Qi Men Dun Jia and the Golden Section

辰巳	午	未申
卯	(see chart below)	酉
寅丑	子	戌亥

九天 惊门 戊 天柱 辛	九地 开门 己 天心 丙	玄武 休门 丁 天蓬 癸
值符 庚 死门 癸 禽 天芮 壬	 庚	白虎 生门 乙 天任 戊
螣蛇 景门 丙 天英 乙	太阴 杜门 辛 天辅 丁	六合 伤门 壬 天冲 己

By John Frederick Sweeney

Abstract

Qi Men Dun Jia is based on the Clifford Clock, as well as an icosahedron. The purpose of the icosahedron relates to the Pisano Period, which has a limit of 60, or the periodicity of Fibonacci Numbers and the Fibonacci Spiral, which are related to the Golden Ratio and the Platonic Solids. In addition, the icosahedron forms an isomorphic relationship to the 60 Jia Zi and 60 Na Yin of Chinese metaphysics, which provide the entry point for the Five Elements into the formation of matter. The icosahedron is composed of three Golden Rectangles and is edged in the Golden Ratio. The three Golden Rectangles are directly related to three Fano Planes, which are composed of Octonions. Taken together, the Pisano Period, Fibonacci Numbers and the Golden Section outline the path of growth of matter in the universe. By following this natural order, the Qi Men Dun Jia model is capable of making accurate predictions about natural and human phenomena.

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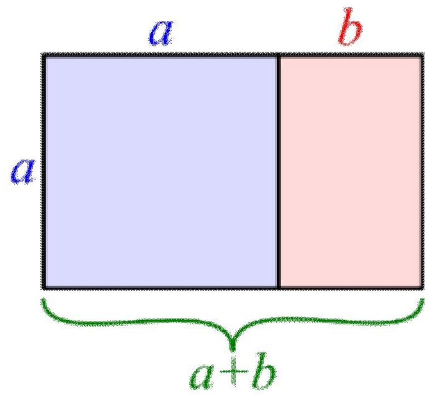
Introduction

Qi Men Dun Jia is based on a 3 x 3 Magic Square. If this square is extended to a Golden Rectangle, then this engenders a Fibonacci Spiral, which in turn may engender a torus.

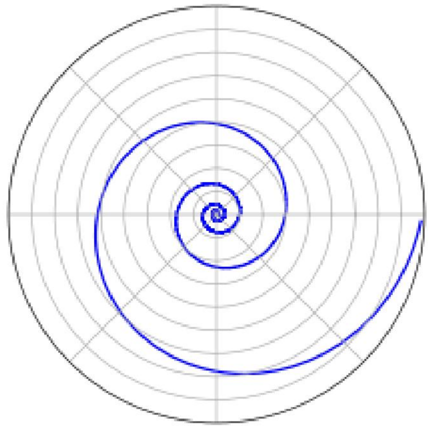


A golden rectangle with longer side ***a*** and shorter side ***b***, when placed adjacent to a square with sides of length ***a***, will produce a similar golden rectangle with longer side ***a* + *b*** and shorter side ***a***. This illustrates the relationship $\frac{a+b}{a} = \frac{a}{b} \equiv \varphi$.

Hypothesis

Matter grows or extends with each count or beat of the oscillation of matter, to an area which is proportional to the Golden Rectangle, since the beat or count itself is regulated in tandem with the Golden Ratio.

A **logarithmic spiral**, **equiangular spiral** or **growth spiral** is a special kind of spiral curve which often appears in nature. The logarithmic spiral was first described by Descartes and later extensively investigated by Jacob Bernoulli, who called it *Spira mirabilis*, "the marvelous spiral".



Wolfram writes;

The logarithmic spiral is a spiral whose polar equation is given by

$$r = a e^{b\theta}, \quad (1)$$

where r is the distance from the origin, θ is the angle from the x-axis, and a and b are arbitrary constants. The logarithmic spiral is also known as the growth spiral, equiangular spiral, and spira mirabilis. It can be expressed parametrically as

$$x = r\cos\theta = a\cos\theta\, e^{b\theta}$$

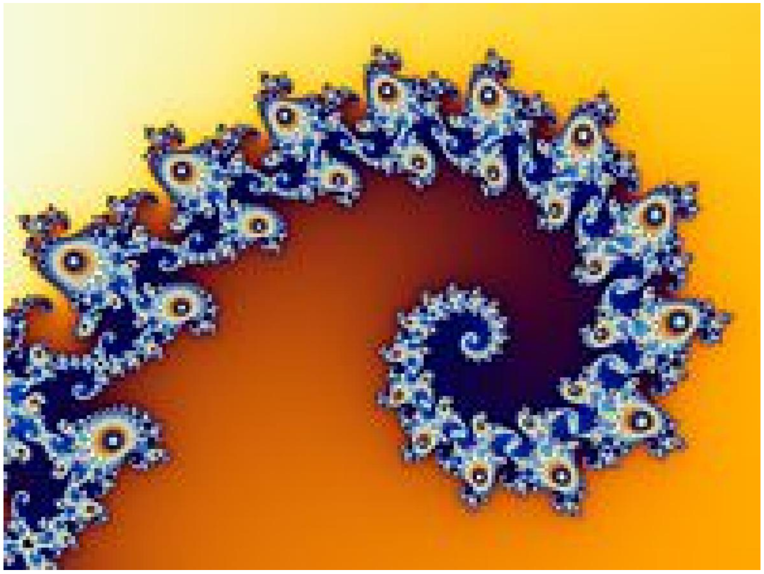
$$y = r\sin\theta = a\sin\theta\, e^{b\theta}.$$

This spiral is related to Fibonacci numbers, the golden ratio, and golden rectangles, and is sometimes called the golden spiral.

The Golden Quartet

How do all of these function and play together? At the center of the icosahedron lies the 3 x 3 Luo Shu Magic Square of Qi Men Dun Jia, where each row adds up to 15. It may be the case that Qi Men Dun Jia takes advantage of other magic squares; in a similar way, the magic square for the Svas Tika, or swastika, creates a spiral motion, with the arms picking up energy as if to start movement. This is the reason why the Hindu people have regarded the Svas Tika as a sacred object, and the reason why the National Socialists adopted the Svas Tika as their emblem.

