

ARTICLE 9

How the Square Encodes the Superstring Parameters 168 & 248

by

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Abstract

Previous articles showed that the superstring parameters 248 and 168 are embodied as numbers in the outer and inner forms of the Tree of Life, as well as in various sets of regular polygons belonging to the latter whose properties are determined by the number values of the Godnames of the ten Sephiroth. This article will prove that the prescription by the Godnames of 'sacred geometry' encoding such numbers of universal (therefore scientific) meaning applies also to single, regular polygon, particularly the square. The 25 yods of a square divided into four tetractyses symbolise the spatial dimensions predicted by the quantum mechanics of spinless strings, their geometrical differentiation corresponding to the distinction between bosonic and superstring dimensions of space. There are 248 yods other than corners of tetractyses in a square whose sectors are transformed into the next higher-order tetractys. 168 is the number of yods surround the centre of a square whose sectors are divided into three triangles, the latter then being each divided into three tetractyses. As further illustration of the Tetrad Principle proposed in Article 1, the square, symbol of the number 4, or Pythagorean Tetrad, also represents in an arithmetic way the properties of these transformed squares, whilst the hexagon, the fourth regular polygon, embodies the dimension 248 of E_8 , the superstring gauge symmetry group. Finally, equivalence (in the sense of sharing similar properties) is demonstrated between the square and the seven, enfolded, regular polygons constituting each half of the inner form of the Tree of Life.

1. Introduction

The Pythagorean mathematician Nichomachus of Gerasa said that the Pythagoreans called the number 4, or tetrad, "the greatest miracle," "a God after another manner," "a manifold divinity," and "holding the key of Nature." Why did he (and his precursors) value this number so highly? Lacking insight into the mystical wisdom of ancient sages like Pythagoras and possessing only a few surviving written fragments of his teachings — themselves only elementary and distorted summaries of a now lost knowledge taught by word of mouth — modern scholarship has no satisfactory answer to this question. Historians of Greek

mathematics realise that the early Pythagoreans placed special emphasis on the number 4 because their so-called ‘perfect number’ 10 is the fourth triangular number, otherwise known as the ‘tetractys’ (from *tetras*, four):

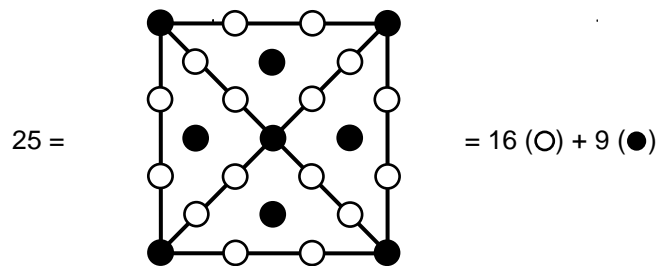


They knew also that the numbers 1, 2, 3 & 4 contain the symphonic ratios that make possible the musical scale, i.e. 1:2, the octave; 2:3, the perfect fifth; and 3:4, the perfect fourth. But the *true* reason why the Pythagoreans valued the tetrad so highly was far more profound. They intuitively recognised that a four-fold pattern or structure existed in the *mathematics* of the cosmos, generating not only the number 10 as the measure of divine perfection and the tetractys as its symbol of wholeness but also numbers that *quantify physical phenomena*. This rule was formulated as the ‘Tetrad Principle’ in Article 1, which showed how parameters of superstring theory have a natural expression in terms of the numbers 1, 2, 3 & 4 — even the number 4 itself.

In this article it will be explained how the square, the geometrical symbol of the number 4, embodies certain numbers of relevance to superstring theory (and beyond), thus amply justifying the assignment to the Tetrad by the Pythagoreans of the title “holding the key of Nature.”

2. The square encodes 25 spatial dimensions & dimension 248 of E_8

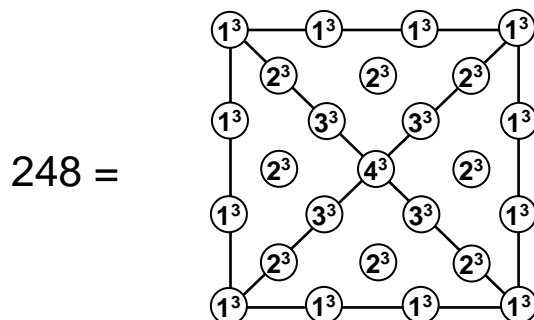
When its sectors are tetractyses, a square contains 25 yods:



They symbolise the 25 dimensions of space predicted by the quantum mechanics of spinless (bosonic) strings. The number 16 (4th square number) is the number of purely bosonic string dimensions of the 26-dimensional space-time whose compactification, according to the author’s theory outlined in Article 2, generates superstrings with 9 remaining spatial dimensions (9 = 4th odd integer after 1). The central yod (●) symbolises the longitudinal dimension of a bosonic string, the surrounding 24 (=1×2×3×4=4!) yods represent the 24 transverse dimensions of a string and the surrounding 8 yods (●) denote the 8 transverse, purely superstring dimensions (8 = 4th even integer). 25 is the arithmetic mean of the cubes of the first 4 integers:

$$25 = \frac{1^3 + 2^3 + 3^3 + 4^3}{4}$$

When the cubes of the integers 1, 2, 3 & 4 are assigned to the positions of the 25 yods in a square, their sum:



is the dimension of the unified, superstring gauge symmetry group E_8 . In other words, the square not only encodes the number of spatial dimensions of space-time but also embodies the number of quantum states

Table 1. Number values of the ten Sephiroth in the four Worlds.

