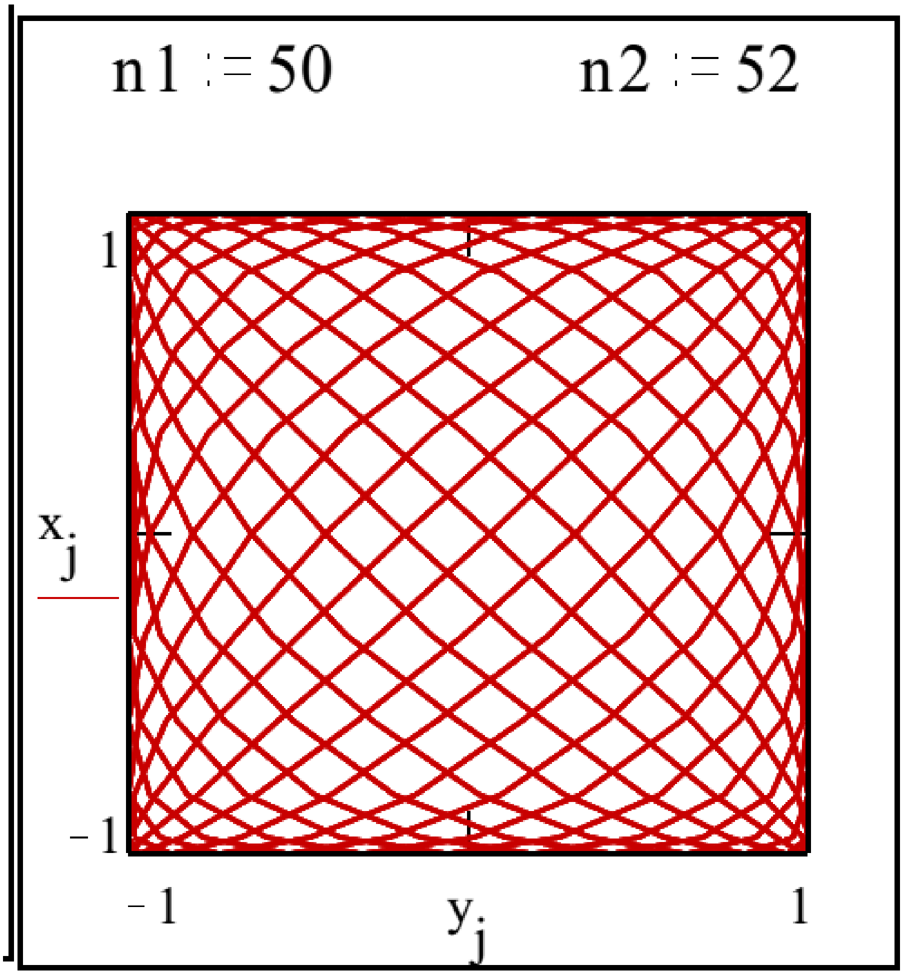
Sedenions, Lissajous Figures and the Exceptional Lie Algebra G2



De - Constructing de Marrais Series

By John Frederick Sweeney

Abstract

This paper examines a point of intersection between the work of the late Robert de Marrais and Vedic Physics. Specifically, de Marrais discussed the concept of Lissajous Figures in relation to Sedenions and his 42 Assessors, in his first paper about Box Kites. Later, John Baez took up a related subject, the problem of epicycloids, apparently without having read the work of de Marrais. This paper examines this intersection between leading - edge mathematical physics and Vedic Physics in order to further illuminate the higher algebras - the Octonions, Sedenions and Trigintaduonions.

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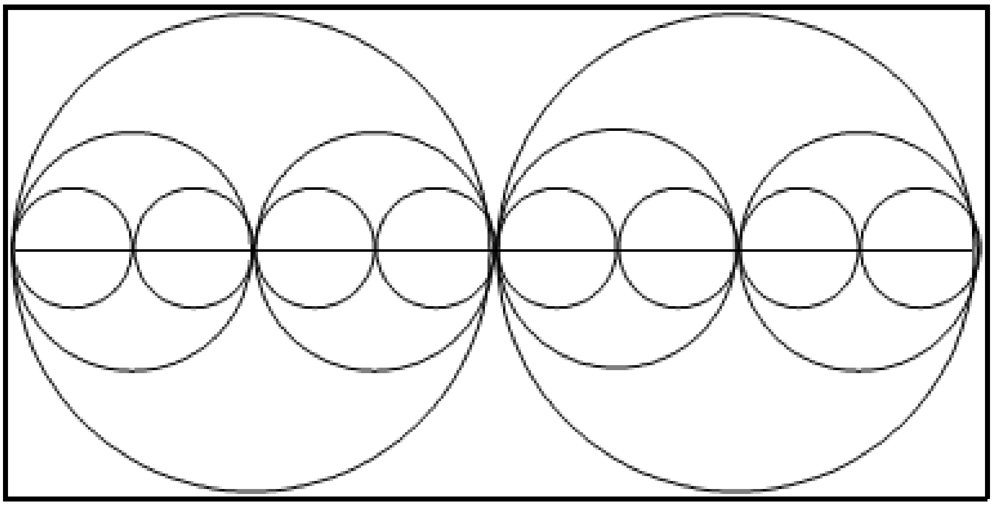
Introduction

Our combinatorial universe includes the process of dividing space by 2, which keeps the central point in the same location, or at the level of 50%. The diagram shows a circle with its radius continuously divided by 2 until 8 small circles appear.



In a combinatorial universe with periodic functions, these are the rolling balls which make the shapes. In more formal terms, these epicycloids rotate about a common line, and never exceed eight rotations in any cycle. These rotations create sinoidal waves.

