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The How, Energy from Chaos, becomes The Spin of the → Discrete Elementary - Monads

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Abstract

From Mechanics in case that , *in an Axisymmetric Rotating Body , with constant Angular-Velocity* , w , ***the moment of Inertia ,*** $J_x = J_y$ *, is equal about the two of the three Principal axis ,* ***then*** ,

1.. ***The Angular – velocity - vector ,*** $\overline{w}$ **,** describes the Ellipsoid of Angular Velocity and its nib describes a Cone of which Plane-Base is Fixed , ***and Simultaneously*** ,

2.. ***The Angular-Momentum ,*** $\overline{B}$ **,** describes the Ellipsoid of Angular-Momentum and its nib describes a Cone also of which Plane-Base is also Fixed .

3.. ***The Nib of Angular – velocity - vector ,*** $\overline{w}$, describes on the Tangential-Plane of the Angular-Momentum-Ellipsoid , ***the Herpolhode*** , while ,

4.. ***The Nib of Angular-Momentum ,*** $\overline{B}$, describes on the Tangential-Plane , of the Angular-Velocity-Ellipsoid , ***the Polhode*** .

5.. ***The Fixed-Tangential-Planes on ,*** $\overline{w}$ ***, and ,*** $\overline{B}$, ***nib*** are alternately Perpendicular to , $\overline{B}$, and , $\overline{w}$, central axes of rotation .

6.. ***The Kinetic Rotational – Energy of monad ,*** which is the Work in monad ***, is the Scalar quantity ,*** **L** ***, The Vector Angular Momentum quantity*** is ***,*** $\overline{B}$ ***,*** and the ***Vector Angular - Velocity quantity*** is , $\overline{w}$ ***,*** *which Three monads are related as* $\overline{B} \cdot \overline{w} = 2L = J \cdot w^2$ where J = The moment of inertia around the axis of rotation.

All above happen in , Material-Point ***, where the Positive*** ⊕ ***constituent , is Eternally self rolling on the Negative*** ⊖ ***constituent ,*** with Angular-Velocity , w ***, in Infinite Spherical traces , either at Great-circles*** [+or -] , ***or Small-circles ,*** [+] where is the Clockwise Left direction , and [-] where is the Anti-Clockwise Right direction , ***or any other close Spherical-curve , and by Applying all laws of Mechanics into this Energy - Chaos , is thus created the*** → **First–Discrete – Energy–monad** ***, the Material Point i.e. ,*** *The Quantum of Physics and , of all Energy - Space -Universe* **.**
Present Article [64A] *is the completion of prior* [61A] *using the Geometrical logic of Material Geometry* .
Everything in this cosmos , is Done or Becomes , from a Mould .

Geometry has the Monad , *the discrete continuity* **AB** length becoming from the *Zero-Point* ≡ 0 , and ***Mechanics - Physics*** the Recent-Acquisition of the Material - Geometry , where Zero-point 0 = ∅ = {⊕+⊖} = The Material-point = *The Quantum* = Positive Space and Negative Anti-Space . [58]
Monad in Geometry → ***Linearly*** is , through mould of Parallel Theorem [44-45] ,*which are the equal distances between points of parallel and line* → ***In Plane*** is through mould of Squaring the circle [46-47] , *where the two equal and perpendicular monads consist a Plane acquiring the common Plane- meter* ,π, → ***In Space*** (volume) is through mould of the Duplication of the Cube [44-46] , *where any two Unequal perpendicular monads acquire the common Space-meter* ,$\sqrt[3]{2}$, *to be twice each other* . ***Monad in Mechanics*** *and Physics* is → The Material-point = *the discrete continuity* |{⊕+⊖}| = ***The Quantum*** through mould of Space –Anti-space in itself , *which is the material dipole in inner monad Structure and is Identical with the Electromagnetic cycloidal field of Energy monads* .
This is , the Energy distance , *the deep concept of Material-geometry.*
Energy monads presuppose Energy-Space Base (*the caves beyond Planck`s length ,Gravity`s and Spaces levels*) the [PNS] Space Anti-Space as work → W = ∫ P.ds = 0 , which is the cause of Spaces existence and the motion of particles . Since are also Quantized then , this property is encountered in Stationary waves where energy , **E** , is proportional to angular velocity **w** . This property of particles , *Angular momentum* = The *Spin* , becomes from the Intrinsic , *Inward* , cycloidal wave motion, which is their cause of external motion *as outward waves* .[43]
The varying lever arms , on cycloid-evolute is the cause of vibrations and which cause the EM-waves and Spin . Common-circle of radius , r_c , is the common source of vibration excitation for the Space , Anti –space , considered as rotating with angular velocity **,w**, and then their relative motion becomes the , Rolling of Space , ABC , on Anti-space $A_E B_E C_E$ and since also this relative motion is applied on STPL [Six Triple Points Line] Mechanism , then D_A , P_A , points on it are the corresponding linear links of vibrations and Poles of rotation .
[STPL] is a ***Geometrical Mechanism*** that produces and composite all opposite Space and Anti - space Points to Material-points → Waves ← the three Breakages { [$s^2 = \pm(\bar{w}.r)^2$, [∇i] = $2(wr)^2$] of [MFMF] mechanism under $\bar{v} = \bar{c}$ thrust } , and through it are becoming ,
The Fermions → **[$\pm\bar{v}.s^2$]** and ***The Bosons*** → [$\bar{v}$.∇i = [$\bar{v}.2(\bar{w}.r)^2$] = **[$\bar{v}.2s^2$]** , [35]
It was shown [33-36] that Un-clashed Fragments through center , O , consist the Medium-Field Material-Fragment → [± s^2] = [MFMF] = ***The Chaos*** , as base for all motions , and Gravity as force [∇i] , while the clashed with the constant velocity ,$\bar{c}$, consist the Dark matter [±.$\bar{c}$.s] and the Dark energy [$\bar{c}$.∇i] **,** ***declaring that*** → Antimatter-Galaxies and Antimatter – Asteroids can exist only as Dark-matter or and Dark-Energy and **Not** as Antimatter light , **- c** , alone , or from → Breakages
[± s^2 = ± $(wr)^2$] and [∇i = $2(wr)^2$] , where then become Waves { *Distance* ds = |AA_E| *is the Work embedded in monads and it is what is vibrated* } with the Vibrating equations of motion , become ,

A → Particles , with Inherent Vibration ,
B → Gravity-Field-Energy , without Vibration
C → Dark-matter-Energy constituents and as ,

A.. [$\pm\bar{v}.s^2$] → Fermions and → [$\bar{v}$.∇i] → Bosons,
B.. [± s^2] → [MFMF] Field = ***The Chaos*** , and the binder , Field is [∇i] → Gravity force ,
C.. [$\pm\bar{c}.s^2$] → Dark matter , and the binder Gravity force [∇i] , [$\bar{c}$.∇i] → The Expanding Dark energy.