	SEPHIRAH	GODNAME	ARCHANGEL	ORDER OF ANGELS	MUNDANE CHAKRA
1	Kether (Crown) 620	EHYEH (I am) 21	Metatron (Angel of the Presence) 314	Chaioth ha Qadesh (Holy Living Creatures) 833	Rashith ha Gilgalim First Swirlings. (Primum Mobile) 636
2	Chokmah (Wisdom) 73	YAHVEH, YAH (The Lord) 26, 15	Raziel (Herald of the Deity) 248	Auphanim (Wheels) 187	Masloth (The Sphere of the Zodiac) 140
3	Binah (Understanding) 67	ELOHIM (God in multiplicity) 50	Tzaphkiel (Contemplation of God) 311	Aralim (Thrones) 282	Shabathai Rest. (Saturn) 317
	Daath (Knowledge) 474				
4	Chesed (Mercy) 72	EL (God) 31	Tzadkiel (Benevolence of God) 62	Chasmalim (Shining Ones) 428	Tzadekh Righteousness. (Jupiter) 194
5	Geburah (Severity) 216	ELOHA (The Almighty) 36	Samael (Severity of God) 131	Seraphim (Fiery Serpents) 630	Madim Vehement Strength. (Mars) 95
6	Tiphareth (Beauty) 1081	YAHVEH ELOHIM (God the Creator) 76	Michael (Like unto God) 101	Malachim (Kings) 140	Shemesh The Solar Light. (Sun) 640
7	Netzach (Victory) 148	YAHVEH SABAOTH (Lord of Hosts) 129	Haniel (Grace of God) 97	Tarshishim or Elohim 1260	Nogah Glittering Splendour. (Venus) 64
8	Hod (Glory) 15	ELOHIM SABAOTH (God of Hosts) 153	Raphael (Divine Physician) 311	Beni Elohim (Sons of God) 112	Kokab The Stellar Light. (Mercury) 48
9	Yesod (Foundation) 80	SHADDAI EL CHAI (Almighty Living God) 49, 363	Gabriel (Strong Man of God) 246	Cherubim (The Strong) 272	Levanah The Lunar Flame. (Moon) 87
10	Malkuth (Kingdom) 496	ADONAI MELEKH (The Lord and King) 65, 155	Sandalphon (Manifest Messiah) 280	Ashim (Souls of Fire) 351	Cholem Yesodoth The Breaker of the Foundations. The Elements. (Earth) 168

The Sephiroth exist in the four Worlds of Atziluth, Beriah, Yetzirah and Assiyah. Corresponding to them are the Godnames, Archangels, Order of Angels and Mundane Chakras (their physical manifestation). This table gives their number values obtained by the ancient practice of gematria, wherein a number is assigned to each letter of the alphabet, thereby giving a number value to a word that is the sum of the numbers of its letters.

of the particle transmitting the unified force between superstrings! Superstring theory, of course, predicts not 25 but nine spatial dimensions of space-time. Unless one is willing to dismiss as coincidence the appearance of the number 248 along with the number 25 and its break-down into the numbers 9 & 16, it indicates that superstrings and their gauge symmetry group E_8 have their origin in **26**-d, not 10-d, space-time.

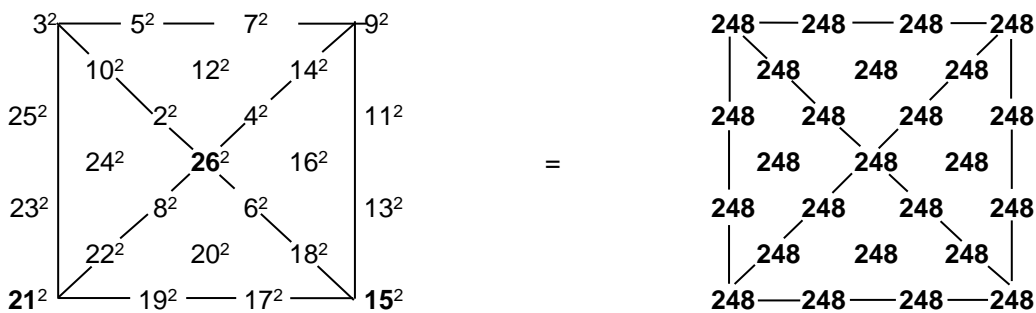
That the number 26 should be connected to the number 248 is less surprising when it is realised that it is the number value of YAHWEH, the Godname of Chokmah (Table 1).¹ The Godnames of the Sephiroth of the Tree of Life were shown in previous articles to prescribe the sacred geometries of its outer and inner forms, which were also shown to embody the number 248. That the number **26** should have fundamental scientific significance is indicated by the Tetrad Principle formulated in Article 1 (1), for it is the sum of the first *four* Mersenne numbers (2), that is, the sum of the combinations of 10 objects arranged in the four rows of a tetractys:

A B C D E F G H I J	Number of combinations $2^1 - 1 = 1$ $2^2 - 1 = 3$ $2^3 - 1 = 7$ $2^4 - 1 = \underline{15}$ TOTAL = <u>26</u>
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There is also a remarkable arithmetic relationship between the two numbers. Using the identity:

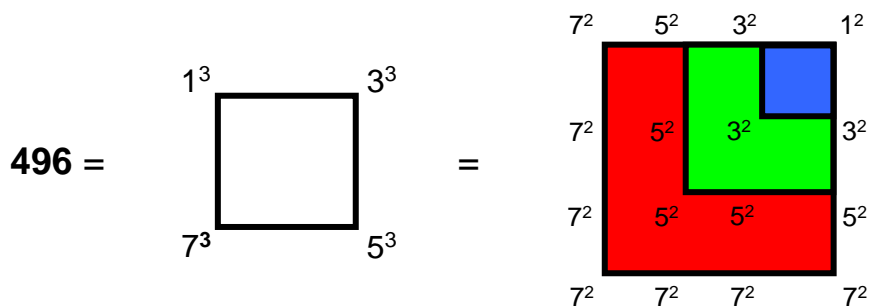
$$6200 = \mathbf{248} \times 25 = 2^2 + 3^2 + 4^2 + \dots + \mathbf{26}^2,$$

where the first term, $2^2 = 4$, is the Tetrad, we see that the square displays the following remarkable property of the number **248**:



Starting with the Tetrad, $2^2 = 4$, at the centre of the square and assigning the 24 ($=1 \times 2 \times 3 \times 4$) squares $3^2, 4^2, \dots, 26^2$ to the surrounding 24 yods of the four tetractyses, with squares of even integers inside the square and squares of odd integers on its boundary, the sum of these 25 squares is that resulting from assigning the number **248** to each yod in the square. This demonstrates the unique significance of the superstring parameter **248** vis-à-vis the square.