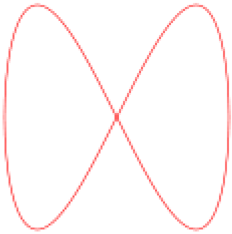
This diagram illustrates the famous Daoist dictum: “One creates two, two create four.” One may envision these circles as embedded Tai Ji symbols. This diagram helps to explain Bott Periodicity and the Clifford Clock, along with the Clock of Complex Spaces. These concepts provide the foundation for making accurate predictions about phenomena in nature, including human nature.

Sequentially dividing by two keeps the central point in the same location where all the lines pass through and form a node of density proportional to the number divisions made. The nodes are cubic domains of permanent certainty whereas the intermediate regions contain changing flux and acceleration parameters.

Numerical accuracy in this region depends on sectioning at least two related parameters. Hence, the numerical ratio of cubic space is ½ 3 or 1/8. If the cubic values of all subsequent sequence of such divisions are added up it will equal 1/7 as the spectral states.

Lissajous Figures / Wikipedia

Below are examples of Lissajous figures with $\delta = \pi/2$, an odd natural number a, an even natural number b, and $|a - b| = 1$.

			
a = 1, b = 2 (1:2)	a = 3, b = 2 (3:2)	a = 3, b = 4 (3:4)	a = 5, b = 4 (5:4)

De Marrais on Lissajous Figures

The late Robert de Marrais demonstrated in this passage how Zero - Divisor Sedenions impose order at higher level organizations of matter, by directing the flow patterns on tori. With his highly - idiosyncratic metaphors, de Marrais describes how this might occur between two helices:

In a different section, de Marrais

The simplest way to guarantee this is by fiat: define a “zip” (Zero -divisor Indigenous Power - orbit) function. Ignoring internal signing for simplicity, for Assessor indices (A, B) and (C, D), and angular variables x and y, write products of the circular motions in the two Assessor planes like this:

We know, from our first production rule, how to interpret this: two currents with opposite clockwise senses or “chirality,” spawned by angular “currents” in two Co -Assessors’ planes, manifest as alternately con-and destructive wave interference effects, in the plane spanned by the third Assessor they mutually zero -divide.

In this “toy model,” patterns readily recognizable as Lissajous figures sweep through the origin, “showing on the oscilloscope” in accordance with the opposing currents’ relative velocities (provided their ratio only involves small integers).

This is, of course, vastly simplified: just one Co -Assessor trio’s interactions require considering six dimensions of toroidal “plumbing,” and Assessors can interact directly in two different trios, and indirectly receive or transmit “pass-along currents” in ways that will require separate study. By the end of the present investigation, we will have sufficient information to enable the framing of such studies, but insufficient space to contemplate them further in these pages.

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Discussion

In a combinatorial universe, it remains possible to exclude extraneous concepts such as “dimension,” which could simplify things enormously, perhaps more than de Marrais believed possible. Instead, dimensions might be considered as the “beats” which create these periodic circles. Certainly the Sedenion Assessors involve a great deal of complexity, involved with two different sets of triplets, as de Marrais points out above. For this reason, the author will continue to De - Construct De Marrais and his work in this series of papers.

The pair containing the (1, i0) and (in, en) planes will show isomorphic, identically sized, epitrochoids. These are curves of the broad family which Albrecht Durer first explored in the 1520’s, generated by a point attached to the (possibly extended) diameter of a small circle rolling around the circumference of a larger, and corresponding, in the 2:1 case, to the map in “behavior” space of the HU’s epicycloid (with the rose -to-epitrochoid pairing obtaining for the higher strata.)

Epicycloids

From Albrecht Durer, c. 1525.

The remaining planes, the intersections - whose main diagonals with circles of radius (½)½ - correspond to the idempotents and their negatives -- ½(±1 ± e n) --and their square roots ½(± I 0± n) respectively, contain Lissajous figures associated with the ratios between the spin -unit circles' angular velocities.

We know that the 2-torus in 4-D is diffeomorphic to the 3-D doughnut, so that helical "currents" are preserved in the 4-to 3-D projection. The 6 planar sections boil down to 2 + 1 = 3 (the Lissajous figures' oscillation playing a role here akin to the dilating "third circle" used to map the 4-D orbits of the Quaternions into 3-space): i.e., to a 3-D pattern diffeomorphic to the 2-torus in 4-D.

The 16-D Lyashko singularity with boundary, especially given its close relationship to the "obstacle bypass" evolvent context, is suggestive in its own right: in particular, a novel opening to exploring some recent approaches to quantum non-localization would seem indicated. Readers are encouraged to pursue the URL and/or text version of the source containing the quotes, while keeping the "Lissajous ping-pong" motif broached much earlier clearly in mind.

The general model of the process of creation of visible matter described by this author in this series of papers published on Vixra during 2013 posits a model much like that de Marrais describes in this passage, the full symmetry group of the icosahedron and the dodecahedron, along with two helices, in the form of the BCC Helix. The helices are generated by the magic square at the center of the Clifford Clock and Clock of Complex Spaces, and spiral through each layer of creation to control the helices.

As John Baez notes below, his "rolling ball" works only for the 3:1 ratio, which de Marrais includes above in his spectrum of possible ratios. Had they read about de Marrais' Box Kites, Baez and Huerta would have known that the other ratios listed above are possible as well.