This is where the spiral movement begins, to connect the Magic Square to the Golden Rectangle moving up through the icosahedron.



Properties of Logarithmic Spirals / Wikipedia

The logarithmic spiral can be distinguished from the Archimedean spiral by the fact that the distances between the turnings of a logarithmic spiral increase in geometric progression, while in an Archimedean spiral these distances are constant.

Logarithmic spirals are self-similar in that the result of applying any similarity transformation to the spiral is congruent to the original untransformed spiral.

Scaling by a factor $e^{2\pi b}$, for an integer *b*, with the center of scaling at the origin, gives the same curve as the original; other scale factors give a curve that is rotated from the original position of the spiral.

Logarithmic spirals are also congruent to their own involutes, evolutes, and the pedal curves based on their centers.

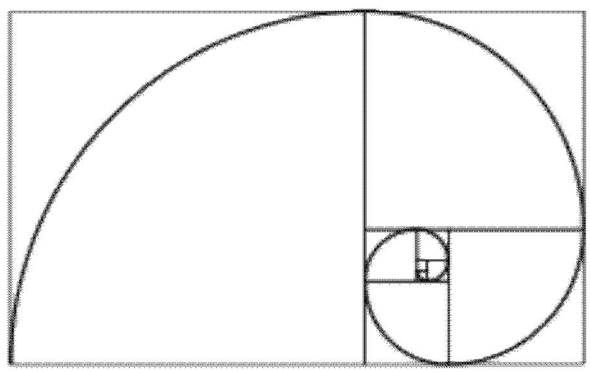
Starting at a point P and moving inward along the spiral, one can circle the origin an unbounded number of times without reaching it; yet, the total distance covered on this path is finite; that is, the limit as θ goes toward $-\infty$ is finite. This property was first realized by Evangelista Torricelli even before calculus had been invented.[4] The total distance covered is $\frac{r}{\cos(\phi)}$, where r is the straight-line distance from P to the origin.

The exponential function exactly maps all lines not parallel with the real or imaginary axis in the complex plane, to all logarithmic spirals in the complex plane with centre at 0. (Up to adding integer multiples of $2\pi i$ to the lines, the mapping of all lines to all logarithmic spirals is onto.) The pitch angle of the logarithmic spiral is the angle between the line and the imaginary axis.

The function $x \mapsto x^k$, where the constant k is a complex number with non-zero imaginary part, maps the real line to a logarithmic spiral in the complex plane.

One can construct a golden spiral, a logarithmic spiral that grows outward by a factor of the golden ratio for every 90 degrees of rotation (pitch about 17.03239 degrees), or approximate it using Fibonacci numbers.

A **golden spiral** is a logarithmic spiral whose growth factor is φ, the golden ratio.[1] That is, a golden spiral gets wider (or further from its origin) by a factor of φ for every quarter turn it makes.



A Fibonacci spiral approximates the golden spiral using quarter-circle arcs inscribed in squares of integer Fibonacci-number side, shown for square sizes 1, 1, 2, 3, 5, 8, 13, 21, and 34.

By this process, it might prove possible that matter expands in this way, but increments, perhaps in counts or beats of the universe. That is to say, with every new beat or count, the universe expands by this extra rectangular area, along the lines of Fibonacci Numbers and the Golden Section.

This is probably so, since an 8 x 8 state of matter may grow side by side with a 9 x 9 piece of matter. The Golden Ratio creates the ideal balance between the two states of matter.

Hypothesis

The Golden Ratio appears in nature wherever the two visible states of matter, Satva and Raja, appear side by side, forming a seam between them, or a border region. The Golden Ratio approximates and modulates the values on both sides.

Bott Periodicity and Pisano Periodicity

The harshest critique that this author reserves is for the mathematicians and physicists who started the tradition of naming every insignificant discovery after themselves. Thus, math physics becomes a hodge podge of four or five hundred names of dead European men, with the exception of Ruth Moufang. This practice makes the study of this field even more difficult than it need be.

Fibonacci, or Pisano, serves as the perfect case in point. This author has known about Fibonacci numbers for many decades. Only after the evolution of the internet was it clear to this author that Fibonacci had gotten most of his information from an Arab text which he translated, and the Fibonacci numbers were not his discovery, and he barely paid attention to them in his lifetime.

What is wholly unforgiveable about mathematics and physics is that an extremely crucial mathematical theorem exists under his real name, if Fibonacci is the pseudonym of Leonardo di Pisano. The two are rarely, if ever connected in print, yet have enormous impact on nature and science. From the point of view of a former librarian and information specialist, this sin is unpardonable.

Wikipedia describes this theorem in this way:

In number theory, the *n*th **Pisano period**, written π(*n*), is the period with which the sequence of Fibonacci numbers, modulo *n* repeats. For example, the Fibonacci numbers modulo 3 are 0, 1, 1, 2, 0, 2, 2, 1, 0, 1, 1, 2, 0, 2, 2, 1, etc., with the first eight numbers repeating, so π(3) = 8. Pisano periods are named after Leonardo Pisano, better known as Fibonacci. The existence of periodic functions in Fibonacci numbers was noted by Joseph Louis Lagrange in 1774.

Unfortunately, the Wiki writer and subsequent editors "buried the lead" in this entry: in fact, they did not even bury the lead, they entirely missed the point.

There are exactly 60 terms in this sequence before it begins repeating.

Which comes from a different website.

The 60 terms in the Pisano Period of the Fibonnacci numbers provide the reason why this author has chosen the icosahedron and its isomorphs, the 60 Jia Zi and the 60 Na Yin, for the Qi Men Dun Jia Cosmic Board model. The Pisano Period automatically lends periodicity to the icoshedron and its related forms. At this point, our QMDJ model now contains Bott Periodicity and Pisano Periodicity, and the two work neatly together, given the common multiples and factors.