The dimension **496** of the superstring gauge symmetry groups $E_8 \times E_8$ and $O(32)$ that apply to the five superstring theories is the sum of the cubes of the first *four* odd integers:

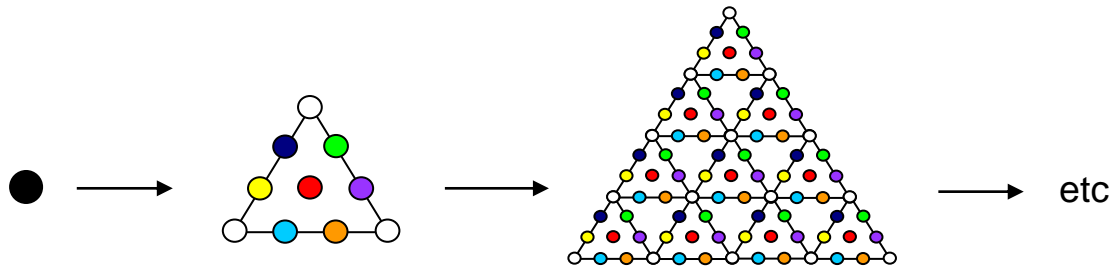


This means that it can also be represented by a 4×4 square array of the squares of 1, 3, 5 & 7. It is an illustration *par excellence* of the Tetrad Principle.

The square encodes the number **248** geometrically as well as arithmetically, as now explained. Starting

¹ Henceforth, all numbers in this table are written in boldface.

from the point, or Pythagorean monad, the tetractys has ten points (symbolised below by circles), each of which is a potential tetractys of ten points, and so on.



Let us call the point the 0th-order tetractys, the tetractys known to mathematicians as the fourth triangular number the 1st-order tetractys, the next member of the infinite sequence the 2nd-order tetractys, etc. The number of yods in the 2nd-order tetractys shown above is:

$$85 = 4^0 + 4^1 + 4^2 + 4^3.$$

This is a property of the Pythagorean representation of holistic systems that illustrates the Tetrad Principle. The number of yods (O) at corners of the ten tetractyses is **15**, which is both the number of combinations of

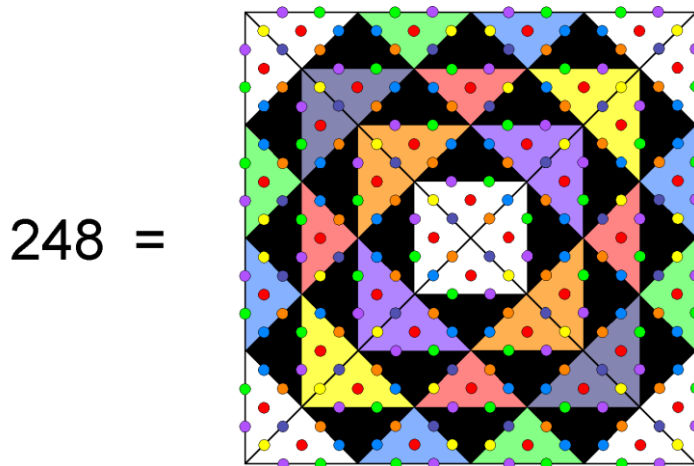


Figure 1. The 40 tetractyses in the square when its sectors are 2nd-order tetractyses contain **248** coloured yods other than the 41 corners. These hexagonal yods, which symbolise the Sephiroth of Construction, denote the **248** gauge fields transmitting the unified force between superstrings.

four objects and the *fourth* Mersenne number (see earlier). The number of coloured yods is

$$70 = \begin{matrix} & & 7 & & \\ & & 7 & 7 & \\ & 7 & 7 & 7 & \\ & 7 & 7 & 7 & 7, \end{matrix}$$

where 7 is the *fourth* odd integer. 70 is the *fourth*, 4-dimensional, *tetrahedral* number after 1, i.e., it is the number of balls that can be piled up in 4-dimensional space into the fourth tetrahedron.

Consider now a square divided into its four sectors, each of which is the 2nd-order tetractys (Fig. 1). The number of tetractyses is

$$40 = \begin{matrix} & & & 4 & & \\ & & & 4 & 4 & \\ & 4 & 4 & 4 & & \\ & 4 & 4 & 4 & 4, & \end{matrix}$$

as is the number of corners surrounding the centre of the square. The number of yods surrounding the centre of the square is

$$288 = 1^1 + 2^2 + 3^3 + 4^4.$$

Notice how the Tetrad expresses the properties of both the 2nd-order tetractys and the square when the latter is constructed from the former. There are **72** yods per sector, of which 10 are corners and **62** are coloured yods (what in earlier articles were referred to as “hexagonal yods,” so-called because they are located at the centres and corners of hexagons). **72** is the number of Chesed and **62** is the number value of

Tzadkiel, the Archangel of Chesed. There are **48** yods lining the square, where **48** is the number value of *Kokab*, the Mundane Chakra of Hod. **80** corners & centres of tetractyses surround the centre of the square, where **80** is the number value of Yesod. **49** yods line its diagonals, where **49** is the number value of EL ChAI, the Godname of Yesod. **64** hexagonal yods line the edges of the 2nd-order tetractyses, where **64** is the number value of *Nogah*, the Mundane Chakra of Netzach. Fig. 1 shows that there are **248** hexagonal yods (yods other than corners of tetractyses). **248** is the number value of *Raziel*, the Archangel of Chokmah. Symbolising Sephiroth of Construction, they denote the **248** gauge fields of the superstring gauge symmetry group E_8 transmitting the unified force between superstrings. It is a remarkable demonstration of the way in which the Tetrad determines numbers of scientific significance, in this case the dimension of E_8 . The Godname EHYEH prescribes it because the **36** tetractyses have **21** corners.