From above in , A , *and* , C, *case* → *Energy as velocity* ,$\bar{v}$, *exists in the Discrete monads* ,± $\bar{v}.s^2$ *and* ± $\bar{c}.s^2$.
B , ***case ,*** **→** ***is the transportation of Energy , from Chaos to Material points either***

***Linearly* [⊕s² ↔ ⊖s²] *or Rotationally* [⊕s² ↻↺ ⊖s²] .**

The How Energy from Chaos becomes the Monad of particles in → (Page 38)

A : NEWTON – FORCES

Newton`s , First - Law states that , *Any change in motion involves an acceleration , a* .
In circular motion , for an object of mass , m , acceleration is equal to , a = $\frac{v^2}{r}$ and force , F, acted is
F = m.a = m $\frac{v^2}{r}$, which is the Centripetal force F_p .
From Newton`s Third-Law , *All forces in the universe occur in equal but opposite directed pairs* , then
For any Centripetal force F_p , there is a force of equal magnitude but of opposite direction , the Centrifugal force , F_f , which acts back on the object , *without specifying the nature , or origin of the forces* .
In Material-point , [⊕⊖] , ***both forces exist apriori*** , as the Glue-Bond between the two opposites which is the main Stress $\sigma = \pm \frac{2.v}{(1+\sqrt{5})}$, and since $v = w.r = 2\pi r/T = (2\pi.r).f$, where

r = the radius of the Energy cave (***the Chaos***)

f = the frequency of this rotation , *then* $\boldsymbol{\sigma = \pm \frac{4\pi r}{(1+\sqrt{5})} . f}$ or → $\boldsymbol{f = \frac{\sigma(1+\sqrt{5}])}{4\pi r}}$.

i.e. a relation between the Glue-Bond , **σ** , and the frequency , **f** , of the rotation , or ,
In ***Chaos*** where r = r → 0 between the ⊕ , ⊖ , Opposites , exists a Stress , **σ** , The Centripetal F_p , and Centrifugal force , F_f , which nature is only the frequency in a complete rotation , and from Planck`s equation **E = h.f** = $\frac{h(1+\sqrt{5}]).\sigma}{4\pi r}$ = $\boldsymbol{\frac{h(1+\sqrt{5}])}{4\pi} . [\frac{\sigma}{r}]}$, then ***from Chaos*** r = r → 0 , ***becomes the Monad*** , [⊕⊖] , which is the Neutral – Material – Point . A wide analysis in [58] .

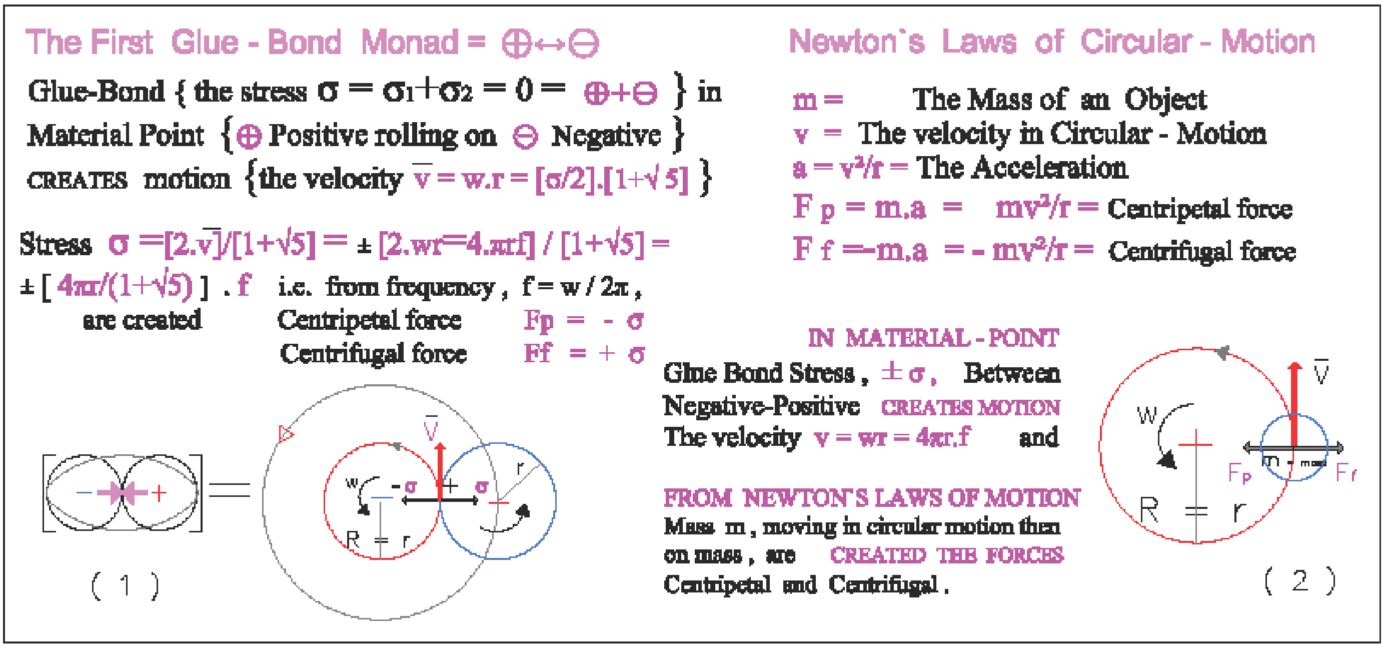


Figure .1. In (**1**) The Glue-Bond pair of opposites [⊖ ⊕] , ***Creates Rotation*** with angular velocity w = v/r , and velocity $v = w.r = \frac{2\pi r}{T} = 2\pi r . f = [\frac{\sigma}{2}].(1+\sqrt{5})$, and or frequency $f = \frac{(1+\sqrt{5}]).\sigma}{4\pi r}$, with Period $T = \frac{4\pi r}{\sigma(1+\sqrt{5})}$ where ± σ , are the two equal and opposite , Centripetal F_p and Centrifugal F_f Glue-bond forces .
In (**2**) Mass , m , of an object rotating with velocity , $\bar{v}$, in a cave of radius , r , creates a pair of equal and opposite forces the Centripetal F_p and Centrifugal F_f .

B : THE SPIN OF MONADS

1.. *Introduction* .

The intrinsic rotation of an elementary particle is called ***Spin*** , and is the amount of the quantized ***Angular momentum*** which is conserved as Potential or Kinetic Energy and *vice versa* . Is proved that Spin is vector **, $\overline{\mathbf{B}}$,** which interacts with magnetic fields and have an effect on bulk properties. The Glue-Bond motion in Material point (*The Rolling of the Positive on Negative*) may be either on Great-circles , or on Small circles in the two Semi-spherical of the Stationary [⊖] constituent . Motion of the [⊕] constituent on each Semi-spherical of the [⊖] constituent , is in the opposite Direction , *and this accidentally because such is the Geometry of Space* , so this Property defines , Spin to be either Clockwise or Anti- clockwise , that is to say Positive [+] or Negative [-] *which is the Symmetry in Opposites* and where the Total Energy is L =(B/2).w

The Geometrical construction of the Particle`s Spin is shown in Figure.2. rectilinear

