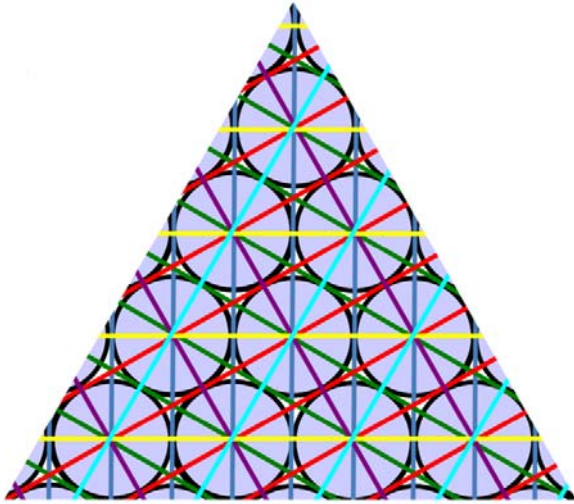


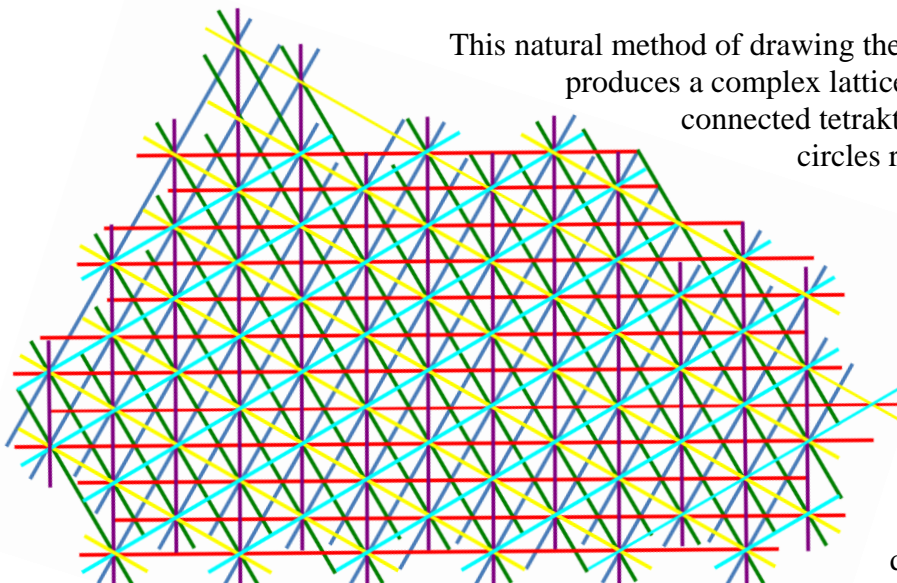
## Tetraktys and Zodiac



The tetraktys is a triangle of ten touching circles. It is a main symbol of Pythagorean geometry. Using only the Masonic tools of compass and ruler, the tetraktys may be used as a simple device to make a clock face in the central circle, shown here, dividing the circle in twelve equal segments so as also to produce a wheel diagram of the twelve signs of the zodiac. In this diagram, the focal circle is connected to the other nine circles by lines bisecting each circle, joining tangents and tangent bisect lines. The lattice of the tetraktys forms triangles, hexagons and interwoven virtual cubes.

Each circle in the group is also the focal point of a tetraktys of ten surrounding circles, with the edges of these external circles shown. Each circle therefore itself in turn forms the twelve spokes of a wheel of clock and zodiac as shown.

Many intriguing geometrical observations flow from this diagram. It provides a simple way to seemingly 'square the circle', forming outlines of cubic shapes in a shape-shifting array of locations, while not actually creating any real squares. This method illustrates the hexagonal and triangular relationships between touching circles. The natural ability of this compact shape to divide the circle in twelve segments derives from the nature of a circle as the set of points on a plane that are equidistant from a point. Each three adjacent circles are connected by an equilateral triangle joining their centres, surrounding diagonals that meet in the space between the three circles.



This natural method of drawing the zodiac wheel produces a complex lattice when expanded to connected tetrakti, shown here with circles removed. Each rhombus in the diagram joins with two other rhombi to form a hexagon, serving also to produce an interwoven two dimensional model of a three dimensional cube.

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This mathematical drawing serves to illustrate how the twelve-fold division of time into months and hours derives from an entirely natural and logical geometrical division of the circle, resulting from the formation of the hexagon from six circles around a central circle. It also helps in conceptualizing the mathematical harmonics of the zodiac signs. This spatial topology points to a perennial philosophy, a cyclic model of time as envisioned as long ago as the time of Plato, who imagined isosceles and equilateral triangles as forming the five Platonic Solids and forming the old idea of the four elements of fire, earth, air and water, and a fifth element ether.