There are 32 hexagonal yods lying on the sides of the square that are unshared with adjacent tetractyses. This leaves $(248-32=216)$ hexagonal yods inside the square. There are 46 internal hexagonal yods per sector that are unshared. The number of unshared hexagonal yods in the square = $32 + 4 \times 46 = 216$. It is amusing that this is the number of years that, according to Androcydes, the Pythagorean writer of the work *On Symbols*, and others was thought in antiquity to elapse between successive lives of Pythagoras. **216** is the number value of Geburah, the fifth Sephirah (see Table 1). It is also the notorious number mentioned by Plato in a passage in his *Republic*, which is thought (3) to refer to its property as the sum of the cubes of

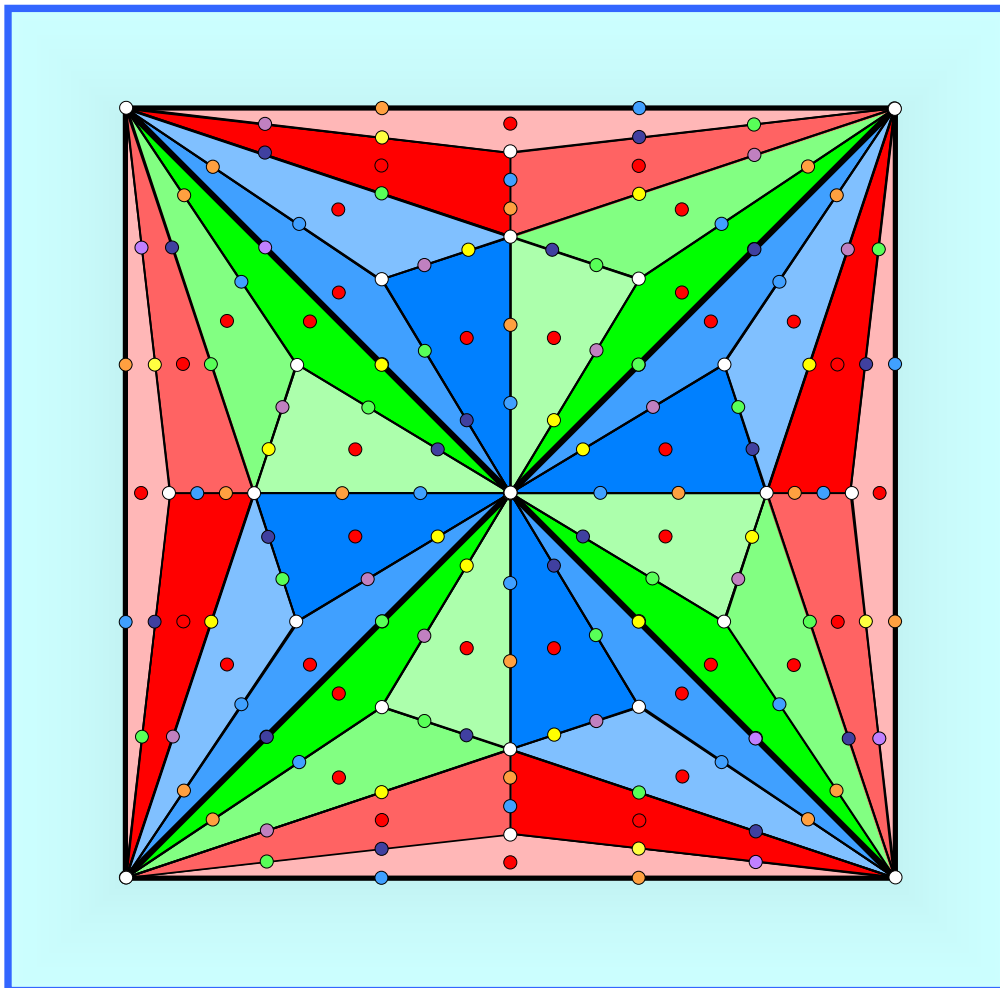


Figure 2. Symbol of the Pythagorean Tetrad, the square can be formed from **36** tetractyses with **21** corners and with **168** yods surrounding its centre.

the numbers 3, 4 & 5 measuring the sides of Pythagoras' famous right-angled triangle.

Of the **48** yods on the boundary of the square whose sectors are divided into the next higher-order tetractys, four are its corners, leaving 44 other yods, once again illustrating the influence of the Tetrad in determining or expressing the properties of objects with sacred geometry.

3. Square encodes superstring structural parameter 168

In previous articles, it was explained how the outer and inner forms of the Tree of Life encode the number **168**, which is the number value of *Cholem Yesodoth*, the Mundane Chakra assigned to Malkuth (physical universe). It is the number of circularly polarised waves making up half a revolution of each of the ten whorls of the superstring constituent of up and down quarks. We have already seen that the square encodes its dynamical parameter **248**. It will now be shown how it embodies its *structural* parameter **168**.

Instead of turning each sector of a square into a 2nd-order tetractys, consider it as a triangles divided into three sectors, each of which is then split into three more triangles turned into tetractyses (Fig. 2). Both a single square constructed in this way and the pair of squares enfolded in the inner form of the Tree of Life will be considered. Their properties are analysed below. Table 2 depicts the numbers in Table 1 that appear in the analysis presented in this article.

Table 2
(Numbers in coloured boxes appear in the discussion below)

Sephirah	Title	Godname	Archangel	Order of Angels	Mundane Chakra
Kether	620	21	314	833	636
Chokmah	73	15, 26	248	187	140
Binah	67	50	311	282	317
Chesed	72	31	62	428	194
Geburah	216	36	131	630	95
Tiphareth	1081	76	101	140	640
Netzach	148	129	97	1260	64
Hod	15	153	311	112	48
Yesod	80	49	246	272	87
Malkuth	496	65, 155	280	351	168

Single square

Square has four sectors, each with $(3 \times 3 = 9)$ triangles/tetractyses having 12 edges inside it.