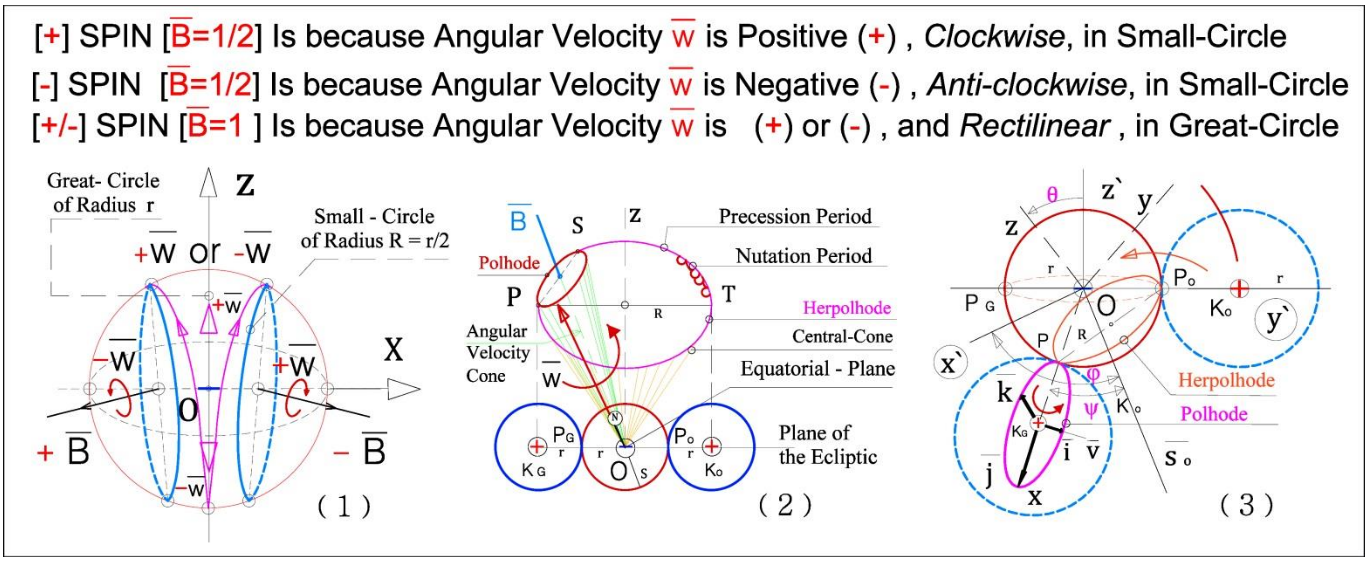


Figure .2.. In (**1**) The Glue-Bond pair of opposites [⊖ ⊕] in the ***Straight Direction of Great circles ,*** creates rotation on circle of radius , r , with velocity v = w.r =$\frac{2\pi}{T}$.r =2πr. f = [$\frac{\sigma}{2}$].(1+$\sqrt{5}$) , where frequency f = $\frac{(1+\sqrt{5}]).\sigma}{4\pi r}$, Period T =$\frac{4\pi r}{\sigma(1+\sqrt{5})}$ and ±σ , are the two equal and opposite Centripetal ,F_p , Centrifugal ,F_f forces . Energy is → E = h.f = $\frac{(1+\sqrt{5}]).\sigma h}{4\pi r}$ *in* ***Zero*** *Wave-note.*

In (**1**) The Glue-Bond pair of opposites [⊖ ⊕] in the ***Left Direction of Small circles*** , creates rotation on circle of radius , R , with velocity v = w.2r =$\frac{2\pi}{T}$.2r =4πr. f = [$\frac{\sigma}{2}$].(1+$\sqrt{5}$) , where frequency f = $\frac{(1+\sqrt{5}]).\sigma}{8\pi r}$, Period T =$\frac{8\pi r}{\sigma(1+\sqrt{5})}$ and ± σ are the two equal and opposite Centripetal,F_p, Centrifugal,F_f forces . Energy is → E = h.f = $\frac{(1+\sqrt{5}]).\sigma h}{8\pi r}$ *in* ***One*** *Wave-note.*

In (**1**) The Glue-Bond pair of opposites [⊖ ⊕] in the ***Right Direction of Small circles*** , creates rotation on circle of radius , R , with velocity v = w.2r =$\frac{2\pi}{T}$.2r =4πr. f = [$\frac{\sigma}{2}$].(1+$\sqrt{5}$) , where frequency f = $\frac{(1+\sqrt{5}]).\sigma}{8\pi r}$, Period T =$\frac{8\pi r}{\sigma(1+\sqrt{5})}$ and ± σ are the two equal and opposite Centripetal,F_p, Centrifugal,F_f forces . Energy is → E = h.f = $\frac{(1+\sqrt{5}]).\sigma h}{8\pi r}$ *in* ***One*** *Wave-note.*

In analysis ,The Torsional Momentum is a Vector noted as ,$\overline{\text{B}}$*, and is the Spin of monads* →(Page-62)

A.. *Preliminaries* .

1. Introduction

Zeno`s Paradox and
The nature of Points .

Word , *quantization* , has to do with the discrete continuity, which describes the Physical reality through the Euclidean conceptual , for Points Straight lines, Planes , the Monads in Universe and the Dual Nature of Spaces as *discrete* and *continuous* **.** Euclidean Geometry is proved to be the *Model of Spaces* and Material Geometry the *Model of Physical Reality* since it is Quantized as the Complex numbers , which are such.

The proposed Euclidean solution.

Points :

Euclidean geometry definition for Points is as < *that which has no part* > meaning that a point cannot be defined in terms of previously defined objects , but from axioms only as that of , any length , area , volume or any other dimensional attribute (a unique location) . This consideration of points was devised by Zeno of Elea to answer , the how Granulation of points may become a segment.
Euclid`s - Markos :
Point is nothing , has not any Position and Dimension , and may be anywhere in Space if exists , *therefore* , the Primary point A , *being nothing also , in no Space* , is the only point and no-where ***i.e. Primary point is the only Space and from this all the others***) . [6]

Straight line :

Straight line AB is continuous in Points between A and B [i.e. all points between line segment AB ***are the elements which fill , AB*** , *and which Points are also Nothing* , or Everything else and are Anywhere as in above and for a Runner in order to run the 100 m , has to pass the infinite points between point A and point B [1.1] . A point ,T, is on line AB only when exists equation TA + TB = AB (*or the whole* AB *is equal to the parts* TA , TB , *as it is the logic of equality and the logic for equations*). Since in nature exists the Principle of Equality and Un-equality consequently any Comparison is including the following three cases .

