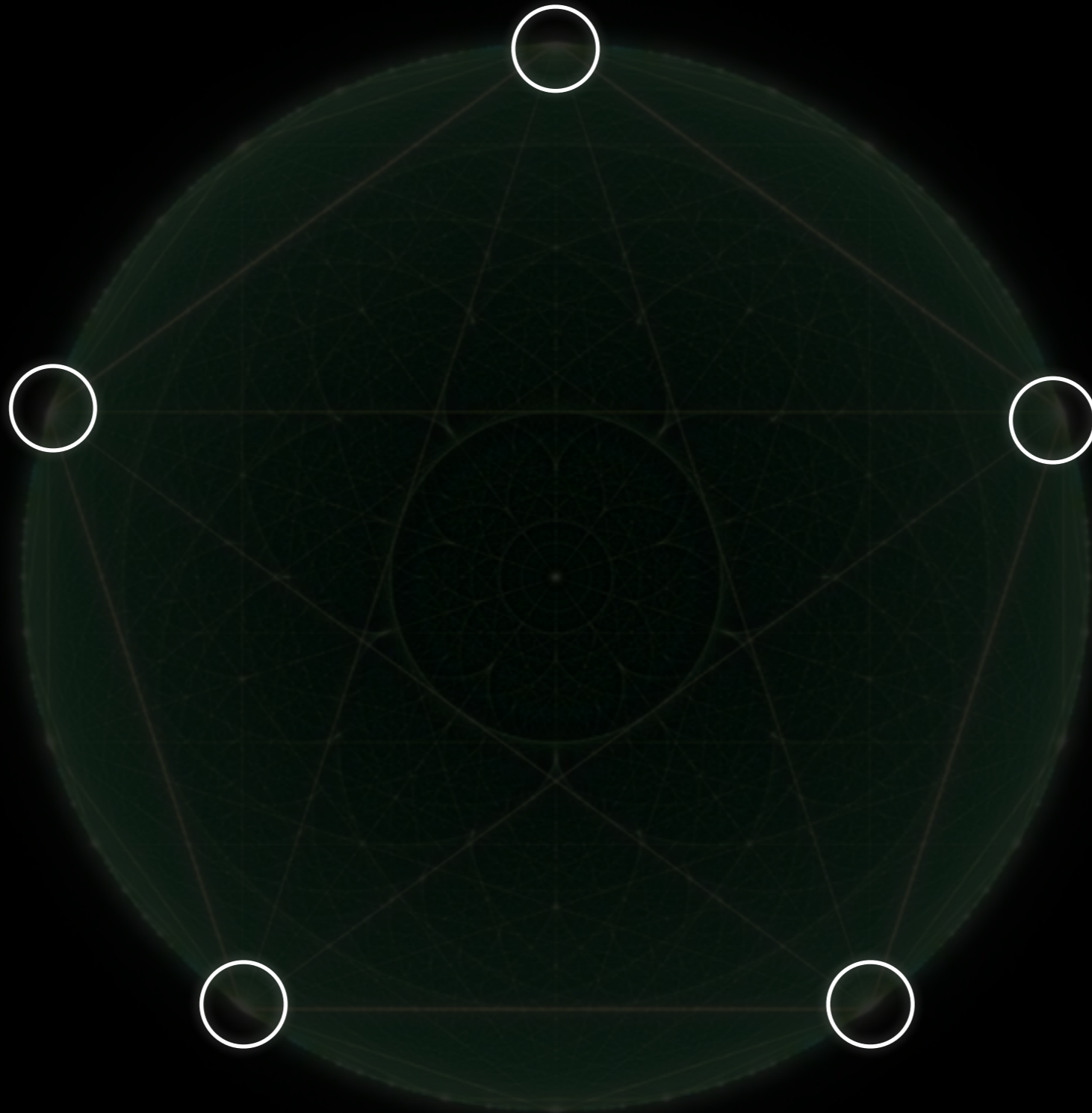
Demonstration 2 - Circular Harmonics

- VibratingCircularMonoChord-11.qtz

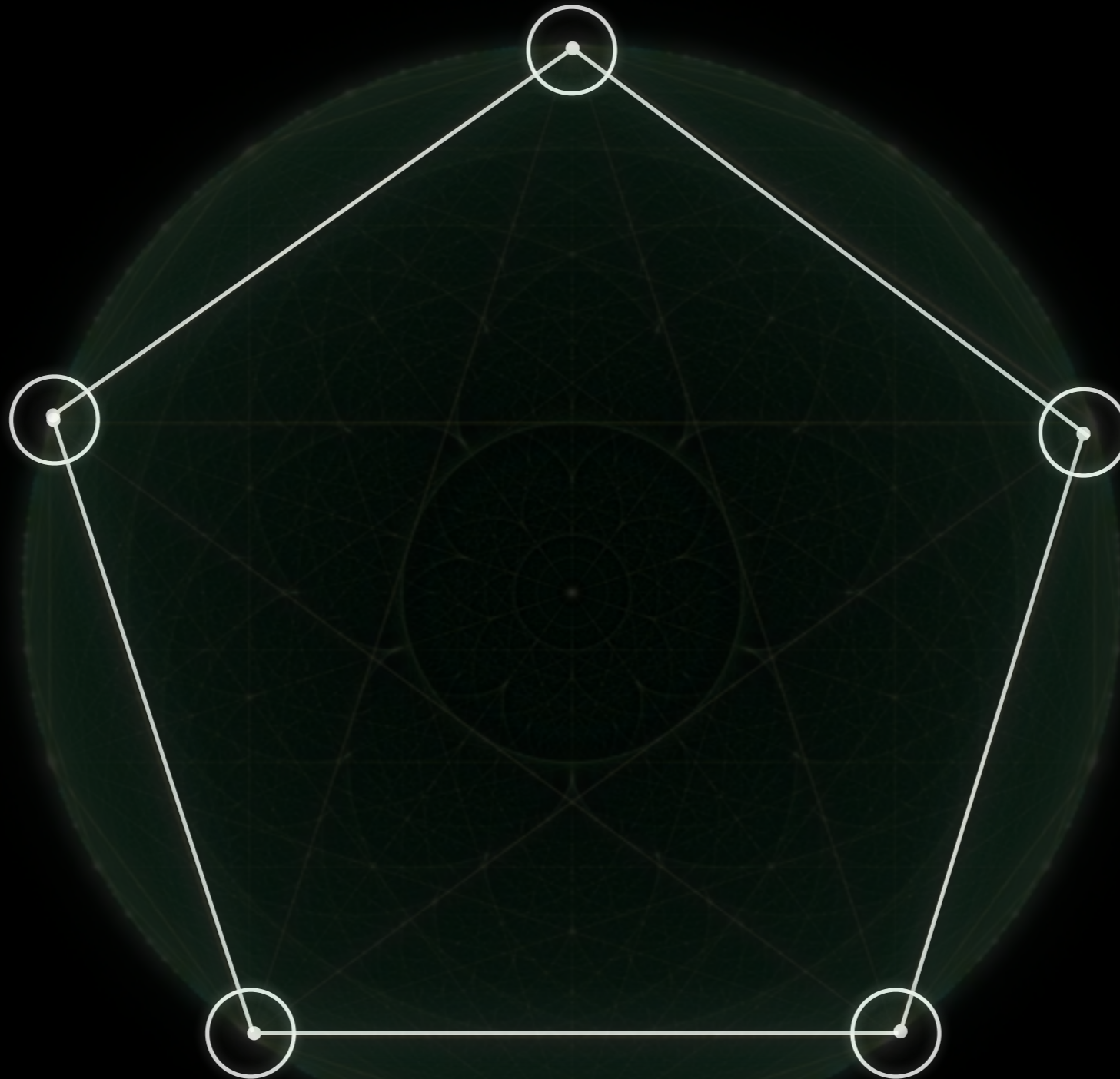
How is the interior web constructed?