The first Pisano periods (sequence A001175 in OEIS) and their cycles (with spaces before the zeros for readability) are:

n	**π(*n*)**	**nr. of 0s**	**cycle**
1	1	1	0
2	3	1	011
3	8	2	0112 0221
4	6	1	011231
5	20	4	01123 03314 04432 02241
6	24	2	011235213415 055431453251
7	16	2	01123516 06654261
8	12	2	011235 055271
9	24	2	011235843718 088764156281
10	60	4	011235831459437 077415617853819 099875279651673 033695493257291

Onward the Pisano periods are 10, 24, 28, 48, 40, 24, 36, 24, 18, 60, 16, 30, 48, 24, 100 ...

Pisano numbers adhere both to Period - 8, as well as to Base 60 periodicity of the Pisano Period, which provide a nice range of factors and multiples for easy use and interchange. So our single atom may develop in between two distinct forms of periodicity, which is called a Complex Lattice and is related to Elliptic Functions. The Elliptic Functions, especially the Jacobi Function, are related to the Golden Rectangle, and these offer additional forms of periodicity.

There are 12 Jacobi Functions, which form isomorphic relations to the 12 Earth Branches in Chinese metaphysics, which make up one part of the 60 Jia Zi and 60 Na Yin. These Earth Branches may represent Time, or other archetypes, such as the birth years of individuals, seasons, or even directions. Pentagonal numbers are related to this area as well, with the 5 note scale of traditional Chinese music locking in with the 60 Jia Zi and 60 Na Yin.

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Trigonometric Functions

The Jacobi Functions are related to Trigonometry, and we shall later see in our model that Trigonometric Functions contain periodic properties which adds a fourth type of periodicity to our model. We will deal with the major aspects of Jacobi Functions, theta function and Trigonometry in a separate paper, but it is important to note here their relationship to the Earth Branches as well as to the Pentagonal Numbers.

The following comes from a high school trigonometry text:

Trigonometry originated as part of the study of triangles. The name trigonometry means the measurement of three-cornered figures, and the first definitions of the trigonometric functions were in terms of triangles.

However, the trigonometric functions can also be defined using the unit circle, a definition that makes them periodic, or repeating. Many naturally occurring processes are also periodic. The water level in a tidal basin, the blood pressure in a heart, an alternating current, and the position of the air molecules transmitting a musical note all fluctuate regularly. Such phenomena can be represented by trigonometric functions.

In the theory of Chinese medicine, Qi, or prana, is said to flow with blood. Therefore, if trigonometric functions can be used to measure blood flow, they may be adapted to measure Qi flow.

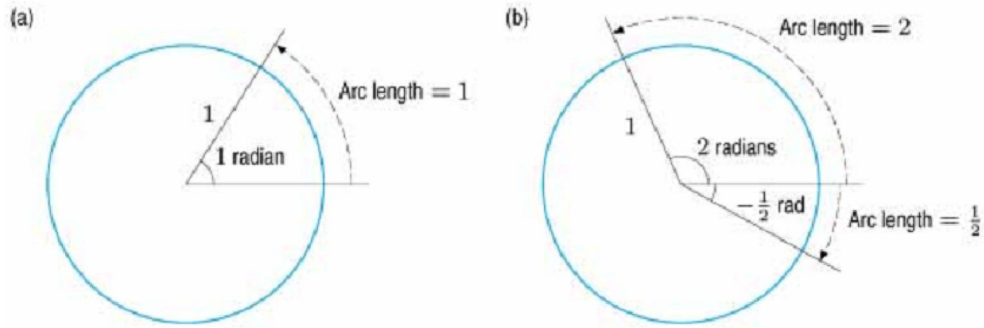


Figure 1.44 Radians defined using unit circle

An angle of 2 radians cuts off an arc of length 2 on a unit circle. A negative angle, such as -1/2 radians, cuts off an arc of length 1/2, but measured clockwise. (See Figure 1.44(b).)

It is useful to think of angles as rotations, since then we can make sense of angles larger than 360°; for example, an angle of 720° represents two complete rotations counterclockwise. Since one full rotation of 360° cuts off an arc of length 2π, the circumference of the unit circle, it follows that

$$360° = 2\pi \text{ radians}, \quad \text{so} \quad 180° = \pi \text{ radians}.$$

In other words, 1 radian = $180°/\pi$, so one radian is about 60°. The word radians is often dropped, so if an angle or rotation is referred to without units, it is understood to be in radians.

Radians are useful for computing the length of an arc in any circle. If the circle has radius r and the arc cuts off an angle θ, as in Figure 1.45, then we have the following relation:

$$\text{Arc length} = s = r\theta.$$

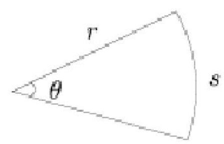


Figure 1.45 Arc length of a sector of a circle

The two basic trigonometric functions—the sine and cosine—are defined using a unit circle. In Figure 1.46, an angle of t radians is measured counterclockwise around the circle from the point (1, 0). If P has coordinates (x, y), we define

$$\cos t = x \quad \text{and} \quad \sin t = y.$$

We assume that the angles are *always* in radians unless specified otherwise.

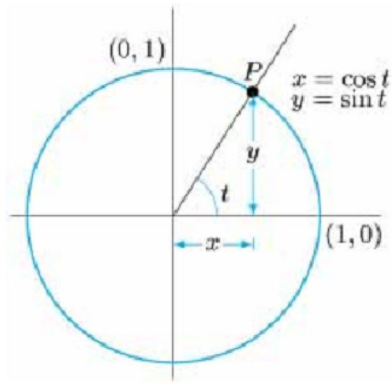


Figure 1.46 The definitions of sin t and cos t

Since the equation of the unit circle is $x^2 + y^2 = 1$, we have the following fundamental identity

$$\cos^2 t + \sin^2 t = 1.$$

As t increases and P moves around the circle, the values of sin t and cos t oscillate between 1 and -1, and eventually repeat as P moves through points where it has been before. If t is negative, the angle is measured clockwise around the circle.