As an example of the cosmic framework of touching spheres, we can imagine the sphere of the sun as surrounded by twelve adjacent 'virtual suns' in a surrounding sphere, six around the path of the ecliptic or zodiacal plane and a further six virtual suns, three above and three below, making twelve touching spheres in the shape of a dodecahedron. This wheel of time can describe twelve natural equal arcs of  $30^\circ$  in the orbital ecliptic plane. On this model, the cusps between each arc are marked by the lines joining the centre and edge of each of the six surrounding virtual suns with the heart of the sun, as shown in the first diagram, with the sun as the focal circle. The earth and planets pass through all these twelve arcs in the course of each orbit. These virtual suns are purely a mathematical topology. The idea is presented here simply as a mathematical thought experiment that may be of help for inquiry into whether the zodiacal signs posited by astrology have any physical referent. In this model the six imaginary spheres around the ecliptic would need to align with the tropical zodiac of the earth in order to produce the sign cusps as observed in tropical astrology, and could be posited as a harmonic product of the orbital relation between the sun and the earth.

The existence of such celestial harmony lacks physical evidence. To build such evidence, we need to look to the new science of cymatics, which examines the formation of visible harmonic waves from regular sound patterns. For example, drawing a violin bow across the edge of a brass plate covered with sand causes the sand to form cymatic patterns at the zones of lowest vibration of the plate. A cymatic example from nature is the sonar of a dolphin, which contains a circular beam of sound surrounded by six touching circular beams. Sounds sent along these seven densely packed beams interact to enable communication and echo-location, illustrating the natural hexagonal shape produced by a circle surrounded by touching circles, similar also to the hexagonal cells of honeycomb in a beehive.

This method can be applied to examine the cymatic relation between the tetraktys and the zodiac, through analysis of harmonic tetrakti.

Cymatics can analyse the harmonic relation of sound waves that produce the twelve spoke wheel of time illustrated in the tetraktys. To explore the cymatics of the tetraktys, each circle centre can be assigned a musical frequency. For example, as shown in the diagram below, across each row in turn, the notes C1, C2, G2, C3, E3, G3, B-3, C4, D4, E4 have frequencies that are equal multiples of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 hertz.

Similarly, C1, E1, G1, C2, E2, G2, C3, E3, G3, C4 produces a major chord, with notes of ratios as shown.

E4 C4, D4, E3, G3, Bf3, C1, C2, G2, C3, = 10 8, 9, 5, 6, 7, 1, 2, 3, 4,	C4 E3, G3, E2, G2, C3, C1, E1, G1, C2, = 8 5, 6 5/2, 3, 4 1, 5/4, 3/2, 2
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Building a tetraktys of loudspeakers, or human voices, can produce cymatic shapes. The two models shown have musical notes in the top triangle corresponding to harmonic frequency ratios in the bottom triangle. A choir of ten singers could stand in this shape and each singer sing their note, focusing on the harmonic links between their own voice and the other nine notes of the chord.

Rhythm may also be introduced by each note having its corresponding number of beats per bar. In the first example, from C1 to E4, this rhythm pattern would mean C1 has one beat per bar, C2 has two beats, and so on to E4 with ten beats per bar. All complex cross time signatures up to ten beats per bar are produced simultaneously by this method.

Beats per bar	Beats per minute	Note	Cycles per Second
1	20	C1	128
2	40	C2	256
3	60	G2	384
4	80	C3	512
5	100	E3	640
6	120	G3	768
7	140	B-3	896
8	160	C4	1024
9	180	D4	1152
10	200	E4	1280

A cymatic topology of this soundscape can aim to produce the tetraktys model pictured at the start of this essay. Loudspeakers can be programmed in each location to produce the note and rhythm with constant stability for a long period, enabling cymatic exploration on

a membrane or metal plate or computer program, seeking to produce both the circles themselves and the lattice of lines connecting them and dividing each circle in twelve natural segments. Cymatic production of the zodiac wheel in the central circle – G3 in example one and G2 in example 2 – can illustrate how this shape is built into the harmonic geometry of space.

Here again the tetraktys is shown with the wheel of time. The twelve signs of the zodiac form unique segments of the tetraktys, illustrating the annual cycle of the elements and qualities.

Fire signs are shown in red, earth in brown, air in sky blue and water in sea blue. The qualities group around the four arms of the cross. Cardinal signs are the first triangle moving clockwise after each axis, fixed signs are those midway between two axes, and mutable signs are those before an axis.

This model applies precisely to describe the annual cycle of the tropical signs of the zodiac. It also shows the cosmic and geometric origin of Christian iconography, with the four fixed signs providing the symbols of the Four Evangelists, Matthew, Mark, Luke and John, and of the four angelic creatures of Ezekiel and Revelation.

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5 March 2010