That they failed to do so speaks to the inaccessibility of the work of de Marrais: of all the mathematicians and physicists in the world today, he was the first to scale the heights of the Sedenions, Trigintaduonions and beyond, and he climbed alone. All other experts fail to understand the importance of the Sedenions, Trigintaduonions and higher algebras in the process of the formation of visible matter. To his everlasting credit, de Marrais not only scaled the heights of the highest algebras, but examined each level in detail to describe how they inter-acted.

What is Peixoto's Theorem?

In the theory of dynamical systems, **Peixoto theorem**, proved by Maurício Peixoto, states that among all smooth flows on surfaces, i.e. compact two-dimensional manifolds, structurally stable systems may be characterized by the following properties:

- The set of non-wandering points consists only of periodic orbits and fixed points.
- The set of fixed points is finite and consists only of hyperbolic equilibrium points.
- Finiteness of attracting or repelling periodic orbits.
- Absence of saddle-to-saddle connections.

Moreover, they form an open set in the space of all flows endowed with C^1 topology.

The **Andronov–Pontryagin criterion** is a necessary and sufficient condition for the stability of dynamical systems in the plane. It was derived byAleksandr Andronov and Lev Pontryagin in 1937.

Statement

A dynamical system

where v is a C^1-vector field on the plane, $x \in \mathbf{R}^2$, is orbitally topologically stable if and only if the following two conditions hold:

1. All equilibrium points and periodic orbits are *hyperbolic*.

2. There are no *saddle connections*.

The same statement holds if the vector field *v* is defined on the unit disk and is transversal to the boundary.

Clarifications

Orbital topological stability of a dynamical system means that for any sufficiently small perturbation (in the C^1-metric), there exists ahomeomorphism close to the identity map which transforms the orbits of the original dynamical system to the orbits of the perturbed system (cf structural stability).

The first condition of the theorem is known as **global hyperbolicity**. A zero of a vector field *v*, i.e. a point x_0 where $v(x_0)=0$, is said to be**hyperbolic** if none of the eigenvalues of the linearization of *v* at x_0 is purely imaginary. A periodic orbit of a flow is said to be hyperbolic if none of the eigenvalues of the Poincaré return map at a point on the orbit has absolute value one.

Finally, **saddle connection** refers to a situation where an orbit from one saddle point enters the same or another saddle point, i.e. the unstable and stable separatrices are connected (cf homoclinic orbit and heteroclinic orbit).

Poincaré Map

In mathematics, particularly in dynamical systems, a **first recurrence map** or **Poincaré map**, named after Henri Poincaré, is the intersection of a periodic orbit in the state space of a continuous dynamical system with a certain lower dimensional subspace, called the **Poincaré section**, transversal to the flow of the system.

More precisely, one considers a periodic orbit with initial conditions within a section of the space, which leaves that section afterwards, and observes the point at which this orbit first returns to the section.

One then creates a map to send the first point to the second, hence the name first recurrence map. The transversality of the Poincaré section means that periodic orbits starting on the subspace flow through it and not parallel to it.

A Poincaré map can be interpreted as a discrete dynamical system with a state space that is one dimension smaller than the original continuous dynamical system. Because it preserves many properties of periodic and quasi - periodic orbits of the original system and has a lower dimensional state space it is often used for analyzing the original system. In practice this is not always possible as there is no general method to construct a Poincaré map.

A Poincaré map differs from a recurrence plot in that space, not time, determines when to plot a point. For instance, the locus of the moon when the earth is at perihelion is a recurrence plot; the locus of the moon when it passes through the plane perpendicular to the Earth's orbit and passing through the sun and the earth at perihelion is a Poincaré map.

It was used by Michel Hénon to study the motion of stars in a galaxy, because the path of a star projected onto a plane looks like a tangled mess, while the Poincaré map shows the structure more clearly.

Box Kites II

Robert de Marrais wrote 3 papers in which he compared Octahedral Lattices to Box Kites. Although a heuristic device intended to make a complex subject more comprehensible, the choice of metaphor was perhaps unfortunate and may have led many to fail to understand his meaning. The raison d'etre of this series of papers, De - Constructing De Marrais - is to clarify the meanings that de Marrais probably intended, to make his work more accessible to readers, since de Marrais is among the first thinkers in today's world to seriously take on the task of understanding the higher numbers, from the Octononions to the Trigintaduonions and beyond.

By the term "Assessor," de Marrais makes reference to the 42 Ancient Egyptian gods which are visible in panels which illustrate the weighing of the soul of Osiris in the Underworld or Aum - dejadt. He connects this term to the numbers which remain in the Sedenion multiplication table, with the exception of the diagonal line of zero's. De Marrais made an extensive study of these Assessors and their relationships, figuring out which ones associated with others, and which fail to associate. This latter relates to the concept of null triplet that Baez & Huerta discuss below.

What is de Marrais saying here? In his idiosyncratic manner, he created 3 "Production Rules" for box kites, instead of merely creating 3 theorems. This part involves three planes, one of which pertains to a Zero Divisor, or a plane which is zero - divided by the others. Next there arrive two currents with opposite chirality, or handed - ness, which have been engendered by angular currents in the two Co - Assessor planes. These two currents manifest in a third plane with constructive and destructive effects.

In this sense, then, these structures of planes and currents resemble the Tai Ji symbol, which is composed of binary Yin and Yang energies, which could be constructive or destructive, depending upon circumstances. Generally speaking, Yang energy is constructive, but an excess of Yang energy may prove destructive, and the converse holds as well.

The process of the formation of visible matter includes a series of the Platonic Solids, yet here de Marrais reassures the reader that that, at least one track of the formation of matter leads to the Torus, and that the helical currents of the torus are preserved during this process. The process of the formation of visible matter requires four dimensions, and the function of the Lissajous figures is precisely to map the four - dimensional orbits of the Quarternions into the space of three dimensions.