Amplitude, Period, and Phase

The graphs of sine and cosine are shown in Figure 1.47. Notice that sine is an odd function, and cosine is even. The maximum and minimum values of sine and cosine are +1 and -1, because those are the maximum and minimum values of y and x on the unit circle. After the point P has moved around the complete circle once, the values of cos t and sin t start to repeat; we say the functions are *periodic*.

For any periodic function of time, the

- **Amplitude** is half the distance between the maximum and minimum values (if it exists).
- **Period** is the smallest time needed for the function to execute one complete cycle.

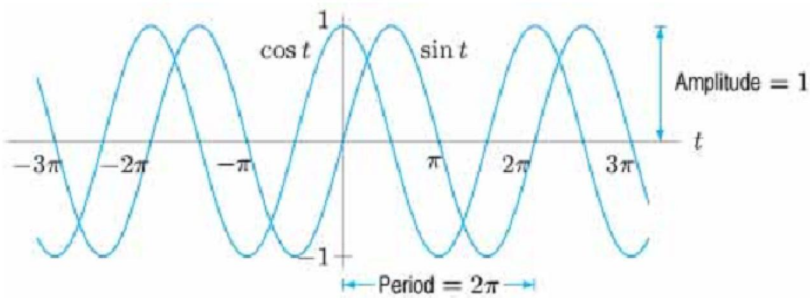


Figure 1.47 Graphs of cos t and sin t

The amplitude of cos t and sin t is 1, and the period is 2π. Why 2π? Because that's the value of t when the point P has gone exactly once around the circle. (Remember that 360° = 2π radians.)

In Figure 1.47, we see that the sine and cosine graphs are exactly the same shape, only shifted horizontally. Since the cosine graph is the sine graph shifted π/2 to the left,

$$\cos t = \sin(t + \pi/2).$$

Equivalently, the sine graph is the cosine graph shifted π/2 to the right, so

$$\sin t = \cos(t - \pi/2).$$

We say that the *phase difference* or *phase shift*[8] between sin t and cos t is π/2.

Functions whose graphs are the shape of a sine or cosine curve are called *sinusoidal* functions.

To describe arbitrary amplitudes and periods of sinusoidal functions, we use functions of the form

$$f(t) = A\sin(Bt) \quad \text{and} \quad g(t) = A\cos(Bt),$$

where $|A|$ is the amplitude and $2\pi/|B|$ is the period.

The graph of a sinusoidal function is shifted horizontally by a distance $|h|$ when t is replaced by $t - h$ or $t + h$.

Functions of the form $f(t) = A\sin(Bt) + C$ and $g(t) = A\cos(Bt) + C$ have graphs which are shifted vertically and oscillate about the value C.

Elliptic Function and Jacobi Functions

These two types of functions play a key role in the Qi Men Dun Jia Cosmic Board model. Later in this series we shall see how these figure in with Rhiemann surfaces and the three - torus. In essence, the Qi Men Dun Jia Cosmic Board model contains a wide variety of periodicities, which give the system tremendous flexibility in accounting for time and space. Here we describe these functions for the non - specialist reader.

Wikipedia describes the elliptic function and Jacobi functions in this way:

In complex analysis, an **elliptic function** is a meromorphic function that is periodic in two directions. Just as a periodic function of a real variable is defined by its values on an interval, an elliptic function is determined by its values on a fundamental parallelogram, which then repeat in a lattice.

Such a doubly periodic function cannot be holomorphic, as it would then be a bounded entire function, and by Liouville's theorem every such function must be constant.

In fact, an elliptic function must have at least two poles (counting multiplicity) in a fundamental parallelogram, as it is easy to show using the periodicity that a contour integral around its boundary must vanish, implying that the residues of any simple poles must cancel.

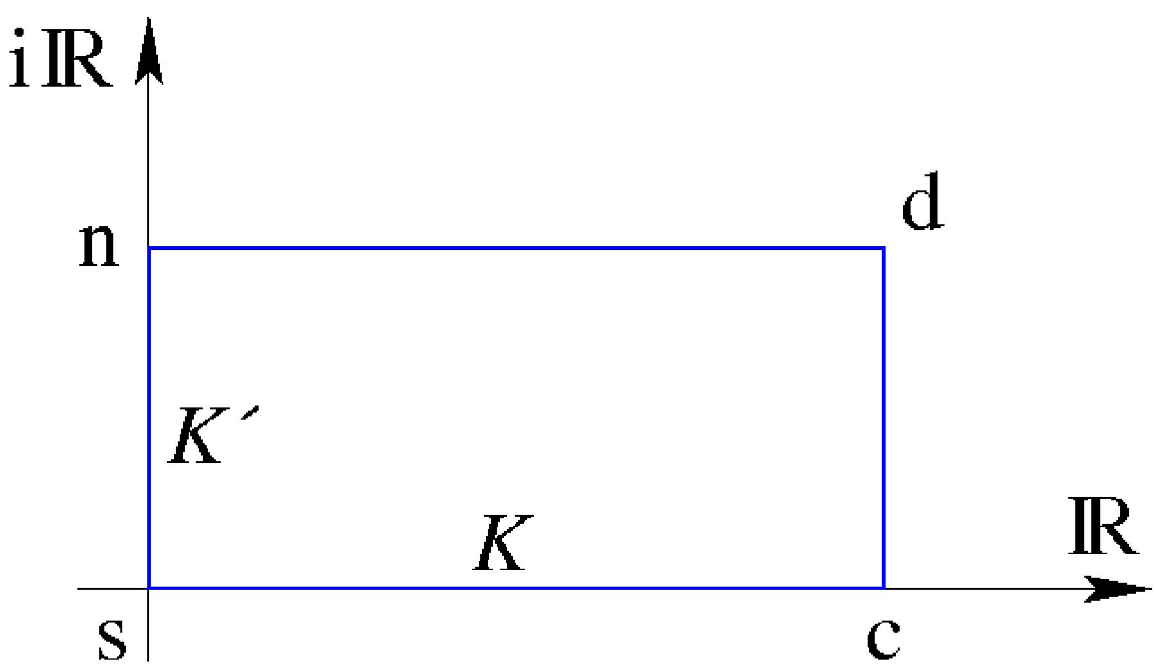
Historically, elliptic functions were first discovered by Niels Henrik Abel as inverse functions of elliptic integrals, and their theory improved by Carl Gustav Jacobi; these in turn were studied in connection with the problem of the arc length of an ellipse, whence the name derives.