1.. In case TA + TB > AB then point , T , is not on line AB , **it is OUT**, and then issues the Property of ***Anequality*** and it is the triangle ABT lying in ABT Plane .
This is the main difference between the Euclidean and the Non-Euclidean geometries . On this is based the Philosophy of Parallel fifth Postulate which is proofed to be a Theorem , and also all the Ancient unsolved and now solved problems . [44-47]

***In Euclidean Geometry points* A , B , T *consist the Plane* ABT ,**
***while for Others is a curve in Plane* ABT .**
The Definition 2 (*a line AB is breathless length*) is altered as → *for any point* T *on line* AB *exists* TA + TB = AB , i.e. it is the equation which is also and equality . [9-10]

Since points have not any dimension and since only AB has dimension (the length |AB| and for any $\overline{AT}$ the length AT) , and since also on $\overline{AB}$ exist infinite line segments AT < → AB , which become the quantized material - lengths and have ***infinite Spaces , Anti-Spaces and Sub - Spaces*** , then (1.1) is impossible in--bringing Achilles to the Tortoise´s starting point B , and also for Tortoise´s to 110 m , because issues as follows **,**

Straight line* AB *is not continuous unless* a Common Dimensional Unit AT > 0 *or
AT = ds → AB *is accepted , and thus in this way exists ,*

a .. Straight line AB is continuous with points as filling (*Infinitively divisible*)
b.. Straight line AB is discontinuous (*discrete*) with dimensional Units , ds, as filling (that is made up of finite indivisible parts the Monads , where ds ≠ 0 , as in Material geometry) and so defining the Space Anti-space at A , B points and Sub-space as [ds ≠ AB /n , where n =1 , 2 , → ∞] .

c.. Straight line AB is continuous in ,ds, with ds = 0 as points of filling , and also discontinuous (*discrete*) with the dimensional Units , ds ≠ 0 , defining the Space , Anti-space at A,B points and Sub-space , where , *ds = quantum* = AB / n , **{** where n = 1,2,3 → ∞ = [a+b.i] / n = complex number *and Infinitively divisible which is keeping the conservation of Properties at End Points A , B* **}** as filling , ***and continuous with points as filling ,***

[for n = ∞ then ds = 0 i.e. the ∞ Positions of points in ds] , i.e.

Monads ds = 0 → ∞ are simultaneously (*actual infinity*) and also (potential infinity) in Complex number form , and this defines that , infinity exists between all points which are not coinciding , and because ,**ds,** comprises any two edge points with imaginary part , then this property differs between all the infinite points .

This is the Vector relation of Monads , ds , (or , as Complex Numbers in their general form ***$\bar{w}$ = a + b . i) , which is the , Dual Nature of lines (discrete as $\frac{\bar{w}}{|a^2+b^2|}$ and continuous as points*** **(.)** ***and in recent Material-Geometry the Work ≡ Energy ≡ Monads ≡ Imaginary part ,i,) .*** [57-58]

2.. In case TA + TB = AB then point T is **ON** straight line AB , where then issues the Property of Equality.

On *Monad* AB which maybe equal to , 0 ↔ AB ↔ ± ∞ , exists < *a bounded State of energy for each of the Infinite Spaces and Anti-Spaces* called ***Energy monad*** in Space moulds > and this [*Dipole AB = Matter = The meter of the reaction to Energy-change*] is the communicator of Impulse [*Force P*] *of Primary Space* .

This Energy-monad is modified as the Quanta of Energy , *the monad* , and is represented as the above Dipole i.e. This motion is Continuous and occurs on Dimensional Units , ds , *which is the Maxwell`s Monads - Displacement-Electromagnetic-current* [E+$\bar{v}$xP] , and not on Points which are dimensionless, upon these Bounded States of [PNS] , *the Spaces and Anti-Spaces, and because of the different Impulses* P_A , P_B , *of edge points A , B , and that of Impulses* , P_{iA} , P_{iB} of Sub-Spaces , *they are* either on straight lines AB or on tracks of the Spaces , Anti-Spaces and Sub-Spaces of AB . The range of *Relative velocities* , is bounded according to the single slices of spaces (*ds*) . [14 -15] , [39-40] .

3.. In case TA + TB < AB then point ,T, is **IN** straight line AB , *where then is* NOT *issuing the Property of Equality or Un-equality* .

It is issuing a ***New Paradox in Geometry which is the recently new Material-Geometry*** as in articles [55 - 56] , and connects , Geometry – Mechanics – Chemistry - Physics.

From D. Hilbert`s → 4. Problem of the straight line as the shortest distance between two points A and B become the following :

Lobachevsky : (Hyperbolic Geometry) is excluding the axiom of parallels or assume it as not satisfied .
Rieman`s : (Elliptic Geometry) is excluding the axiom of parallels which assums that one and only one Point lies between the other two.
Hilbert`s : (Non-Archimedian Geometry) is excluding the axiom of parallels , assuming that Infinitive Points on Parallels lie between the other two and straight line is the shortest distance between the two points .
Euclid`s - Markos :
Straight line is from 0 Pont , to Positive , Negative ± ∞ points ,and since is composed of infinite points which are filling line , *then nature of line is that of Point (the all is one for Lines and for Points).*
Euclid`s-Markos : (Geometry - Material Geometry) ,The Definition 2 , *(a line AB is breathless length)* is altered as , *for any point , T , on line AB exists* the Equality TA + TB = AB .

The critic of all above is in my articles , and because of the inattention in the establishment in these Definitions , allowed the creation of Non-euclid Geometries which acted Negatively to the Right - Orientation of sciences . The deep concept of Material-Geometry is this , ***distance*** , from the Opposites [⊖ ⊕] become the ***First Self – Rotating – Monads*** in M-Geometry ,

Plane :

Is Positive , Negative , ± Neutral and ± Complex points and since is composed of infinite Straight lines which are filling Plane , then , *nature of Plane is that of Lines and that of Points (the all is one for Planes , Lines and Points) .*

Space :

Space is Positive , Negative , ± Neutral and ± Complex points , and since is composed of infinite Planes which are filling Space , then , *nature of Space is that of Plane and that of Points (the all is one for Spaces , Planes , Lines and Points) .*

1.1. Achilles and the Tortoise :

The Problem :

(0m) → (100 m) (110 m)
A -------------------T----------------- B → - - - - -

< ***In a race , the Quickest runner ,*** *Achilles* ***, can never overtake the Slowest ,*** Tortoise , ***since the Pursuer must first reach the Point whence the Pursued started , so that the Slower must always hold a lead*** >

This problem was devised by Zeno of Elea to support Parmenides´s doctrine that < *all is one in Euclidean Absolute Space* > , contrary to the evidence of our senses for plurality and change and to others arguing the opposite . Zeno´s arguments are as proof by contradiction or (*reduction ad absurdum*) which is a philosophical dialectic method . Achilles at point ,A, allows the Tortoise at point ,T, a head start 100 m , and each racer starts running at some constant speed , *one very fast and one very slow* , the Tortoise say has further 10 m at point ,B , .
Since Straight line AB is continuous with points as filling , *The Quickest* ,
has to pass *Infinitive* points to reach point T , so since the steps are the points ($\frac{AB}{\infty} = 0$) ,
The Quickest will never reach point T .
The same also for *The Slower* with step , ($\frac{TB}{\infty} = 0$) will never reach point B .

1.2. The Arrow Paradox (*Arrow*) :

The Problem :

< ***If everything when it occupies an equal Space is at rest ,*** **[PNS]** ***, and if that which is in locomotion is always occupying such a Space at any moment , the flying Arrow is Therefore motionless*** >

| (10 m) |
(10m) **ds = a+b.i = v.dt** (10 m)

A ----------------------- > B

A ------- C - D -------- > B

The Arrow Paradox is not only a simple mathematical problem , because is referred also to ,
motion in Absolute Euclidean Space , i.e.
in a Space where ***issues Geometry*** , *with all the unsolved till recently problems as ,The Parallel Postulate the Squaring of circle etc*, and also the ***Physical*** where Space [PNS] is not moving and because of its Duality (*discrete and continuous as Complex numbers are*) , shows that ,

Time is not existing as any essence but only a measure for measurements , i.e. a number .