Number of corners of triangles = $1 + 4 + 4 \times 4 = 21$ (19 outside root edge).

Number of sides of triangles = $4 + 4 + 4 \times 12 = 56$ (55 outside root edge, **48** not sides of sectors).

Number of triangles = $4 \times 9 = 36$.

Number of corners & sides of triangles = $21 + 56 = 77$.

Number of corners & triangles = $21 + 36 = 57$ (55 outside root edge).

Number of sides & triangles = $56 + 36 = 92$ (91 outside root edge).

Number of corners, sides & triangles = $77 + 36 = 113$ ($113 - 3 = 110$ outside root edge, $113 - 8 = 105$ inside square).

Number of yods = $21 + 36 + 56 \times 2 = 169$ ($169 - 4 = 165$ outside root edge, **168** surrounding centre).

Number of yods at corners of tetractyses = **21**.

Number of hexagonal yods = $169 - 21 = 148$.

Number of yods on edges of tetractyses = $169 - 36 = 133$ ($133 - 4 = 129$ yods outside root edge or generated from square with four corners).

Number of hexagonal yods on edges of tetractyses = $133 - 21 = 112$.

Number of yods on boundary of square = 12.

Number of yods inside square = $169 - 12 = 157$ (17 corners and **140** hexagonal yods).

Number of yods generated from square with 4 yods at corners = $169 - 4 = 165$.

Two joined squares

Two squares have 8 sectors, each with $(3 \times 3 = 9)$ triangles/tetractyses with 12 edges inside it.

Number of corners of triangles = $2 + 2 \times 19 = 40$.
 Number of sides of triangles = $1 + 2 \times 55 = 111$ (110 outside root edge).
 Number of triangles = $2 \times 36 = 72$.
 Number of corners & sides of triangles = $40 + 111 = 151$.
 Number of corners & triangles = $40 + 72 = 112$.
 Number of sides & triangles = $111 + 72 = 183$.
 Number of corners, sides & triangles = $151 + 72 = 223$ ($223 - 3 = 220$ outside root edge, $223 - 13 = 210$ inside squares).
 Number of yods = $4 + 2 \times 165 = 334$ ($334 - 4 = 330$ outside root edge).
 Number of yods at corners of tetractyses = $2 + 2 \times 19 = 40$.
 Number of hexagonal yods = $334 - 40 = 294$ (292 outside root edge).
 Number of yods on edges of tetractyses = $334 - 72 = 262$ ($262 - 4 = 258$ outside root edge).
 Number of hexagonal yods on edges of tetractyses = $262 - 40 = 222$ (220 outside root edge).
 Number of yods on boundary of squares = $4 + 2 \times (12 - 4) = 20$.
 Number of yods inside squares = $334 - 20 = 314$ (34 corners and **280** hexagonal yods, **140** in each square).
 Number of yods generated from two joined squares with 6 corners = $334 - 6 = 328$.

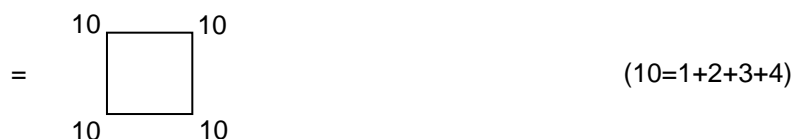
Listed below are the ways in which the number values of the Godnames of the 10 Sephiroth prescribe the properties of the square and the pair of joined squares:

- Kether: 21** **36** triangles in square have **21** corners. Also, 210 ($=21 \times 10$) corners, sides & triangles inside squares.
- Chokmah: 15** Number of corners & sides of triangles = $151 = 150$ th integer after 1, where $150 = 15 \times 10$.
26 **36** triangles in square have 56 sides, of which 52 are generated from square, where 52 = **26**th even integer.
- Binah: 50** Number of corners, sides & triangles in two squares separated by root edge = $3 + 2 \times 113 = 229 = 50$ th prime number.
- Chesed: 31** Number of new yods outside root edge on edges of tetractyses in square = $129 - 2 = 127 = 31$ st prime number. Also, number of yods outside root edge of two joined squares other than corners = $330 - 19 = 311 = 310$ th integer after 1, where $310 = 31 \times 10$.
- Geburah: 36** Square has **36** triangles. Also, two joined squares have 151 corners & sides, where 151 = **36**th prime number.
- Tiphareth: 76** Square has 77 corners & sides, where $77 = 76$ th integer after 1.
- Netzach: 129** Number of yods in two joined squares outside root edge on sides of tetractyses = $258 = 129$ th even integer. Also, the number of yods generated from square with four corners.
- Hod: 153** Number of corners & sides of two separate squares = $2 \times 77 = 154 = 153$ rd integer after 1.
- Yesod: 49** **72** triangles in two joined squares have 111 sides, of which 14 are sides of sectors other than root edge. Number of sides other than sector edges = $111 - 14 = 97 = 49$ th odd integer.
- Malkuth: 65** **129** yods outside root edge on sides of two squares, where $129 = 65$ th odd integer.
155 Number of yods inside square surrounding centre = $157 - 1 = 156 = 155$ th integer after 1.

The most important property listed above is that **168** yods surround the centre of a square whose sectors are constructed from three triangles, themselves constructed from three tetractyses. The number values of the Godnames of the ten Sephiroth therefore prescribe this basic structural parameter of the superstring.