Or, as de Marrais indicates, to a three - dimensional pattern which is diffeomorphic to the 2-torus in four dimensions.

John Baez on the Epicycloid

This section presents the most important aspects of a paper written by John Baez and John Huerta. Based on the references and internal evidence, Baez and Huerta apparently never read the work of de Marrais. For example, the authors never mention the word epicycloids. This underscores the failure of mathematicians to understand the work of de Marrais, perhaps due to his overwhelming intelligence and the difficulties inherent in trying to follow the path of his thought, which follows the paradigm of computer programming.

Even so, Baez and Huerta explain certain aspects of the problem, such as the relationship to G2 and its relationship to the split octonions / bioctonions, as well as the concept of null triplets, which may help to understand the process under examination here.

G2 and the Rolling Ball

John C. Baez, John Huerta

Abstract

(Submitted on 11 May 2012 (v1), last revised 5 Aug 2012 (this version, v3))

Understanding the exceptional Lie groups as the symmetry groups of simpler objects is a long-standing program in mathematics. Here, we explore one famous realization of the smallest exceptional Lie group, G2. Its Lie algebra acts locally as the symmetries of a ball rolling on a larger ball, but only when the ratio of radii is 1:3.

Using the split octonions, we devise a similar, but more global, picture of G2: it acts as the symmetries of a 'spinorial ball rolling on a projective plane', again when the ratio of radii is 1:3. We explain this ratio in simple terms, use the dot product and cross product of split octonions to describe the G2 incidence

geometry, and show how a form of geometric quantization applied to this geometry lets us recover the imaginary split octonions and these operations.

In this paper, we study two famous realizations of the split real form of G2, both essentially due to Cartan. First, this group is the automorphism group of an 8-dimensional non - associative algebra: the split octonions. Second, it is roughly the group of symmetries of a ball rolling on a larger fixed ball without slipping or twisting, but only when the ratio of radii is 1:3.

A`spinor rolling on a projective plane' lives inside the imaginary split octonions as the space of `light rays': 1-dimensional null subspaces we must consider three variants of the rolling ball system.

The first is the ordinary rolling ball, which has configuration space S2 SO(3). This never has G2 symmetry. We thus pass to the double cover, S2 SU(2), where such symmetry is possible.

We can view this as the configuration space of a `rolling spinor': a rolling ball that does not come back to its original orientation after one full rotation, but only after two. To connect this system with the split octonions, it pays to go a step further, and identify antipodal points of the fixed sphere S2

.

This gives RP2 SU(2), which is the configuration space of a spinor rolling on a projective plane. This last space lets us see why the 1:3 ratio of radii is so special. As mentioned, a spinor comes back to its original state only after two full turns. On the other hand, a point moving on the projective plane comes back to its original position after going halfway around the double cover S2

.

Consider a ball rolling without slipping or twisting on a larger fixed ball. What must the ratio of their radii be so that the rolling ball makes two full turns as it rolls halfway around the fixed one?

Or put another way: what must the ratio be so that the rolling ball makes four full turns as it roll ls once around the fixed one? The answer is 1:3. At first glance this may seem surprising. Isn't the correct answer 1:4?

No: a ball of radius 1 turns R + 1 times as it rolls once around a fixed ball of radius R. One can check this when R = 1 using two coins of the same kind. As one rolls all the way about the other without slipping, it makes two full turns. Similarly, in our 365 1/4 day year, the Earth actually turns 366 1/4 times.

This is why the sidereal day, the day as judged by the position of the stars, is slightly shorter than the ordinary solar day. The Earth is not rolling without slipping on some imaginary sphere. However, just as with the rolling ball, it makes an `extra turn' by completing one full revolution around the center of its orbit.

In the case of the 1:3 ratio, and only in this case, we can find the rolling ball system hiding inside the split octonions. There is an incidence geometry with points and lines defined as follows:

¤ The points are configurations of a spinorial ball of radius 1 rolling on a fixed projective plane of radius 3.

¤ The lines are curves where the spinorial ball rolls along lines in the projective plane without slipping or twisting. However, this geometry can equivalently be defined using null sub - algebras of the split octonions.

A `null sub - algebra' is one where the product of any two elements is zero. Then our rolling ball geometry is isomorphic to one where:

¤ The points are 1d null subalgebras of the imaginary split octonions.
¤ The lines are 2d null subalgebras of the imaginary split octonions.

As a consequence, this geometry is invariant under the automorphism group of the split octonions: the split real form of G2.

This group is precisely the group that preserves the dot product and cross product operations on the imaginary split octonions. These are defined by decomposing the octonionic product into real and imaginary parts:

$$xy = x \quad y + x \quad y$$

where x   y is an imaginary split octonion and x   y is a real multiple of the identity, which we identify with a real number.

One of our main goals here is to give a detailed description of the above incidence geometry in terms of these operations. The key idea is that any non - zero imaginary split octonion x with x   x = 0 spans a 1-dimensional null sub - algebra hxi, which is a point in this geometry.

Given two points hxi and hyi, we say they are `at most n rolls away' if we can get from one to the other by moving along a sequence of at most n lines.

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Then:

¤ hxi and hyi are at most one roll away if and only if xy = 0, or equivalently, x y = 0.
¤ hxi and hyi are at most two rolls away if and only if x y = 0.
¤ hxi and hyi are always at most three rolls away.

We define a `null triple' to be an ordered triple of nonzero null imaginary split octonions x; y; z 2 I, pair - wise orthogonal, obeying the condition

$$(x \ \ y) \ \ z = 12$$

We show that any null triple gives rise to a configuration of points and lines.