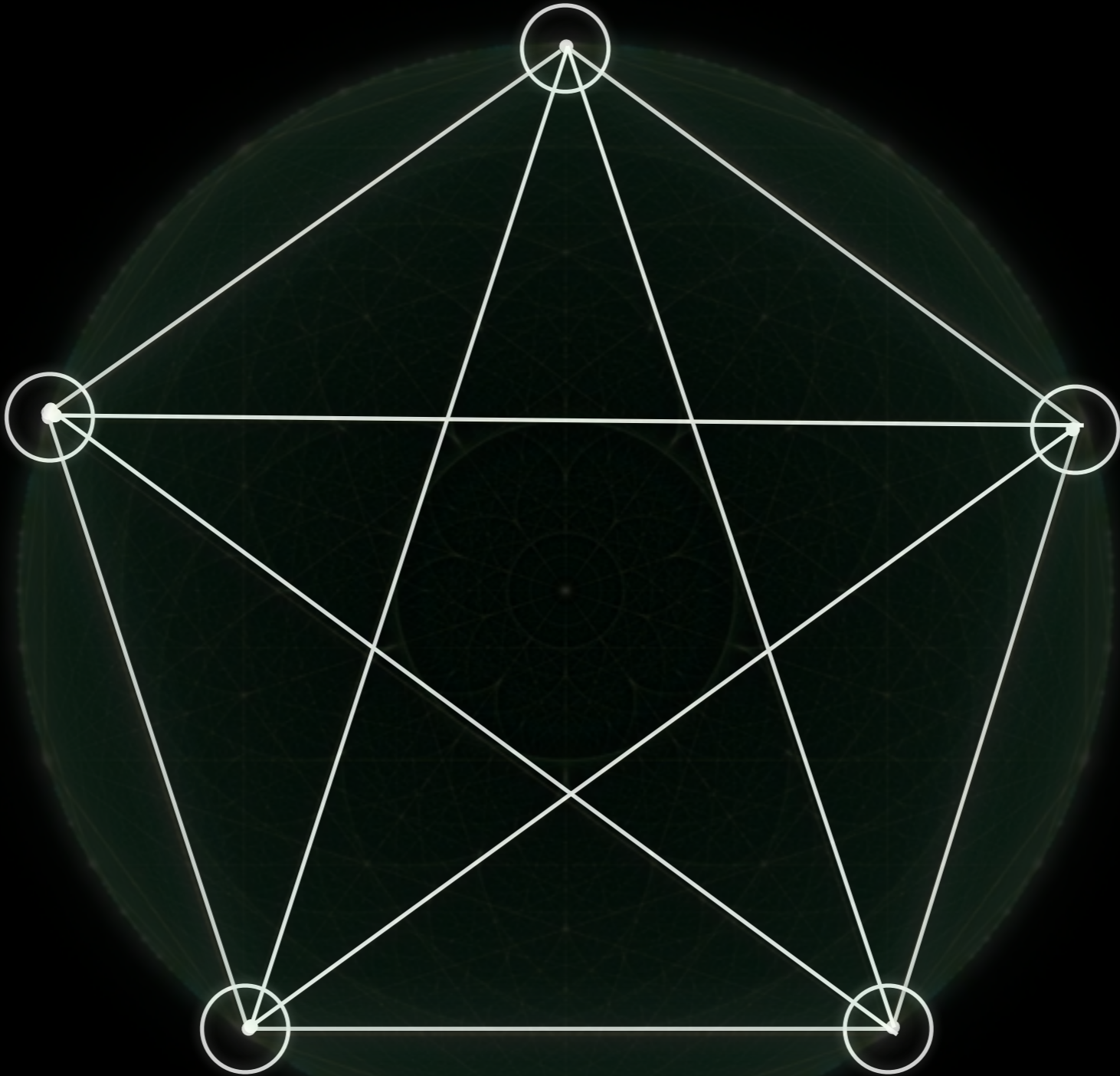
First, we mark the nodes...