The Pythagorean Tetrad determines the following properties of the square and the pair of joined squares present in the inner form of the Tree of Life:

- Number of corners of tetractyses in two joined squares = 40

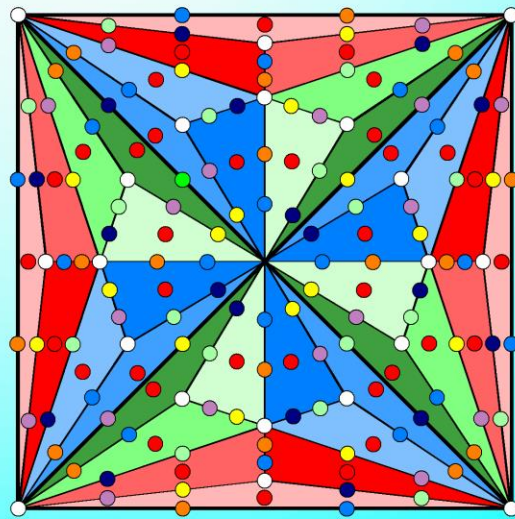
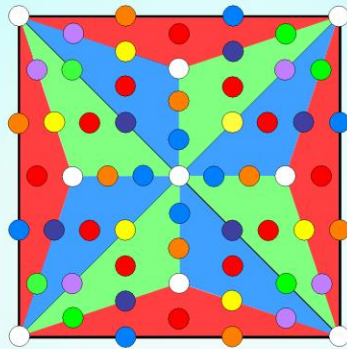
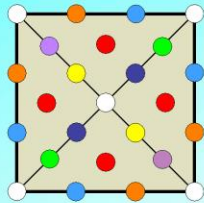


- Number of sides outside the root edge of the square = 55



TETRAD PRINCIPLE

The fourth member of the sequence of squares embodies the superstring structural parameter **168**.

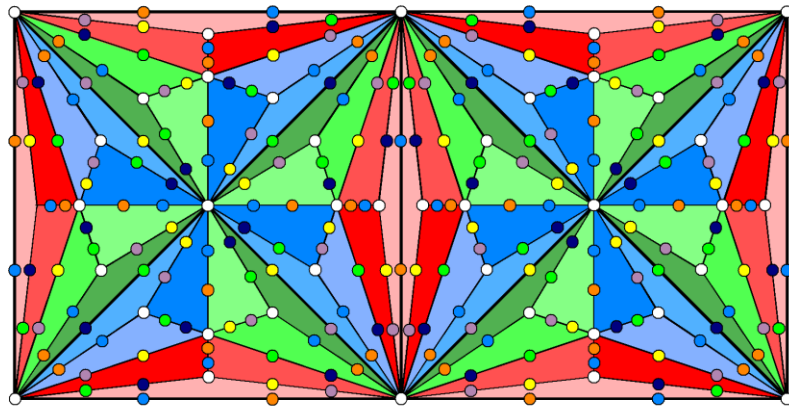


168 yods surround the centre of the square

Figure 3. The fourth type of square has **168** yods surrounding its centre.

$$\begin{array}{c}
 1 \\
 2 \ 3 \\
 = \ 4 \ 5 \ 6 \\
 7 \ 8 \ 9 \ 10.
 \end{array}
 \qquad (10=1+2+3+4)$$

This is also the number of corners and triangles in the square outside the root edge.
 3. Number of corners, sides & triangles in two joined squares outside the root edge = 220



= 262 =

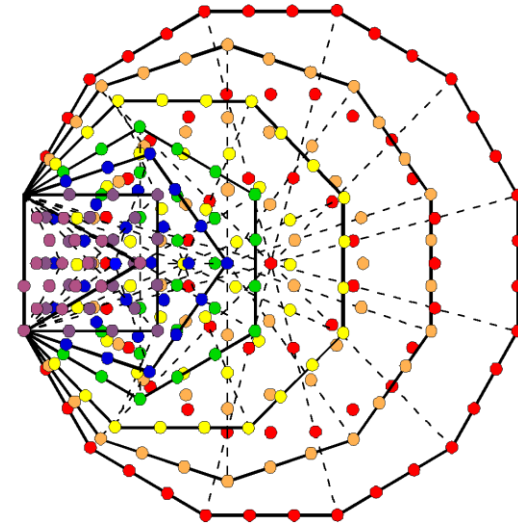
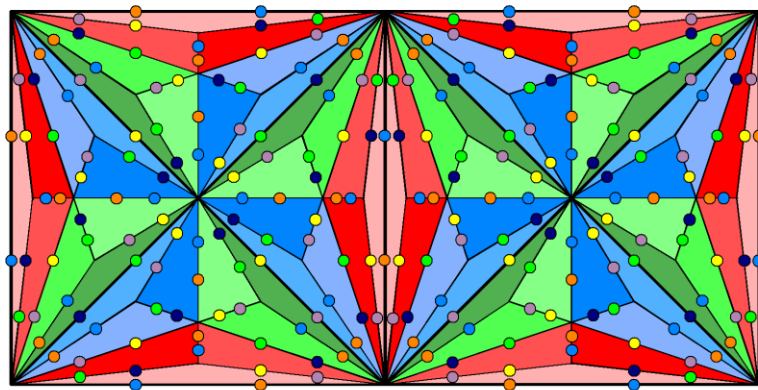


Figure 4. There are as many yods (262) on the edges of the **72** tetractyses in two joined squares as there are yods associated with the seven enfolded, regular polygons.



= 222 =

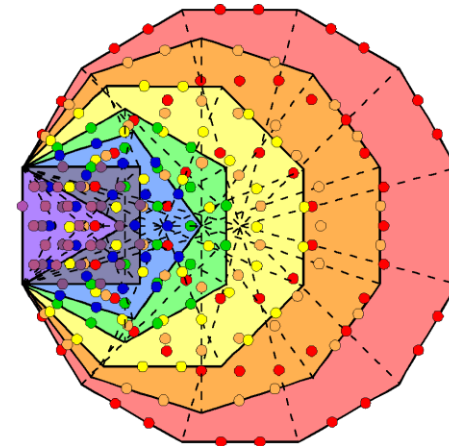
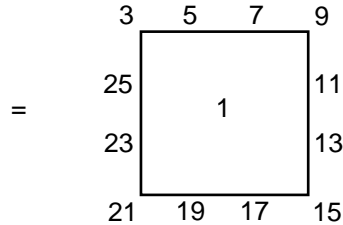