This Paradox ***is not*** in metaphysical sphere of mind since is was proved in [15] that , Complex numbers and Quantum Mechanics Spring out of ***the Quantized Euclidean Geometry .***

As before Straight line AB is discontinuous (***discrete***) with dimensional Units , **ds = CD** as filling

and ***continuous with points*** as filling (The Complex Numbers in the general form w = a+b. i) , ***which is the Dual Nature of lines*** (line = *discrete with* , *Line-Segments* , *and continuous with points*). It has been shown that PNS Primary Neutral Space is not moving and Time is not existing , *so Points* , in Primary Space cannot move to where they are because are already there and motion is impossible. Since any *Points C , D* of the Primary Neutral Space , PNS , are motionless (v = 0) this is at any Time (the composed instants are dt = 0) , and so then motion is impossible , i.e. issues [ds = a + b. i = v.dt] where , *for*

$a = 0$ then ds = b.i = v.dt *and for*

$b \neq 0$ and dt = 0 then $ds = Constant = v \cdot 0 \rightarrow$ i.e. $\mathbf{v} = \infty$, *for*

$b = 0$ then ds = a = v.dt *and for* dt = 0 then $\rightarrow$ $ds = a = Constant = v \cdot 0 \rightarrow$

i.e. again , $\mathbf{v} = \infty$,

Therefore in* PNS *,* $v = \infty$ *,* T = 0 *, meaning infinite velocity and Time not existing , so , Since Arrow is moving from point A to point B , then exists the Numerical order A → B which is not valid for Temporal order (dt) . In case that dt = 0 then motion from Point A to point B has not any concept , and the distance CD **,** and anywhere exist the Equal CD , is unmovable **, i.e.**

Motion of points C , D of* PNS is not existing** ***because time (dt = 0) and infinite velocity (v = ∞) exists , while motion of the same points C , D **exists in PNS** ***out of a moving Sub-Space of AB*** **(** arrow CD is one of the ∞ roots of AB) **where , (** *ds = CD = The Monad in* PNS **) .** [15] .

It has been shown that Primary Neutral Space [PNS] is not moving and Time is not existing , *so Points* , in Primary Space cannot move , *to where they are* , because are already there and motion is impossible . Since *Points T , C,,,* of Primary Neutral Space , PNS , are motionless (v = 0) at any Time (the composed instants are dt = 0) , then motion (*s = v.dt*) is impossible . i.e.

In PNS *velocity v = ∞ and Time = 0 , meaning infinite velocity ,v, and Time is not existing , so since any Arrow (a vector) moving from point A to point B , then exists a Numerical order A → B , which is not valid for Temporal order (dt) . In case dt = 0 then motion from Point A to point B has not any concept* , and distance , *CD magnitude* , and anywhere exist the Equal CD which is unmovable (*s=v*) ,

i.e. *The Motion of points C , D , T….. of PNS* is not existing *because time (d t = 0) and for ds = Any constant exists with infinite velocity (v = ∞) while motion of the same points C , D ,T* exists *in* PNS *out of a moving Sub- Space of AB* (Included Arrow CD is one of the ∞ roots of this line segment AB).

Monads ds =CD= 0 $\rightarrow \infty$ are Simultaneously, *actual infinity* (*because for* $n = \infty$ *then* $ds = [AB / (n = \infty)] = 0$ *i.e. a point*) *and* , *potential infinity* , (*because for* $n = 0$ *then*

$ds = [AB / (n = 0)] = \infty$ *i.e. the straight line through sector AB* .

Infinity exists between all points which are not coinciding , and because Monads ,ds, *comprises any two edge points with Imaginary part , then this property differs between the ,i, infinite points or as* $d\bar{s} = \lambda i + \nabla i$, which ($\lambda \equiv$ Space, $i \equiv$ Energy) , is the Quaternion .

Since Primary point ,A, is the only Space then on this exists the Principle of Virtual Displacements $W = \int_A^B P . ds = 0$ or $[ds.(P_A+P_B) = 0]$, i.e. for any monad ds > 0 Impulse $P = (P_A+P_B) = 0$ and $[ds. (P_A+P_B) = 0]$, Therefore , Each Unit AB = ds > 0, exists by this Inner Impulse (P) where $P_A+P_B= 0$, → i.e.

The Position and Dimension of all Points which are connected across the Universe and that of Spaces exists, because of this equilibrium Static Inner Impulse , on the contrary should be one point only (Primary Point A ≡ Black Hole → ds=0 and P = ∞) . [17,22] . Monad AB is dipole $[\{A(P_A) \leftarrow 0 \rightarrow (P_B)B\}]$ and it is the symbolism of the two opposite forces (P_A) , (P_B) which are created at points A , B . This Symbolism of primary point (*zero* 0 *is nothing*) shows the creation of Opposites , A and B , points from this zero point which is the Non-existence. [13] .

All points may exist with force P = 0 → { PNS the Primary Neutral Space} and also with P ≠ 0 , ($P_A+P_B= 0$) , { PS is the Primary Space} for all points in Spaces and Anti – Spaces , therefore [PNS] is self-created , and because at each point may exist also with P ≠ 0 , then [PNS] is a (perfectly Homogenous , Isotropic and Elastic Medium) Field with infinite points (i) which have a ± Charge with force Pi = 0 → P = Λ→ ∞ and containing rotational energy Λ in cave λ/2 .

Since points A ,B of [PNS] coincide with the infinite Points , of the infinite Spaces , Anti-Spaces and Sub-Spaces of [PNS] and exists there rotational energy ± Λ and since Motion may occur at all Bounded Sub–Spaces (± Λ , λ), then this Relative motion is happening between all points belonging to [PNS] and to those points belonging to the other Sub-Spaces (A≡B) . The Infinite points in [PNS] form infinite Units (The monads = segments) AiBi = ds , which equilibrium by the Primary Anti-Space by an Inner Impulse (P) at edges A , B where $P_{iA}+P_{iB} \neq 0$, and distance ds = 0 →N→ ∞ .

Monad , the *discrete* Unit ds = Quaternion ($\overleftrightarrow{AB}$) is the ENTITY and [AB – P_A , P_B] is the LAW , therefore Entities are embodied with the Laws . Entity is quaternion $\overleftrightarrow{AB}$, and law |AB| = Energy length (*the energy quanta*) of points |A,B| or the wavelength where then AB=0 and imaginary part are the equal forces P_A , P_B as the fields , *the medium* , in monads , (***This is distinctly seen for Actions at a distance*** , *where there the continuity of all intermediate points being also nothing* , ***is succeeded on a quantized , tiny energy volume which consists the material point*** *i.e.*

it is a field , the medium , ***or*** *by the Exchange of energy in the Inner-monads field*) . [39-40].