Jacobi's elliptic functions have found numerous applications in physics, and were used by Jacobi to prove some results in elementary number theory.

A more complete study of elliptic functions was later undertaken by Karl Weierstrass, who found a simple elliptic function in terms of which all the others could be expressed. Besides their practical use in the evaluation of integrals and the explicit solution of certain differential equations, they have deep connections with elliptic curves and modular forms.

There are twelve Jacobian elliptic functions. Each of the twelve corresponds to an arrow drawn from one corner of a rectangle to another. The corners of the rectangle are labeled, by convention, s, c, d and n. The rectangle is understood to be lying on the complex plane, so that s is at the origin, c is at the point K on the real axis, d is at the point $K + iK'$ and n is at point iK' on the imaginary axis. The numbers K and K' are called the quarter periods.

The twelve Jacobian elliptic functions are then pq, where each of p and q is one of the letters s, c, d, n.



The Jacobian elliptic functions are then the unique doubly periodic, meromorphic functions satisfying the following three properties:

- There is a simple zero at the corner p, and a simple pole at the corner q.
- The step from p to q is equal to half the period of the function pq u; that is, the function pq u is periodic in the direction pq, with the period being twice the distance from p to q. The function pq u is also periodic in the other two directions, with a period such that the distance from p to one of the other corners is a quarter period.
- If the function pq u is expanded in terms of u at one of the corners, the leading term in the expansion has a coefficient of 1. In other words, the leading term of the expansion of pq u at the corner p is u; the leading term of the expansion at the corner q is $1/u$, and the leading term of an expansion at the other two corners is 1.

More generally, there is no need to impose a rectangle; a parallelogram will do. However, if K and iK' are kept on the real and imaginary axis, respectively, then the Jacobi elliptic functions pq u will be real functions when u is real.

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The twelve Earth Branches in Qi Men Dun Jia form a circle around the 3 x 3 Magic Square, and are assigned to the eight outside palaces in this way: Zi, Mao, Wu and You to the four cardinal directions, starting from North at bottom; two each to the corner palaces. Each of the branches carries a Yin or Yang value, a Five Element value and forms an archetype with distinct meanings and directions. For example, Mao refers to the East and Wood, but may also refer to a month or year, depending upon the context of the question.

There are twelve Jacobian elliptic functions, and twelve Earth Branches in Chinese metaphysics, which exercise inter - relationships, such as opposites, which clash, and the same Five Elements, to create Wood, Fire, Water, Metal or Earth situations. For present purposes we note the isomorphic relations between Jacobian functions and Earth Branches.

The Cycle of Sixty

甲子	甲戌	甲申	甲午	甲辰	甲寅
乙丑	乙亥	乙酉	乙未	乙巳	乙卯
丙寅	丙子	丙戌	丙申	丙午	丙辰
丁卯	丁丑	丁亥	丁酉	丁未	丁巳
戊辰	戊寅	戊子	戊戌	戊申	戊午
己巳	己卯	己丑	己亥	己酉	己未
庚午	庚辰	庚寅	庚子	庚戌	庚申
辛未	辛巳	辛卯	辛丑	辛亥	辛酉
壬申	壬午	壬辰	壬寅	壬子	壬戌
癸酉	癸未	癸巳	癸卯	癸丑	癸亥

The ten Heavenly Stems are paired with the twelve Earth Branches to form the cycle of sixty, which form the basis for the 60 Na Yin and the Jia Zi, which are used to keep time, with four rotating cycles. Jia Zi provide Yin and Yang or binary values for the 60 group, while adding Five Element values as well. The 60 Na Yin add the values of tones or frequencies.

Jose Arguelles added tones to his Dreamspell calendar, which is loosely based on the ancient Mayan calendar. This is an interesting take, since this author assumes that calendrical knowledge was spread globally in the ancient world. However, Arguelles' reasons for adding tones remain unclear to this author, and application of the tones seemed to be based on contemporary guess work.

The main Glyph represent the true nature of the day, while the tone represent the manifestation of that nature in this reality. There are a total of 20 Glyphs and 13 Tones, for a total of 260 different variations (full lunar cycle). Each variation or unit of the 260 are called KIN (translation:day)

The Vedas and Hindu Mathematicians

One underlying assumption of this paper and the related series, is that "Chinese" metaphysical divination probably originated in India with Vedic literature, and was borrowed by the Chinese over the past two or three thousand years. The study of Da Yan provides one such example.

We include a discussion of Trigonometric Functions here to illustrate that medieval, if not ancient, Hindu mathematicians possessed knowledge of these functions, and that these functions are sufficient to produce some of the effects needed for the operation of the Qi Men Dun Jia Cosmic Board. That is to say that, if ancient Indians did not have Clifford Algebras, they still enjoyed a fairly advanced knowledge of mathematics, as they do today, which is why the Silicon Valley suburbs of Fremont and Milpitas are filled with NRI's today.

The point is that Hindu mathematicians possessed enough advanced knowledge to prove capable of constructing the Qi Men Dun Jia Cosmic Board, which the Chinese may have then borrowed at some point in the distant past. Since India lost much of its cultural heritage under the Moghul invasion, when many heretical books were burned, it remains possible that China's cultural borrowings helped to preserve Qi Men Dun Jia for posterity.

An example of this is the ancient Indian art of reading bird omens, which has presumably been lost in India, but preserved in the doctrines of Qi Men Dun Jia; every double hour is assigned a bird omen in the form of the meaning of what an owl or magpie might say.