Then connect them along the perimeter...



Lastly, we connect every node to every other node...



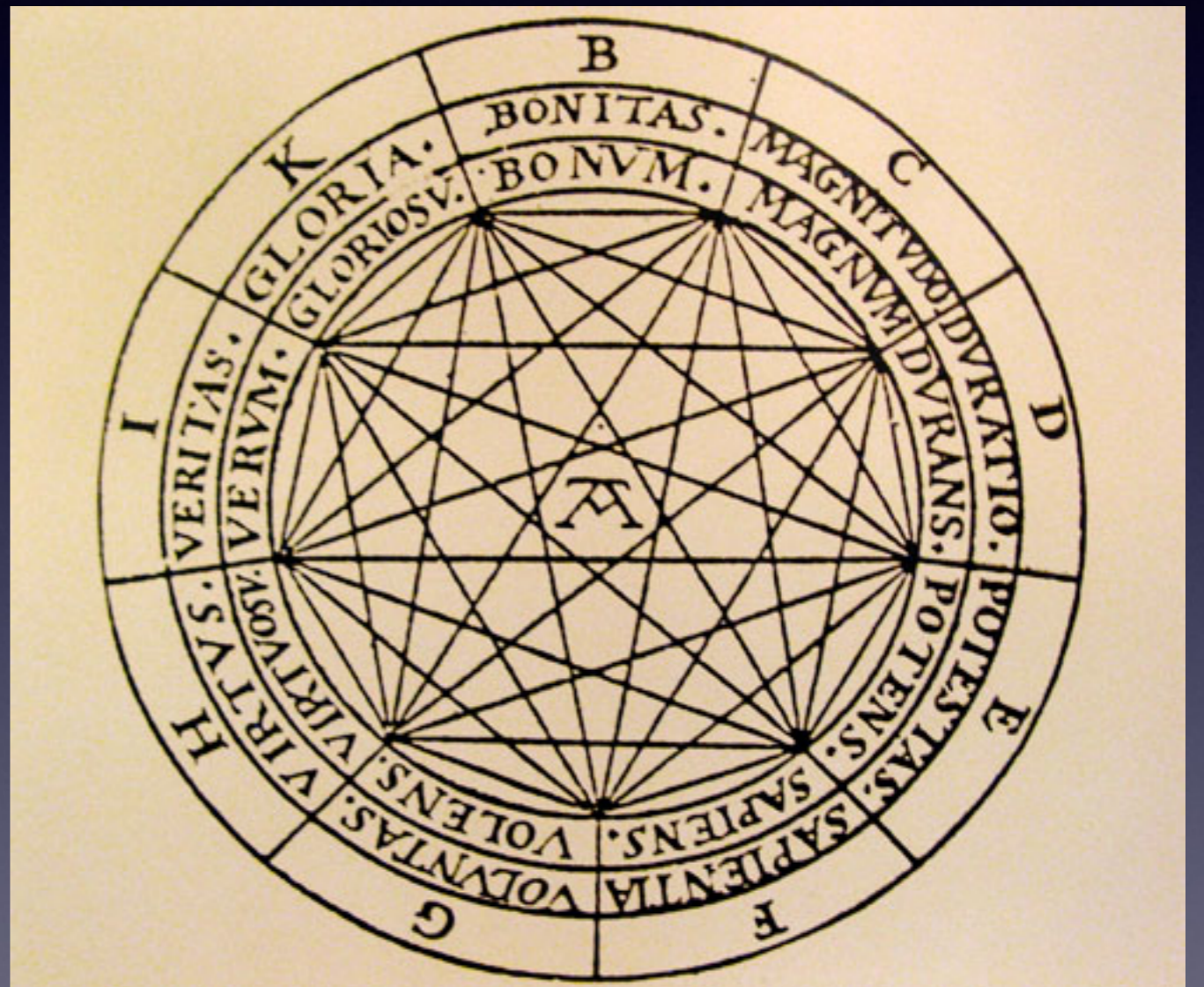
Harmonic Division of the Circle

Geometric construction relating
the attributes of the Divine.