Pythagoras definition for a **Unit** is → *it is a Point without position* , *while in Material-geometry*
a Point is → ***Linearly* [⊕s² ↔ ⊖s²] *or Rotationally* [⊕s² ↻↺ ⊖s²]** , *is a Unit having position.*

1.3. The dichotomy Paradox (*Dichotomy*) :

The Problem :

< ***That which is in locomotion must arrive at the half-way stage before it arrives at the goal*** >

(0m) → → (50 m) (100 m)
A ---------D------------ C-------------------- B

As before , Straight line AB is not continuous unless a Common Dimensional Unit AC > 0 or , as the problem , ds = 0 → AB / 2 → AB is accepted and this because point C is on line AB , where then issues CA + CB = AB and since CA = CB then CD < CB therefore point D on (AD) will pass through C on (AC) before it arrives at the goal B on (AB) .

1.4. The Algebraic Numbers :

From priors , *Monad* ≡ **AB = 0 ↔ |AB| ↔ ± ∞ ,** *a wave in* AB *Cycloidal or circular cave with wavelength* λ= 2.AB , **which represents** the Spaces , A , the Anti-Spaces , B , the Sub-Spaces of AB which are **the Infinite Regular Polygons** , on circle with AB as Side , and on circle with AB as the diameter , and it is what is said , *monad in monad* . According to De Moivre's formula the n-th roots on the unit circle AB are represented by the vertices of these Regular , n-sided Polygon inscribed in the circle which are Complex numbers in the general form as ,
$\mathbf{w = a + b.i = r.e^{(i\varphi)}}$, and **,** **a** and **b** = Real Numbers **,**
$\mathbf{r} = \sqrt{a^2+b^2}$ **,** (±) **i** = Imaginary Unit.
We will show that since Complex Numbers are *as* ***the Monads AB*** (*A Monad is any two points non coinciding*) and it is the only manifold , for the Physical reality , ***and in the same way the Euclidean Geometry is also Quantized*** .
This geometrically is as follows,
a. Since Exists $^2\sqrt{1} = \pm 1$ or square roots of monad are **[-1 ↔ +1]** , therefore **xx** (axis) coordinate system represents the one-dimensional Space (+1) and the Anti-Space (-1) which is (the Straight line) , 1.1 = 1 , (-1).(-1) = 1 and **[+ i]** .

b. Since Exists $^2\sqrt{-1} = \pm i$ ***or both directionally*** **[↨]** , therefore **yy** (axis) coordinate system represents [- i] a perpendicular axis on (-i).(- i) = + i ² = + (-1) = -1 , (+ i).(+ i) = + i ² = -1
c. Since Exists $^3\sqrt{1}$ **= the three roots [1 , - ½ + (√ 3.i) /2 , - ½ - (√ 3.i) /2]**
therefore **xx-yy** coordinate system represents the two - dimensional ± Spaces and the ± Complex numbers , (the Plane)
1.1.1 = 1 , [-½ +(√3.i) /2] ³ = 1 , [-½ -(√3.i) /2] ³ = 1 + i
d. Since Exists ∜1 = ²√ ²√**1** = ²√ **±1 = [+1 , -1] , [²√ -1 = + i , - i]**
or on the two perpendicular axis -1 ↔ +1 , ↨
therefore coordinate systems **xx - yy** represent all these Spaces , - i , i.e. (± Real and ± Complex numbers) , where Monad = 1 = (*that which is one*) , and represents the three-dimensional Space and Anti-Space (the Sphere) which is , $[\pm 1]^4 = [\pm i]^4 = 1$.

The fourth root of **1** ***are the vertices of Square in circle*** with **1** as diameter and this because the Geometrical Visualization of Complex numbers , is the formula $^4\sqrt{1} = \pm 1 , \pm i$ …(d) and also since ± 1 is the one-dimensional ***real Space*** (*the straight line*) , the vertical axis is the other one-dimensional ***Imaginary Space*** ± i **.**
Since for dimension , *discrete* , are needed N+1 points , then (d) is representing the Space with three dimensions (dx ,dy ,dz) which are Natural , the Real and Complex . Monads (or the Entities = AB) and are the Harmonic repetition of their roots , and since roots are the combinations of the purely real and purely Imaginary numbers , *which is a similarity with Complex numbers* (*Real and Image*) , then , ***Monads are composed of Real and Imaginary parts as Complex Numbers are*** **,** i.e. Objective reality contains both aspects (Real and Imaginary **,** discrete , AB , and the Continuous Impulses $\mathbf{P_A}$ **,** $\mathbf{P_B}$, etc.) meaning that , *Euclidean - Geometry is such Quantized , and becomes the Energy – Space - Reality* . [15]

i.e. The Position and Dimension of all Points which are connected across the Universe and that of Spaces exists , because of this Static Inner Impulse P , **on the contrary** ***should be one point only (Primary Point ≡ Black Hole → ds = 0) .*** [43 - 45]
Impulse is ∞ and may be , Vacuum , Momentum , or Potential , or Induced Potential.

Change (motion) and plurality are impossible in Absolute Space [PNS] and since is composed only of Points that consist an Unmovable Space , then neither Motion nor Time exists i.e. a constant distance AB = **ds** = monad anywhere existing is motionless . The discrete magnitude **ds = [AB /n]** > **0** = *the quantum* , and for infinite continuous **n** , **then ds** convergence to **0** . Even the smallest particle (say a photon) has mass , *the reaction to velocity change* , [15] and any Bounded Space of ds > 0 is not a mass- less particle and occupies a small Momentum , which is the Rotational motion . It is proved that this Rotational momentum , vector $\overline{B}$, is the Spin of monads .

The Physical world is scale-variant and infinitely divisible , consisted of the finite indivisible entities ds = AB → 0 called monads (under Planck`s level) and of infinite points (ds = 0) in monads , i.e. The Euclidean and the Material Geometry.
All entities are Continuous with points and Discontinuous , *discrete* , with the monads → ds > 0 .

In PNS dt = 0 , *which is the meter of velocity changes* , so motion cannot exist at all and , *ds ≡ v* .

Since any points A , B of PNS coincide with the infinite Points , of the infinite Spaces , Anti - Spaces and Sub-Spaces **of PNS** , and since Motion may occur at all Bounded Sub-Spaces then this ***Relative motion*** is happening on the, e^{yy}_{xx} or ,**e**,ˉdimensional to **xx** Space and ↔ Anti-Space (the Straight line) between all points belonging to PNS and all those belonging to other Spaces .
Time exists in Relative Motion and it is the numerical order of material changes in the PNS - Space , and is not a fundamental Entity as is said in Relativity .??

On *Monad* AB , in any Space - level , and which is = 0 ↔ AB ↔ ± ∞ exists
< *a bounded State of energy for each one between the Infinite Spaces and Anti-Spaces* > and the

[Dipole AB = Matter = monad] is the communicator of Impulses [P] *of the Primary Space*.

This Energy monad is modified as the Quanta of Energy and is represented as the Dipole of Energy-monads in any Space-level , and is proved that it is the Material-point .

2.. Euclidean and Non-E Geometries .