The Cycle of Sixty

甲子	甲戌	甲申	甲午	甲辰	甲寅
乙丑	乙亥	乙酉	乙未	乙巳	乙卯
丙寅	丙子	丙戌	丙申	丙午	丙辰
丁卯	丁丑	丁亥	丁酉	丁未	丁巳
戊辰	戊寅	戊子	戊戌	戊申	戊午
己巳	己卯	己丑	己亥	己酉	己未
庚午	庚辰	庚寅	庚子	庚戌	庚申
辛未	辛巳	辛卯	辛丑	辛亥	辛酉
壬申	壬午	壬辰	壬寅	壬子	壬戌
癸酉	癸未	癸巳	癸卯	癸丑	癸亥

Jia Zi provide Yin and Yang or binary values for the 60 group, while adding Five Element values as well.

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Jose Arguelles added tones to his Dreamspell calendar, which is loosely based on the ancient Mayan calendar. This is an interesting take, since this author assumes that calendrical knowledge was spread globally in the ancient world. However, Arguelles' reasons for adding tones remain unclear to this author, and application of the tones seemed to be based on contemporary guess work.

The main Glyph represent the true nature of the day, while the tone represent the manifestation of that nature in this reality.
There are a total of 20 Glyphs and 13 Tones, for a total of 260 different variations (full lunar cycle). Each variation or unit of the 260 are calledKIN (translation:day)

Hypothesis: The Golden Section

The Golden Section or Golden Ratio forms the border between two states of matter. Since the two states contain two different types of frequencies qualities, it is impossible in nature to simply lay them side by side. The Golden Ratio has the function of approximating a mean between both types of matter, and modulating their edges. Thus the Golden Ratio has certain properties, such as Diophantine, etc. Which allow it to reduce to low levels.

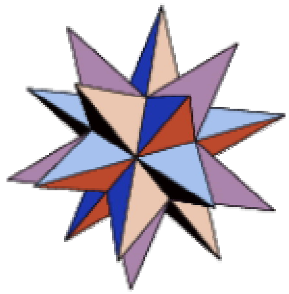
Stellated Icosahedra

In an earlier related paper on Vixra, the author made the partial case for the isomorphic relationship between the icosahedra and the 60 Jia Zi and the 60 Na Yin, precisely with the 59 Stellated Icosahedra. Inadvertently, the author failed to make the case for the 60th permutation of the icosahedra, which we argue here is the **Great Stellated Dodecahedron.**

In an email with the author on 28 June 2013, Frank "Tony" Smith made the point that the best candidate for the 60th permutation would be the Great Stellated Dodecahedron, since the matter remained essentially a question of definition. While the attributes of the Great Stellated Dodecahedron do not quite fit under Miller's Rules, we think an exception can be made in this case.

When the ancients devised the 60 Jia Zi and the 60 Na Yin, they perhaps did not adopt the same rules as Miller. Therefore, a slightly wider definition allows for the Great Stellated Dodecahedron to serve as the 60th stellation, and thus in accord with Frank "Tony" Smith we posit the Great Stellated Dodecahedron as the 60th permutation, not least since it retains the flow of Golden Ratio values through this model.

Great Stellated Dodecahedron
From the Wolfram math website:



since

The great stellated dodecahedron is one of the Kepler-Poinsot solids. It is also uniform polyhedron U_{52}, Wenninger model W_{41}, and is the third dodecahedron stellation (Wenninger 1989). Its dual is the great icosahedron. The great stellated dodecahedron has Schläfli symbol $\{\frac{5}{2}, 3\}$ and Wythoff symbol $3 \mid 2\ \frac{5}{2}$. It has 12 pentagrammic faces. The great stellated dodecahedron was published by Wenzel Jamnitzer in 1568. It was rediscovered by Kepler (and published in his work *Harmonice Mundi* in 1619), and again by Poinsot in 1809.

Its circumradius for unit edge length is

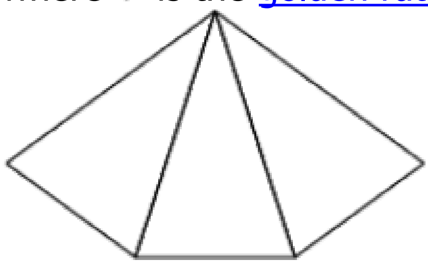
$$R = \frac{1}{2}\sqrt{3}\,\phi^{-1}$$

$$= \frac{1}{4}\sqrt{3}\,(\sqrt{5}-1),$$

where ϕ is the golden ratio.

The skeleton of the great stellated dodecahedron is isomorphic to the dodecahedral graph.

The great stellated dodecahedron can be constructed from a dodecahedron by selecting the 144 sets of five coplanar vertices, then discarding sets whose edges correspond to the edges of the original dodecahedron. This gives 12 pentagrams of edge length $\phi^2 = (3+\sqrt{5})/2$, where ϕ is the golden ratio.



Another way to construct a great stellated dodecahedron via cumulation is to make 20 triangular pyramids with side length $\phi = (1+\sqrt{5})/2$ (the golden ratio) times the base, as illustrated above, and attach them to the sides of an icosahedron. The height of these pyramids is then $\sqrt{\frac{1}{6}(7+3\sqrt{5})}$. Cumulating a dodecahedron to construct a great stellated dodecahedron produces a solid with edge lengths

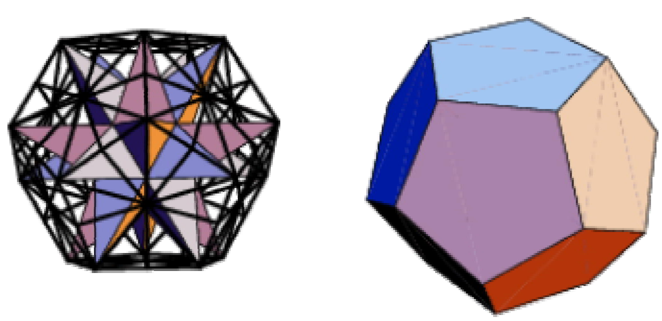
$$s_1 = 1$$

$$s_2 = \frac{1}{2}(1+\sqrt{5}).$$

The surface area and volume of such a great stellated dodecahedron are

$$S = 15\sqrt{5+2\sqrt{5}}$$

$$V = \frac{5}{4}(3+\sqrt{5}).$$



The convex hull of the great stellated dodecahedron is a regular dodecahedron and the dual of the dodecahedron is the icosahedron, so the dual of the great stellated dodecahedron (i.e., the great icosahedron) is one of the icosahedron stellations (Wenninger 1983, p.