The interior construction
employs harmonics 3, 6, and 9.

All attributes are unified through
their relation to the central
point.

from Raymond Lull, *Ars Magna*, ca. 1275

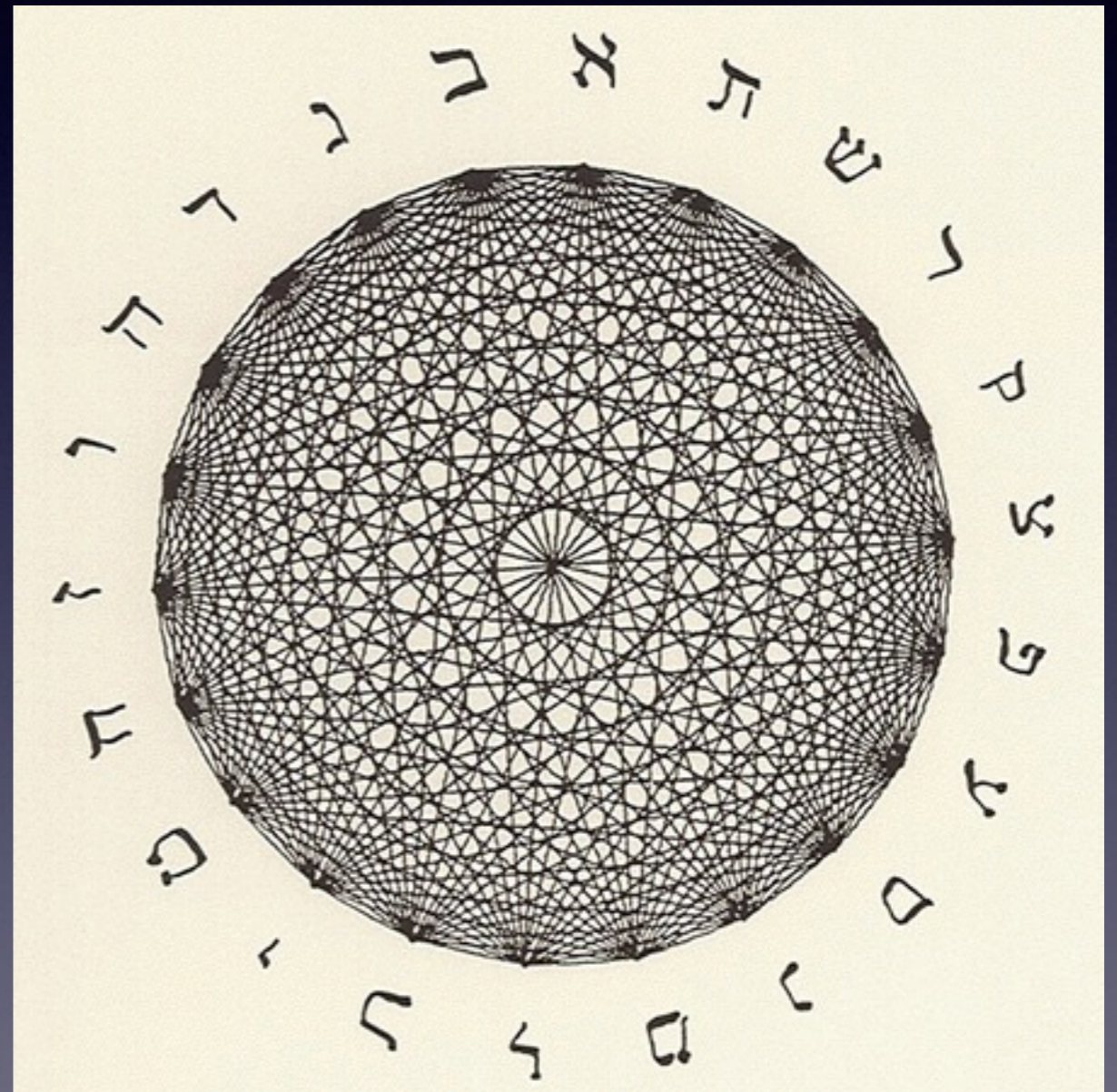


Harmonic Division of the Circle

Cabalistic rendering of the Hebrew alphabet, showing all possible two-letter combinations connected geometrically.