Vedic Physics and Lissajous Figures

Vedic Physics posits 3 entirely different states of matter:

Thaamic - invisible “black hole” state of matter

Raja - 8 x 8 stable state of matter

Satva - 9 x 9 dynamic state of matter

The author of a book on Vedic Physics describes the relationship to Lissajous Figures in this way:

Sequentially dividing by two keeps the central point in the same location where all the lines pass through and form a node of density proportional to the number of divisions made. The nodes are cubic domains of permanent certainty, whereas the intermediate regions contain changing flux and acceleration parameters. Numerical accuracy in this region is dependent on sectioning at least two related parameters, so the numerical ratio of cubic space is ½ - 3 or 1/8.

If the cubic values of all subsequent sequence of such divisions are added up, they equal 1/7, as the spectral states, shown below

The same behaviour takes place when measuring waveforms on an oscilloscope. If the timing between the vertical and horizontal axis is identical, then a single diagonal line or a circle would be visible. If the timing between the two axes is made different, then numerous waveforms in continuous motion would be visible.

A triggering pulse is needed to make the waveforms superimpose one train of waveforms on the next train to make them stay stationary . These patterns are called Lissajou figures and are used to study the state of synchrony between two axes.

If they synchronise perfectly, then the count reduces to that count on any one axis, but the count become rings or cycles of counts. The Lissajou figures below show the coherent ring when n1 n2 are equal, or reflect simultaneous activity. When there are more than one - count differences, the coherent pattern breaks up and increases the interactive count.

In the same way, when the count of C is identical along all three axis the C 3 count falls into step and the value of counts reduce to C thereby hiding C2 as a factor that increases the density and displays mass characteristics.

Coherence produces spherical or circular time period functions or rings of simultaneous interactions and hides the true numbers involved. When interactions take place along one axis from opposite ends, the total value is C2.

But the self - similar internal characteristics allow simultaneous exchanges between compressive and expansive states to vary the proportions, according to Guna laws. The compressive value can raise the count value to a maximum of C 1+x, while reducing the expansive value to a minimum of C 1-x at the same time.

For this reason, the smallest interval beyond which counts along two axes can act simultaneously, like the Lissajou patterns with equal counts, is 1/C 1+x.

Adding the sum of divisions to the difference due to expansion and dividing by 7, gives the ratio of expansion from unit 1 to 2, as the radiant rings of resonant states extending to infinity as RS = 1.02040816.

The cyclic count as shown earlier, is 10. Self - similar expansion as derived earlier is 1+ x and the compression is 1 – x. Hence the self similar ratio of an expansive interactive

Equation No. 1

The ratio EP2 represents a centred or stationary state containing rings of resonant counts and EP3 depicts the ratio of expansive change to sequential change in the same cyclic interval of 7. The comparative rate of change shown below in EP4 of these two dynamic ratios of change in a stationary state defines the change within a change or the accelerative mode of change but is centred & static.

Meaning: Knowledge gained through research on vibratory or oscillatory stress caused by colliding interactions follow three step action (of compression – shuttling- expansion –guna mode) leading to intensive super - positioned, divergent, or synchronized state, raised to the eighth power coherent mode. The original state prior to the interaction has been established to be in a controlled, compressed, cubic, volumetric state, raised to the third power.

Explanation: The components of the substratum are in a dynamic and synchronised state corresponding to a volumetric or cubic representation and follows a third order damping control or reaction, proved and established in the derivation of rules controlling the triple acting guna interactions.

The normal dynamic state is maintained by resonant interactions wherein the three phases of thaama compression, rajah shuttling interaction and consequential reactive sathwa expansion that equalizes according to swabhava or self similar rules.

However when a collision occurs the intensity causes the vibrations or oscillations to aggregate, collect, pile-up or superpose on the component such that the density, mass or inertia increases to eight times or powers (instantaneously).

The proof of this behaviour is established by analytical and mathematical logic as follows: at the instant of collision the oscillatory counts of the two components combine to form a THAAMASIC increase proportionally to two units.

The increment must take place along all three axes to maintain the synchronised and centred state so the count value rises to 2 cubed = 8 within the instant duration of the collision (See note 1).

The corresponding RAJASIC interaction must equal 8 counts in the normal sequential spatial shuttling form in which it normally oscillates. The SATWIC expansive reaction must account for the 8 units by equalising in an expansive mode.

Since only two components were involved in the colliding interaction the reactive values must be generated only by these same two units as an expanding displacement .

Had there been eight unit components involved in the collision the equalisation could have been possible within the unitary cycle by all the 8 components absorbing the 8 counts. Therefore the two unit components must now equalise in eight sequential steps or stages or the duration must equal eight sequential steps to absorb the increased counts.

Subtracting the normal unit displacement in a unitary cycle there are seven additional expanding vibrations or oscillations superposed or accumulated on the component. Therefore the Raja interactive shuttling duration shows seven distinct phases of the oscillations that are superposed in a sequence of seven additional wavelengths in a cycle.

This state continues, because the next cycle adds a similar count value so that the counts increase logarithmically to the 8^{th} power in a cycle.

Since a cycle contains 10 units as a count duration, the 8^{th} power is based on 10. So the consistent, constant, resonant, synchronised state of a cycle must contain 10 8 counts increment or additional interactive displacements that are equally subdivided into the expansive RAJASIC – SATWIC cycle.

Sumarising, an intense colliding interaction value rises to two units that is then translated into cube of two displacements that superpose and the expansive reaction equalises the instantaneous rise in cycle time value of 8 in sequential displacement of 8 cycles and subtracting the normal, usual unit value there exist seven sequential expanding cycles for each intensive collision.