40)

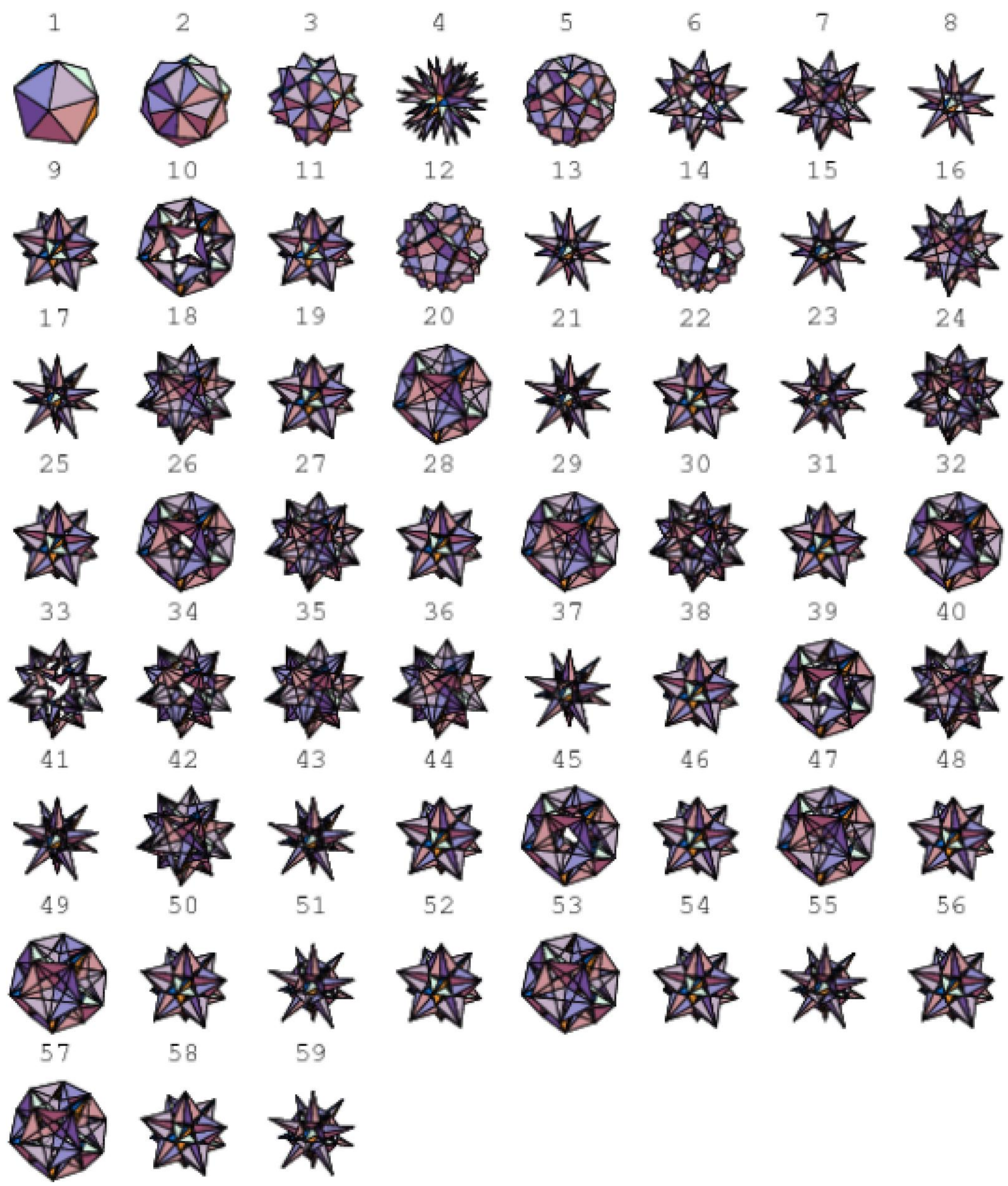
In geometry, the **complete** or **final stellation of the icosahedron**[1][2] is the outermost stellation of the icosahedron, and is "complete" and "final" because it includes all of the cells in the icosahedron's stellation diagram.

It is also called the **echidnahedron**. This polyhedron is the seventeenth stellation of the icosahedron, and given as Wenninger model index 42.
As a geometrical figure, it has two interpretations, described below:

- As an irregular star (self-intersecting) polyhedron with 20 identical self-intersecting enneagrammic faces, 90 edges, 60 vertices.
- As a simple polyhedron with 180 triangular faces (60 isosceles, 120 scalene), 270 edges, and 92 vertices. This interpretation is useful for polyhedron model building.

Johannes Kepler researched stellations that create regular star polyhedra (the Kepler-Poinsot polyhedra) in 1619, but the complete icosahedron, with irregular faces, was first studied in 1900 by Max Brückner.

Applying the stellation process to the icosahedron gives
$20 + 30 + 60 + 20 + 60 + 120 + 12 + 30 + 60 + 60$
cells of 11 different shapes and sizes (including the icosahedron itself).
The icosahedron has 18 fully supported stellations, 16 of them reflexible and 2 of them chiral (Webb; where, as usual, the original icosahedron itself is included in this count).