Synopsis 1 :

Primary point *, which is nothing and* ***has not any Position*** *may be anywhere in Space , if there is any Space , therefore , the unique Primary point ,* A *, being nothing also* ***in no Space*** *,* ***is the only Point*** *and no-where, i.e. Primary Point is the only Space and from this all the others which have Position , and because it is the only Space thus to exist point* A *, at a second point* B *somewhere else , point A must move towards point* B *, where then* A ≡ B *. Point* B *is the Primary Anti-Space which Equilibrium point* A *, and it is the Primary-Neutral-Space* → [PNS] = [A ≡ B] *. The position of points in* [PNS] *creates the infinite dipole* AB *and all the quantum quantities which acquire Potential difference and an Intrinsic momentum* (± Λ) *in the three Spatial dimensions* (x , y , z) *and on the infinite points of the* (i) *Layers at these points , which exist from the other Layers of Primary Space , Anti-Space and Sub-Space , and this is because , Spaces ≡ monads ≡ quaternion . Since Primary point ,* A *, is the only Space then on this point exists the Principle of Virtual Displacements , Work* $W = \int_A^B P.\,ds = 0$ *or* $[ds.(P_A + P_B) = 0]$ *, i.e. for any ds = vector > 0 Impulse* $P = (P_A + P_B) = 0$ *and* $[\,ds.(\ P_A + P_B) = 0]$ *, Therefore , Each Unit* AB = ds > 0 *, exists by this Inner Impulse* (P) *where* **(** $P_A + P_B$ **)** = 0 *. This Monad , discrete , (Unit ds = Quaternion)* $\overleftrightarrow{AB}$ *is the ENTITY and* $[AB - P_A\ ,\ P_B\ ]$ *is the LAW ≡ the Content , therefore Entities are embodied with the Laws . Entity is quaternion* $\overleftrightarrow{AB} \equiv a+b.i = r.e^{(i\varphi)}$ *, and Form* |AB| *= Energy length (the energy-quanta) of points* |A ,B| *or the wavelength , and imaginary part are the equal forces* P_A , P_B *as fields , or the medium , in monads . Line segment* AB *is not continuous unless a* ***Common Dimensional Unit*** AT >0 *or* AT = ds → AB *is accepted and thus in this way exists* TA+TB= AB *and then point* T *is* ON *straight line* AB *, i.e. the whole* AB *is equal to the parts ,* TA *,* TB *, where then issues the Property of Equality and the relation between the Whole and the Parts . This property in Geometry issues in all Physical levels .*

Primary Segment *is of the* ***Form*** $\overleftrightarrow{AB}$ *, where* ***Form*** |AB| *,* ***Finite*** AB *and* ***Infinite*** *, ∞ , to the zero Point* $L_v = e^{i.\left(\frac{N\pi}{2}\right)b = 10^{-N} = -\infty}$ *, and for* N = ∞ → 0 *, where exists , The* ***Content is Atraction*** $P_A \leftrightarrow P_B$ *and the* ***Repulsion*** $P_A \rightarrow \leftarrow P_B$ *, and* ***Quantity*** *in Real part is length* AB ≡ L_v *, and the Imaginary part is Quality* $\mathbf{(}P_A + P_B\mathbf{)} = 0$ *, and when this* ***Quality*** $\mathbf{(}P_A + P_B\mathbf{)} \neq 0$ *then is a differentiation , and so on .*
Since also ***Imaginary Part*** *is always* $\mathbf{(}P_A + P_B\mathbf{)} = 0$ *then* ***Form and Content*** *are absolutely inseparable and pass from zero for all Opposites , so all Entities are embodied with the Laws , and since also valid* $\mathbf{(}P_A + P_B\mathbf{)} \neq 0$ *then ,* ***the Zero equality is the Critical-Energy-Quantity*** {CEQ} *for any transition in different Quality , a kind of Catalyst which is not changing the composition of Primary Segment , it is* the unity of opposites *, and since also Work ≡ Energy involved in all levels , then Generally → is holding that ,*

In Primary Segment $\overleftrightarrow{AB} \equiv a+b.i = r.e^{(i\varphi)}$ ***exists the Contratiction and Identity ,*** *an Extrema-state of Unstable-equilibrium on the edge of nothing , or the opposites interpenetrate in Unity , or Similar charges Repel each other whereas opposite kinds attract , or a Tiny - Energy - Space , Anti-space containing Work ≡ Energy ≡ Eternal Self-Motion as Wave , forming the Material world ,* ***Apriori*** *.*

The Ideal is nothing else than this ***Material-world*** *reflected by the human mind and translated into forms of thoughts . Since Monads are quaternion as* $w = a+b.i = r.e^{(i\varphi)}$ *, composed of Real* (a) *and Imaginary part* (bi) *as Complex Numbers are , so Work , Energy , is the Monad`s most characteristic-existence .*