The construction employs harmonics 11 and 22.

from *Livre de la formation* by Guillaume Postel (1510 – 1581)



Modern Number Mysticism

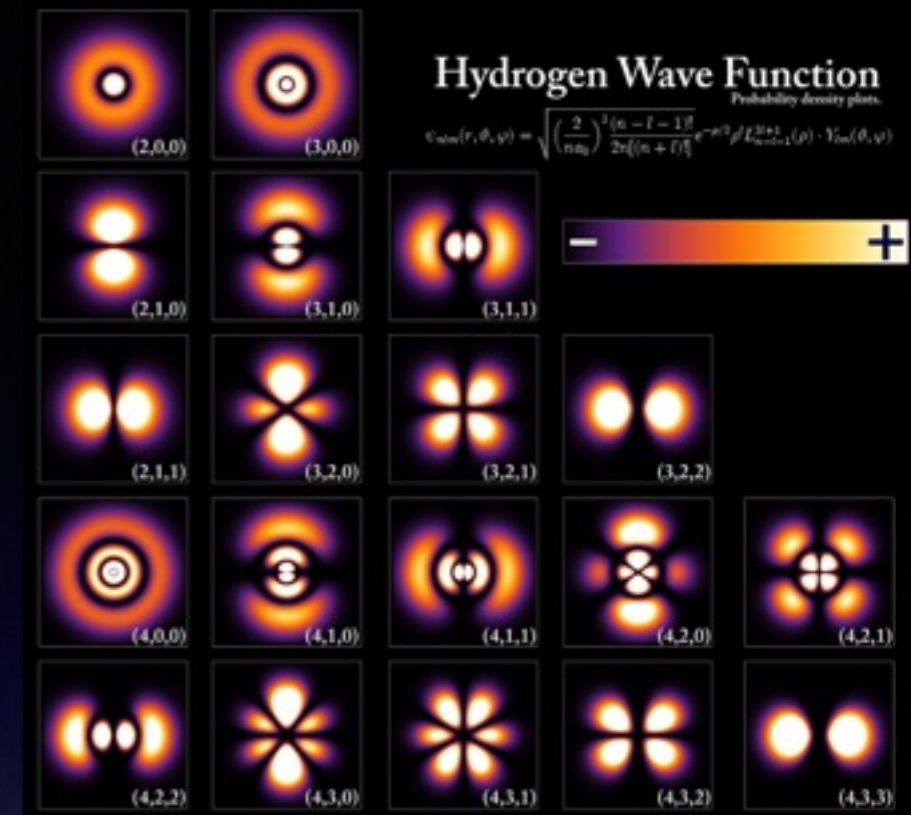
“What we hear today in the language of the spectra is a real music-of- the-spheres of the atom, a concord of whole numbers...and harmonies.”

- physicist Arnold Sommerfeld, speaking of the recent theories in subatomic physics, 1919.

“The Unreasonable Effectiveness of Mathematics” - title of a 1961 paper by Nobel Laureate physicist Eugene Wigner

“(Number) may well be the most primitive element of order in the human mind... thus we define number psychologically as an archetype which has become conscious.”

- C.G. Jung, *On Synchronicity*



Conclusion

- Pythagorean view: *Time is a moving image of Eternity. They connect with one another through Number.*
- *Harmonia* attempts to express this relationship through harmonics of sound and image.

Conclusion

“TIME is one of the great archetypal experiences of man, and has eluded all our attempts at a completely rational explanation. No wonder that it was originally looked on as a Deity, even as a form of manifestation of the Supreme Deity, from which it flows like a river of life.”

- Marie-Louise von Franz, *Time: Rhythm & Repose*