If the 3 axis counts are synchronized, then the count remains at 10 8 and the spherical boundary remains undisturbed . If the 3 axis loose the synchrony the spherical quality is lost and the count rises to a maximum of 10 25.

The observed spectrum of seven colours in light created by an accelerated photon as set , or the seven sound frequencies created by an impact in air are the consequences of the above explanation.

One must note that the substratum is in constant dynamic, self - similar interaction. Light is produced only when it is in an accelerative or unbalanced and therefore non-spherical interaction.

Had the situation been otherwise, then light would have spontaneously emitted from the substratum. Spherical photons with zero helicity would have been detected. The components of the substratum are oscillating continuously at a self similar rate of 296500000 cyclic interactions, which is consistent with a stable oscillatory cycle due to a1 to 2 difference in timing between the axes.

Similarly, the field of air molecules are vibrating at the same proportionate self similar rate of 256 interactions for a unitary cycle, because the air field is not a free one and synchrony along two axis is forced.

The statement that there are so many interactions in a cycle means that not a single interaction is simultaneous with another during that cycle. Both in light and sound and in every spherical harmonic oscillator there are seven incremental levels of changing values before it repeats. This situation is true only if the field functions in the normal SWABHAVA state of freedom from external influences.

Above all this self similar behaviour is possible in a substratum of equalised, similar, identical and compacted plenum of components.

Combinatorial Process of Incremental States

Note 1. Using momentum conservation (though not applicable) principle and using a unit mass then the displacement on colliding will be half the diameter of the component and the volume will be proportional to ½ cubed and density will rise to 2 cubed within the impact duration and this must be dissipated by a linear movement of both units away from the centre. If both units move at the same speed in opposite directions the centre of collision remains stationery. If one remains stationery the other moves away at 10 8
.
Note 2. The same behaviour takes place when measuring waveforms on an oscilloscope. If the timing between the vertical and horizontal axis is identical then a single diagonal line or a circle would be visible. If the timing between the two axes is made different, then numerous waveforms in continuous motion would be visible.

A triggering pulse is needed to make the waveforms superimpose one train of waveforms on the next train to make them stay stationery. These patterns are called Lissajou figures and are used to study the state of synchrony between two axes.

In an odd count interaction the only possible way of synchronising is by combining with the next incremented count rate, which provide the following sequence of numbers by of previous to present and can be expressed as a formula where n = previous number.

The Lp is the equivalent of the Planck length in Quantum theory and My is the mass value of the Planck’s energy constant ‘h.’

Thus, the source value of 1 is perfectly justified. The rest of the incremental steps in the potential as C to C 6 are equated to stable states, whose derivations have been shown earlier.

Reiterating the states, Lp is the smallest displacement along any axis and Tp is the smallest fraction of a cyclic time.

The Vikrithi state Ne is the flux of interactive counts transmigrating constantly at rate C to maintain balance. The equivalence shows the ratio of incremental displacements to cyclic or angular changes in position in the coherent state of the Prakrithi as PM - the nuclear or Hadronic state.

Px is the super-positioning density due to the interactions taking place in the same location or the coherent state. The (PM Px)/My = (C3) or the

$$(PM*Px)/Kx = C3 \text{ state}$$

is a stable and isolated interactive self-similar domain that does not radiate or exchange counts.

For the maximum Kx and minimum My keep it at constant C3, the real description of orthogonal space that is in a dynamic and holographic state. This is the Kaivalya description in Theorem 68 that states that the stress has diminished to such a fine level that space remains in totally synchronised oscillation at an axiomatic rate of C.

But because C 3 is in a coherent state, the detectable count rate will be only C along any axis, since the other two axes are in total and absolute synchrony. In this state, C2 counts will not be detectable. Therefore, the counts seem to vanish. Recall the simultaneous clap episode or the Lissajou figures.

It has been shown that when the interval between any axis is less than 1/C 1+x, the two behave simultaneously. Therefore, any disturbance interval between any two axes exceeds 1/C 1+x. The coherent state is broken down and the transmigration of stresses takes place to initiate a variety of phenomena.

Though only one reason has been shown, there exist numerous factors that contribute to this coherent state breakdown phenomenon. For instance, the nuclear state of PM, although not detectable when submerged in the C3 coherent state, becomes detectable with certain characteristics.

The detectable radius in physics is Rp and the Compton wavelength as shown. Axiomatic confirmation follows:

The factor (k-1) is relative radial expansion when expanding twice cubically. The radial value is still depicts the coherent boundary. When coherence breaks then (k-1) that was synchronized, breaks into its time - dependant value of (k-1)2

When the stress in the substratum rises suddenly due to any type of triggered or impulsive disturbance as derived in Theorem 37, reactive changes take place simultaneously. At the basic cycle level, the cyclic count of 10 rises as 102 at the nodal position at ½ displacement period in the self similar oscillatory rate.

For this reason, the ½ nodal position is raided instantly or the My interval. The C3 state too interacts simultaneously to raise it to the maximum C6. The Mahad Vikrithi, or the first harmonic of the Prakrithi (the nuclear hadron or the Electron) is derived by three independent modes that ensure its existence for a brief period in the same location.

EP17 at Kx displays the centred mass value of the Electron expanding in period k. EP 17 shows a complex high density or simultaneous exchange phenomenon that involves many parameters. It has been dealt with in EP???.

But taking the super - positioning value of C 1-x (the coupling constant) as an instantaneous interaction produces a reaction of C 1+x as the compression value in the hiden C2 regime in the coherent C3 value that can be detected only as C.