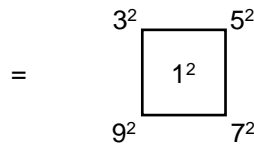
Figure 5. Two joined squares have as many hexagonal yods (222) on the edges of their **72** tetractyses as there are hexagonal yods associated with the seven enfolded, regular polygons of the inner Tree of Life.

$$\begin{array}{cccc}
 & & 4 & \\
 & & 8 & 12 \\
 = & 16 & 20 & 24 \\
 & 28 & 32 & 36 & 40
 \end{array}$$

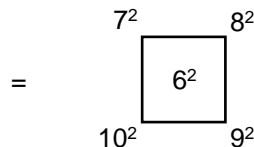
This is also the number of hexagonal yods outside the root edge in two joined squares.
 1. Number of yods in the square = $169 = 13^2$



168 yods surround its centre, which is denoted by the number 1. **168** is the sum of the 12 odd integers after 1 on the square's boundary, four to a side.
 2. Number of yods in the square *generated* by its construction from tetractyses (i.e., yods other than its corners) = $169 - 4 = 165$



Again, the central number, $1^2 = 1$, denotes the centre of the square.
 3. Number of yods outside the root edge of two joined squares = 330



The central number, $6^2 = 36$, denotes the **36** hexagonal yods at the centres of the **36** tetractyses. The Tetrad also determines the superstring structural parameter **168** because it is the number of yods surrounding the centre of the *fourth* member of the sequence of tetractys-generated squares, starting with the square itself (Fig. 3). It is a remarkable illustration of the Tetrad Principle discussed in Article 1.

4. Equivalence of the square & the 7 enfolded polygons

According to the properties of the square listed in Section 2, the pair of squares has 262 yods on the *boundaries* of their **72** tetractyses. The seven regular polygons enfolded in the Tree of Life have 264 yods, that is, 262 yods are associated with either set of polygons. The number of yods defining the *shapes* of the tetractyses making up the pair of squares is that needed to *fill up* each half of the inner form of the Tree of

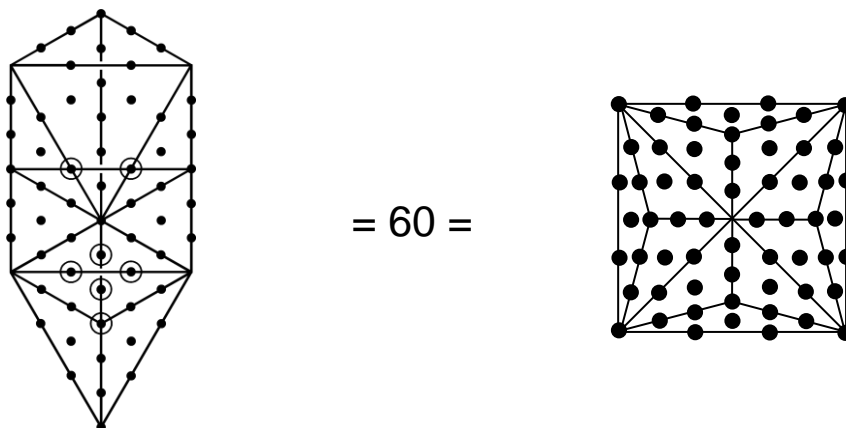
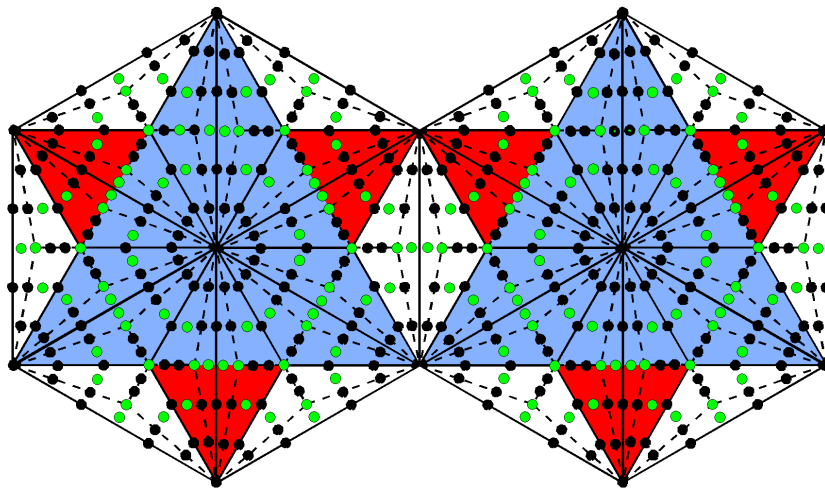


Figure 6. The number of hexagonal (i.e., new) yods in the Tree of Life constructed from tetractyses is the number of yods needed to create a square, starting from its centre, with three tetractyses as each sector.

Life (Fig.4). Furthermore, there are 222 hexagonal yods on the boundaries of the **72** tetractyses. These yods correspond to the Sephiroth of Construction above Malkuth, the lowest Sephirah of Construction. 222 is the number of *hexagonal* yods associated with each set of seven enfolded polygons (Fig. 5). These two remarkable similarities demonstrate that the square possesses an implicit or hidden equivalence to the inner form of the Tree of Life. As there are 444 hexagonal yods in the (7+7) enfolded polygons (4), the Tetrads expresses the hexagonal yod population of the inner form of the Tree of Life.

The square is also equivalent in the same sense to the *outer* form of the Tree of Life. The reason for this is as follows: when the 16 triangles of the Tree of Life are turned into tetractyses, they contain 70 yods made up of the 10 corners of tetractyses at the positions of the Sephiroth and 60 hexagonal yods (Fig. 6). When each sector of a square is divided into three triangles which are then turned into tetractyses, the square is found to contain 61 yods. 60 yods are needed to construct such a transformed square from the point at its centre, just as 60 additional yods are required to construct the outer form of the Tree of Life from 16 tetractyses.