After application of five restrictions known as Miller's rules to define which forms should be considered distinct, 59 stellations (including the original icosahedron itself) are possible (Coxeter *et al.*1999).
Of the 59, 32 have full icosahedral symmetry and 27 are enantiomeric forms. One is a Platonic solid (the icosahedron itself), one is a Kepler-Poinsot solid, four are polyhedron compounds, and one is the dual polyhedron of an Archimedean solid. Note that the first real stellation (stellation #2 in Coxeter's counting) is that obtained by cumulating the icosahedron until the faces of each triangular pyramid

lie parallel to the surrounding original faces. This gives fairly small spikes, and results in a solid known as the small triambic icosahedron. Note also that the great stellated dodecahedron is *not* an icosahedron stellation, since the faces of its groups of five triangular pyramids do not lie in the same plane even though they appear very close to it. The stellations illustrated above are given in the ordering of Maeder (1994); Rogers uses a different ordering. Special cases are summarized in the following table.

n	name
1	icosahedron
2	small triambic icosahedron
3	octahedron 5-compound
4	echidnahedron
11	great icosahedron
13	medial triambic icosahedron
13	great triambic icosahedron
18	tetrahedron 10-compound
36	tetrahedron 5-compound

Miller's Rules

Miller's rules, originally devised to restrict the number of icosahedron stellations to avoid, for example, the occurrence of models that appear identical but have different internal structures, state:
1. The faces must lie in the twenty bounding planes of the icosahedron.
2. The parts of the faces in the twenty planes must be congruent, but those parts lying in one plane may be disconnected.
3. The parts lying in one plane must have threefold rotational symmetry with or without reflections.
4. All parts must be accessible, i.e., lie on the outside of the solid.
5. Compounds are excluded that can be divided into two sets, each of which has the full symmetry of the whole.
These rules can easily be extended for finding stellations of any polyhedron (Webb).
Rule 1 essentially just defines the process of stellation. Rules 2 and 3 stipulate that a valid stellation should have the same full symmetry (but possibly without reflection) as the original polyhedron. Rule 4 requires that the vertices in the cell diagram be connected (i.e., the cell types be connected to each other). Finally, rule 5 requires that all unused vertices of the cell diagram are also connected (with a single exception which is the subject some debate). Coxeter stated in 2001 that he could not remember what Miller intended by his fifth rule, so several different interpretations have been used by various authors (Webb).

Chinese Music

弦次	一	二	三	四	五	六	七	八	九	十	十一	十二	十三
律吕	中声 黄钟	中声 大吕	中声 太簇	中声 夹钟	中声 姑洗	中声 仲吕	中声 蕤宾	中声 林钟	中声 夷则	中声 南吕	中声 无射	中声 应钟	清声 黄钟
高度	# F	G	# G	A	B	C1	# C1	D1	# D1	E1	F1	# F1	

Music in traditional China followed a basic scale of five notes, or an extended scale of 12 notes.

In an email of 28 June 2013, Frank "Tony" Smith wrote:

the Chinese music scale is pentatonic with 5 basic tones.

There are two ways you can get to 60 from the basic 5.

One is to pair the 5 with 12 to get 5x12 = 60 but that is like the Jia Zi 60.

To get the Na Yin 60 by a different way,
here is a guess (it may not be correct, so feel free to ignore it):

Start with the 5 basic tones (denoted by x)

x x x x x

To add to them, put new tones (denoted by O) above, below and in between the 5 x tones

O x O x O x O x O x O

Now you have a total of 11 tones or notes.
Consider combinations of pairs of notes (dyads / chords / intervals).

There are 55 distinct pairs = (11 x 11 total pairs - 11 pairs like AA of the same note) / 2 being divided by 2 because the pairs AB and BA give the same sound.

Then add the 55 dyads to the original 5 to get 55 + 5 = 60 Na Yin.

Mathematically,
the 55 dyads correspond to the 55-dim Lie algebra Spin(11)

Conclusion

This paper began as an attempt to design and to explain a mathematical model which is capable of accurate scientific prediction, the results of which can be independently verified by other researchers. In the process, we have assembled major mathematical and geometrical concepts in a unique way, and so have made discoveries about the world, such as the manner in which Yin and Yang or binary elements fit the model, as well as the Five Elements, the 60 Jia Zi and the 60 Na Yin, along with the five tones of traditional Chinese music. Linking the Pisano Period to the icosahedron and the alternative group A5 demonstrates that nature follows this basic pattern, and the Five Elements, the 60 Jia Zi and the 60 Na Yin conform to this natural pattern.

With this achievement, the model no longer becomes exclusively Chinese nor even Indian, Hindu, Vedic or Greek, but in fact all of those, it becomes a universal truth, since it is based on sound mathematical principles. The Qi Men Dun Jia Cosmic Board model transcends all such labels as "ancient," "Asian" or "metaphysical," and instead becomes a firm part of international science.

This implies that the steadfast refusal of "western" scientists to admit the reality of such formerly exclusively Asian concepts such as Five Elements and the Na Yin must now come to an end.

The relationship between these concepts of Chinese metaphysics and western mathematical physics has been clearly shown here. Time is nigh for the Five Elements, the 60 Jia Zi and the 60 Na Yin to be embraced into the general realm of science.

This paper has shown that the Five Elements and the 60 Jia Zi and the 60 Na Yin form an isomorphic relationship with the icosahedron, and that these are intimately related with the Jacobi triplets and the periodicity of trigonometric functions. All of the concepts and elements described herein are necessary for the operation of the robust We have provided in this and related essays, the foundation for these concepts within the discipline of mathematical physics.

Along with the concepts of Chinese metaphysics, this model includes four types of periodicity: Bott, the periodicity of Base 60 numbers, the elliptic functions and trigonometric functions. The extended reliance upon different types of periodicity allow for flexibility in making accurate predictions with the Qi Men Dun Jia Cosmic Board model.

A final thread is the Golden Section, which runs throughout the model, from the Magic Square and Golden Rectangle, to the Golden Spiral, the Fibonacci numbers related to these and to Pisano Periodicity, as well as to the icosahedron, its associated Golden Rectangles and the Fano Plane. The author hypothesizes that the Golden Ratio forms the border between two states of matter, and that the Golden Ratio is directly related to the harmonic oscillators in each state of matter.

Many thanks to Frank "Tony" Smith for his generous input into the ideas which frame this paper, errors of course are my own.

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