Hence if C1-x is raised 7 times as (2 3 –1 = 7) due to sudden triggering then C 1+x too must react instantly by raising it 7 times too, which leads to the Planck density Dp.

(Applying the preceding principle the Planck's energy quanta is shown to be relatively larger than the elemental Moolaprakriti (My) by 17 orders of magnitude. As the Substratum is always in a quiescent, synchronised and coherent state, it is not externally detectable unless the balance is upset to de-synchronise the coherent state.)

Therefore every time a Vikrithi as an electron is produced a Mahad Mps as Planck mass is also produced. Therefore, Vedic Physics establishes in clear terms that nothing is produced, bound or released as substantial particles but that the vibratory stress of value My transmigrate in various simultaneous lots to produce the socalled objects that are detected.

So the unequivocal conclusion that must be drawn from the above mathematics that the Mahad Vikrithi Me as electron and Mahad Prakrithi Mps as Planck mass are formed and decayed in its respective cyclic interval. Both are the two simultaneous sides of the same coin metaphorically speaking.

What remains constantly in the substratum are the Prakrith Saptha or the Neutron undetectable configuration at the central Linga/Bhava or Strong/weak interface balanced by the Vikrithi Saptha as the Neutrino at the Abhiman / Ahankar or the lepton / photon electromagnetic crossover point.

In the coherent state in space its presence cannot be detected, not because it is not dynamically oscillating, but because in an absolute coherent state, all three axes synchronise so perfectly that a spinning spherical shell does not emit any wave or radiations at all.

Vedic Physics Theorem 30 defines this state as the fundamental position to which a third order damping constraint drives vibrations into its restful state. The Power House is perpetually active ever ready to take the load on instant demand.

Understanding this sequence of actions can enable the extraction of undreamed of levels of power by merely triggering space with a probe of the smallest power but in the shortest time.

The road to that is ingenuity which again is ensured by the same mechanism enacted in the human mind by the Siddhi process of Theorems 4,5 and 6.

Twisted Octonions

This section comes from Donald Chelsley's "Superparity and Curvature of Twisted Octonionic Manifolds Embedded in Higher Dimensional Spaces."

1.4 Zero Divisors in Twisted Octonions

The twisted octonions are differentiated from the true octonions by the associativity pattern of the imaginary units. For true octonions

$e_i(e_je_k) = (e_ie_j)e_k$ iff (e_i, e_j, e_k)

is a quaternionic triad (or two or all of the indices are the same), which occurs in 175 cases.

In the twisted octonions there are 96 further cases in which (e_i, e_j, e_k) is not a quaternionic triad but associates anyway.

The example above of zero divisors has the form

$(e_i+e_j)(e_k+\alpha\, e_l) = 0$, where $\alpha = \pm 1$ and all indices are distinct and > 0.

Expanding gives

$$e_ie_k + \alpha\, e_je_l + \alpha\, e_ie_l + e_je_k = 0, \text{ implying}$$

$e_ie_k = -\alpha\, e_je_l$ and $e_je_k = -\alpha\, e_ie_l$ (N.B. typo in paper drops -),

hence (using anti - commutativity of any two distinct imaginary units)

$$-\alpha\, e_l = (e_je_k)e_i = e_j(e_ke_i).$$

Thus a pair of zero divisors can be constructed for each of the 96 exceptional vanishing associators; indeed, a second pair of zero divisors immediately follows from:

$$(e_i+e_j)(e_k+\alpha\, e_l) = 0 \Leftrightarrow (e_i-e_j)(e_k-\alpha\, e_l) = 0$$

Note that each factor must contain 1 imaginary unit from the distinguished triad in order to produce the term with the "wrong" sign. Also note that a zero divisor multiplied by any real number remains a zero divisor. Geometrically, (some) zero divisors are thereby associated with lines through the origin. Another rearrangement shows

$$e_i e_j = \pm e_k e_l.$$

Hence a recipe for constructing zero divisors: pick any 2 imaginaries e_i, e_k from the distinguished triad, and any e_j not in the distinguished triad. Picking e_l to satisfy $e_i e_j = \pm e_k e_l$ then guarantees that for appropriate sign choice,

$$(e_i + e_j)(e_k \pm e_l) = 0$$

as desired. Note also that for e_i, e_j so chosen, there are actually 2 choices for e_k, each with a corresponding e_l. Any zero-divisor line therefore annihilates 2 independent lines, or any linear combination thereof *i.e.* a zero-divisor plane. Extending the example given earlier(XOR triads with signmask 3a):

$$(e_1+e_4)(A(e_2+e_7) + B(e_3-e_6)) = 0 \text{ and}$$
$$(e_1-e_4)(A(e_2-e_7) + B(e_3+e_6)) = 0 \text{ for any real } A, B.$$

Finally, note that there are 3 choices for an e_i from the distinguished triad, times 4 choices for an e_j *not* in the distinguished triad, times 2 sign choices in $(e_i \pm e_j)$ to construct a linear zero divisor, so there are 3*4*2 = 24 such zero divisor lines, each with a corresponding zero divisor plane.