The hexagon is the *fourth* of the regular polygons. **36** yods surround its centre when its sectors are tetractyses. When the latter are of the same type as that discussed in Section 3 for the embodiment of the



78 (●)

Figure 7. The **(248+248)** yods outside the root edge surrounding the centres of the two joined hexagons symbolise the **(248+248)** gauge fields transmitting the unified force between $E_8 \times E_8$ heterotic superstrings. The 78 green yods in each hexagon that are either centres or corners of tetractyses denote the 78 gauge fields of E_6 ,

number **168** by the square, the hexagon contains 252 yods surrounding its centre. Hence, there are **248** yods outside the root edge that surround its centre. Outside the root edge of the pair of joined hexagons (Fig. 7) are **(248+248=496)** yods surrounding their centres. They symbolise the **(248+248)** gauge fields of the $E_8 \times E_8$ heterotic superstring. Once again, we see how the Tetrads Principle picks out a mathematical object that embodies a number of fundamental significance. The regular polygon with *four* corners embodies the structural parameter **168** of superstrings and the *fourth* regular polygon embodies its dynamical parameters **248** & **496**. ELOHA, the Godname of Geburah with number value **36**, prescribes this representation because each hexagon has **36** yods surrounding its centre when its sectors are tetractyses. ELOHIM, Godname of Binah with number value **50**, prescribes it because, including the four yods of the root edge, **500** ($=50 \times 10$) yods surround the centres of the two hexagons. YAHWEH, the Godname of Chokmah with number value **26**, prescribes this representation of the number **496** because **26** yods on edges of the sectors of each hexagon surround its centre. Each sector has nine hexagonal yods at the centres of tetractyses. There are **(248 - 6x9 = 194)** yods other than centres. **194** is the number value of *Tzadekh*, the Mundane Chakra of Chesed. The nine tetractyses in each sector have four corners inside the boundary of the hexagon (**48** for both hexagons), which has four corners outside the root edge. Hence, there are $(6 \times 4 + 4 + 1 = 29)$ external corners and **(248 - 28 = 220)** hexagonal yods, where $220 = 4 \times 55$

$$\begin{array}{r}
 4 \\
 8 \quad 12 \\
 = \quad 16 \quad 20 \quad 24 \\
 \quad 28 \quad 32 \quad 36 \quad 40,
 \end{array}$$

showing how the Tetrad determines this number. The two joined hexagons have $(2 \times 29 + 2 = 60)$ corners and $(2 \times 220 + 2 = 442)$ hexagonal yods, i.e., 221 hexagonal yods are associated with each hexagon. This is the number of hexagonal yods associated with each set of seven enfolded polygons that are outside the root edge (see Fig. 5). This demonstrates how the pair of joined hexagons embodies a property of the inner Tree of Life. There are 13 corners & centres of the nine tetractyses in each sector. The **248** yods therefore comprise $(6 \times 13 = 78)$ corners & centres (shown in Fig. 7 as green yods). They symbolise the 78 roots of E_6 , an exceptional subgroup of E_8 that physicists have considered as a basis for the physics of the Standard Model (in other words, the *currently* known properties of subatomic particles). Six of the corners are centres of the sectors, leaving **72** other corners & centres. They correspond to the six simple roots of E_6 and its **72** other roots. There are 156 green yods in the two hexagons, where 156 is the **155th** integer after 1 and **155** is the number value of ADONAI MELEKH, the Godname of Malkuth. As this Sephirah is the universe of physical matter, it is an indication that E_6 does, indeed, describe part of its physics.

5. Conclusion

The simple square symbolises the number 4, or Tetrad, so highly esteemed by the Pythagoreans. The four integers 1, 2, 3 & 4 add up to 10, which is the number of Sephiroth of the Tree of Life and the number of points in the tetractys — an equivalent symbol of the ten-fold nature of divine unity and a representation of these integers. A square divided into tetractyses has 25 yods symbolising the 25 spatial dimensions of the universe. A square with each sector divided into three tetractyses has 60 yods surrounding its centre that correspond to the 60 extra yods making up the triangles of the Tree of Life when they are turned into tetractyses. A square with each sector divided into three triangles that are then divided into three tetractyses contains **168** yods surrounding its centre. This number characterises the manifestation of the Tree of Life in the subatomic world as the number of circularly polarised waves made by each one of the ten whorls of a spinning superstring as it completes half a revolution in space about its axis of spin, that is, one-tenth of the five complete revolutions of each whorl. The number **168** is defined arithmetically by a square because it is the sum of the twelve, successive odd integers after 1 that can be spaced along the sides of a square, four to each edge. A square with each sector turned into the next higher order tetractys above the tetractys contains **248** yods other than corners of tetractyses. These yods, which symbolise the seven Sephiroth of Construction, signify the **248** quantum states of the particle transmitting the unified force acting between superstrings of either ordinary or shadow matter. A 4×4 square array of the squares of the first four odd integers has as its sum the number (**496**) of such states responsible for the interactions of superstrings of *both* kinds of matter. Successive transformations of the square generate numbers corresponding to ever more *concrete* realisations of the cosmic blueprint. The fourth of the regular polygons embodies the **248** gauge fields of the superstring symmetry group E_8 , the pair of these polygons embodying the dimension **496** of $E_8 \times E_8$. Truly, one must agree with the Pythagoreans in their calling the number 4 “the greatest miracle” and “holding the key of Nature.”

References

1. Phillips, Stephen M. Article 1: “The Pythagorean nature of superstring and bosonic string theories,” <http://smphillips.mysite.com/Article01.pdf>, p. 4.
2. Named after Father Marin Mersenne, a natural philosopher, theologian, mathematician, musical theorist and friend of René Descartes, the n th Mersenne number is of the form $M_n = 2^n - 1$, where n is an integer.
3. J. Adams, *The Republic of Plato*, Cambridge University Press, Cambridge, 1929.
4. Proof: Of the 264 yods in the seven enfolded polygons, **36** are corners of polygons and five more are just their centres. There are $(264 - 36 - 5 = 223)$ hexagonal yods. Two of them lie on the root edge and 221 are external. Number of hexagonal yods in the $(7+7)$ enfolded polygons = $2 + 2 \times 221 = 444$.