2 Sedenions

Applying the XOR construction above to the case of 15 imaginary units produces a multiplication table complete but for signs, which are determined by handedness assignment to the triads contained in the table. Examination of the table reveals:

- 35 quaternionic triads (hence signmask has 35 bits)
- 15 groupings of 7 triads (henceforth called *heptads*), either octonions or twisted octonions (depending on signmask)
- any 2 intersecting triads generate a heptad
- each imaginary unit is in 7 triads and 7 heptads
- each triad is in 3 heptads
- each triad intersects 18 others, is disjoint with 16 others
- each triad intersects any heptad in 1 or 3 basis elements

As in the case of the octonions, other representations are derivable from the XOR representation by permuting indices. Out of the 15! possible permutations, 8!/2 map the XOR triads onto themselves, leading to the tentative conjecture that there are 2*15!/8! different ways to form the quaternionic groupings of a sedenion multiplication table - certainly there are at least that many. Steiner triples exist for systems of dimension other than 2^n, raising the possibility that quaternionic groupings might exist other than those derived from index permutation acting on the XOR-based multiplication tables.

2.1 Preliminary Classification of Sedenion Types

Testing each of the 2^{35} values of signmask in the XOR-based multiplication tables and analyzing the associators $(e_i e_j)e_k$ - $e_i(e_j e_k)$ shows that there are 9 broad classes of sedenions, classified by the nature of the heptads: of the 15 heptads, anywhere from 0 to 8 are true octonions, with the balance being twisted. Below, counts[N] shows how many signmask values give N true octonionic heptads in the corresponding multiplication table:

counts[0] = 4699455488

counts[1] = 9688596480

counts[2] = 10254827520

counts[3] = 6041190400

counts[4] = 2582200320

counts[5] = 817152000

counts[6] = 248299520

counts[7] = 25804800

counts[8] = 2211840

counts[9] = 0

Adding these up gives 2^{35}, establishing the fact that (at least for representations derived *via* permutation from the XOR-based multiplication tables) all sedenion types must include at least 7 twisted octonion subalgebras.

2.2 Refinements in Classification

When embedded in the sedenions, heptads have more subtle properties than simply whether they are twisted or not, and a more refined classification of the sedenion types must take this into account. Each twisted heptad has a distinguished triad, and that triad occurs in 2 other heptads as well, which might be untwisted, or twisted with a different distinguished triad, or twisted with the same distinguished triad. Any heptad has 7 triads - how many of them are distinguished in some other heptad? A partial analysis based on these questions has so far revealed more than 52 types of sedenions.

Conclusion

The previous section and the section by Baez & Huerta indicate the extreme complexity of the higher algebras, which begin the the Exceptional Lie Algebra G2. We have seen in the previous two segments the involvement of the Split Octonions, the Bi – Octonionions and the Twisted Octonions. Even the Quarternions relate to the Sedenion level of number. Robert de Marrais explored these levels in detail, and this series of papers hopes to make his discoveries more accessible by eliminating idiosyncratic language and by relating his discoveries to the more readily available work of others.

Baez & Huerta readily admit that the subject of their paper had been covered many times previously. Yet given the extremely complex nature of G2, perhaps none had covered the subject from precisely the same angle. This paper has attempted to shed light on the nature and function of the Lissajous Functions in relation to the Sedenions by presenting the intersection of 3 distinct points of view on the Lissajous Functions.

Hopefully this tactic will help to spread more light on the remaining concepts and areas which de Marrais explored. De Marrais has much more to relate about the Octonions, Sedenions and Trigintaduonions, obscured by his references to Box Kites, 8 Balls and Catamarans.

This paper has presented a good deal of information about the 3 separate states of matter and the combinatorial relationships between them. This area is not well understood but is essential to understanding the dynamics of the combinatorial universe in which we live. That great minds such as de Marrais, Baez and Huerta have dealt with the Lissajous Figures and the Epicycloid indicates that the Vedic Physics model rolls down the correct track.

The most assuring discovery in this paper is that de Marrais posits a model which is identical to that described in this series of papers, published this year on Vixra, which feature the icosahedron, the dodecahedron and the helix. De Marrais knew of that which he wrote about, and the Qi Men Dun Jia Model coincides with the conception described by de Marrais herein.

Bibliography

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Chesley, Donald, Superparity and Curvature of Twisted Octonionic Manifolds Embedded in Higher Dimensional Spaces.

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Wikipedia

Wolfram

Appendix

Lissajous Figures / Wolfram

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Lissajous curves are the family of curves described by the parametric equations

(1)
(2)

sometimes also written in the form

(3)
(4)

They are sometimes known as Bowditch curves after Nathaniel Bowditch, who studied them in 1815. They were studied in more detail (independently) by Jules-Antoine Lissajous in 1857 (MacTutor Archive). Lissajous curves have applications in physics, astronomy, and other sciences. The curves close iff is rational.

Lissajous curves are a special case of the harmonograph with damping constants .

Special cases are summarized in the following table, and include the line, circle, ellipse, and section of a parabola.

parameterscurve , line , , circle , , ellipse , section of a parabolaIt follows that , gives a parabola from the fact that this gives the parametric equations , which is simply a horizontally offset form of the parametric equation of the parabola .

Appendix The Epicycloid

In geometry, an **epicycloid** is a plane curve produced by tracing the path of a chosen point of a circle — called an *epicycle* — which rolls without slipping around a fixed circle. It is a particular kind of roulette.

If the smaller circle has radius *r*, and the larger circle has radius *R* = *kr*, then the parametric equations for the curve can be given by either:

or:

If *k* is an integer, then the curve is closed, and has *k* cusps (i.e., sharp corners, where the curve is not differentiable).

If *k* is a rational number, say *k=p/q* expressed in simplest terms, then the curve has *p* cusps.

If *k* is an irrational number, then the curve never closes, and forms a dense subset of the space between the larger circle and a circle of radius *R* + 2*r*.

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Some men see things as they are and say *why?* I dream things that never were and say *why not?*

Let's dedicate ourselves to what the Greeks wrote so many years ago: to tame the savageness of man and make gentle the life of this world.

Robert Francis Kennedy