The How Energy from Chaos Becomes Discrete - Monads and Spin

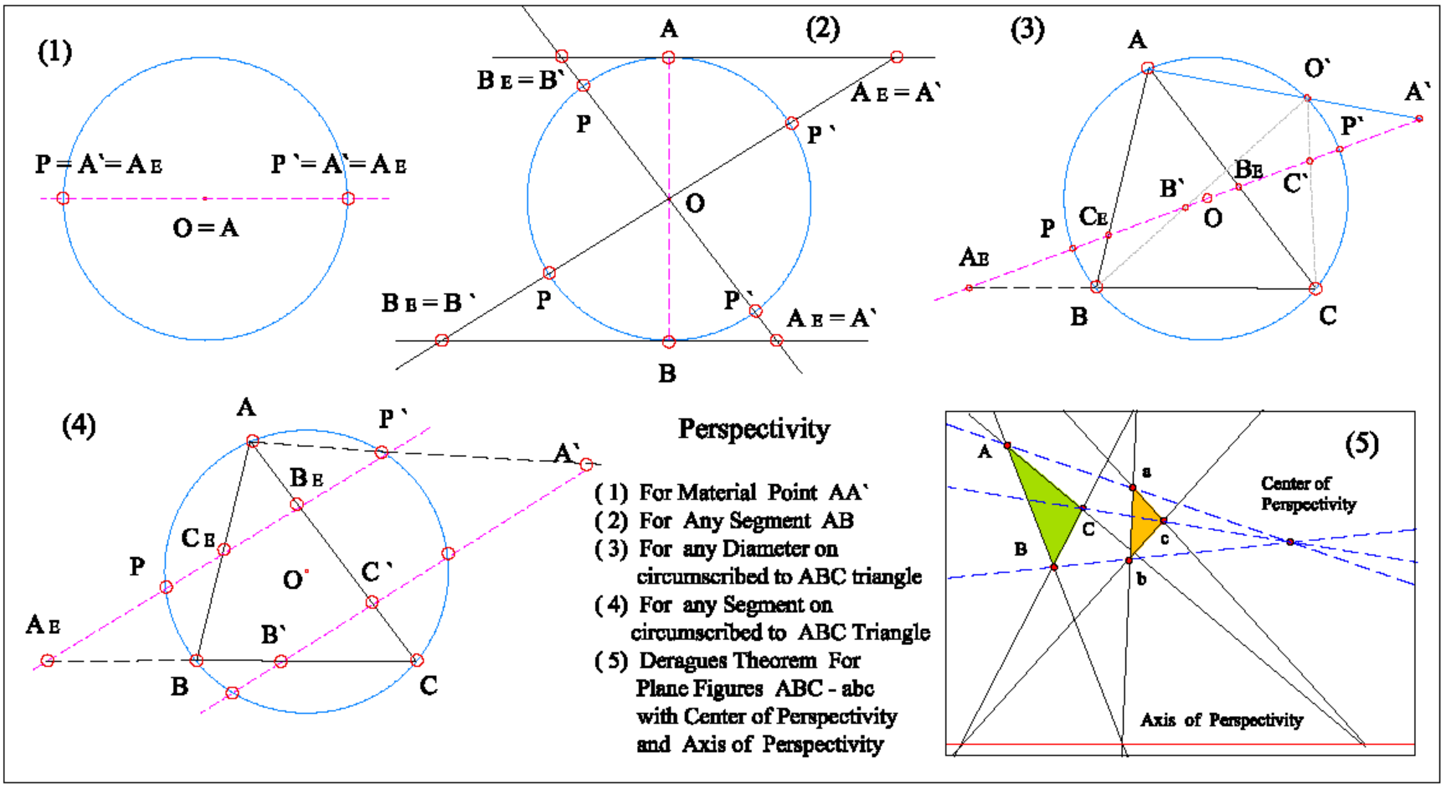


Figure.3.. Pole and Axis of Perspectivity for Points , Sectors , Planes , Volumes.
The two Perspective Desargues triangles ABC – abc with their Axis and Center of Perspectivity.

2.1. Perspectivity :

Projective in geometry has to do with Points , Lines , Planes and Spaces embedded in Euclidean geometry as in Fig.3.

In (1) Perspective Points P , P` lie on line PP` which is monad AA` , and where O is their middle point of this material point AA`.

In (2) Perspective Points P , P` lie on the circumference of the circumscribed sphere of Plane ABO through AB axis , where O is the common circumcenter of Segment AB.

In (3) Perspective Points P , P` lie on the Diameter of the circumscribed circle in Plane ABC , where O is the circumcenter of triangle ABC and O` is the concurrent point on circle .

In (4) Perspective Points P , P` lie on any segment of circumscribed circle in ABC Plane , with O as center and parallel to conjugate A`B`.

In (5) Perspective Points P , P` lie on the Axis of Perspectivity of the Planes of circumscribed circles of Planes ABC , abc being centrally perspective.

*Projective geometry , (**Desargues` theorem**) , declares that , two triangles ABC , abc are in perspective axially , if and only if they are in perspective centrally .*

We will show that , ***Perspective and Projective Geometry*** is embedded and it is an **Extrema** in Euclidean geometry.

Proof :

a.. In F3-(4) , Two points P , P′ on circumcircle of triangle ABC , form **Extrema** on line PP′. Symmetrical axis for the two points is the mid-perpendicular of PP′ which passes through the center O of the circle, *therefore* the Properties of axis PP′ are transferred on the Symmetrical axis in rapport with the center O (central symmetry) , *i.e.* the *three points of intersection* A_E , B_E , C_E *are Symmetrically placed as the other three points* A′ , B′ , C′ *on this Parallel axis .*

b.. In F3-(3) points P , P′ **are on any diameter** of the circumcircle , and then line PP′ coincides with the parallel axis , the points A′ , B′ , C′ are Symmetric in rapport with center O and *the Perspective lines AA′ , BB′ , CC′ are concurrent in a point O′ situated on the circle .*

When in F3-(5) , a pair of lines of the two triangles (ABC , abc,) are parallel , then extrema case is when their point of intersection recedes to infinity ,and axis PP′ passes through the circumcenters of the two triangles , (Maxima) and is not needed “ ***to complete*** *“ the Euclidean plane to a projective plane .i.e.*

Perspective lines of two Symmetric triangles in a circle are concurrent in a point , on the diameters and through the vertices of the corresponding triangles .

c.. *When all pairs of lines of two triangles are parallel* , the equal triangles , *then points of intersection recede to infinity , and axis PP` passes through the circumcenters of the two triangles* (*The Extrema case*).

d.. *When the second triangle is a point* ***P*** *then axis PP′ passes through the circumcenter of the triangle .*

From above is shown that *Perspectivity* exists between any triangle ABC , a line PP′ and a center O , where then exists Extrema for each Point , Line , Plane , Space etc. i.e.

Perspectivity on a Plane is transferred on lines and from lines to Points . This is the compact logic into Euclidean geometry , which holds in Extrema Points , and thus *Projective and Perspective - Geometry* ***is an Extrema in Euclidean–Geometry in all levels without controversy or contradiction .***

Mathematical interpretation and all the relative Philosophical reflections based on the Non - Euclid geometry theories , must be properly revised and resettled in the truth one.

For conceiving alterations from Point to sectors *discrete* , lines , plane and volume is needed Extrema knowledge where there happen the inner transformations on geometry and the external transformations of Physical world .

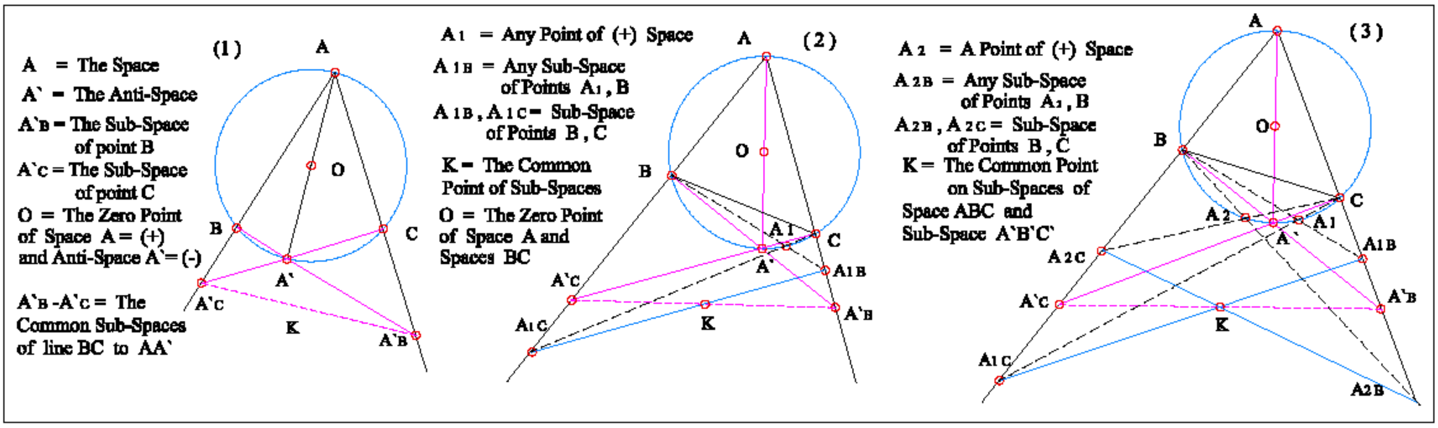


Figure.4.. The Coexistance of Space ABC and Anti-space A` , B` , C` in a Plane .
The Spaces , Anti-Spaces of One Point is A↔A` , of Two Points B,C ↔ $A`_B$,$A`_C$ , of Three Points ABC , *the Plane* , is ABC ↔ A` , $A`_B$ , $A`_C$,and are the Extrema points on any circumcircle in triangle ABC .
Discrete , on Geometry happens in all levels and Primary in STPL as shown below.

2.2. The Extrema Euclidean Geometry :

1.. In Figure .4. Extrema of a point A is point A` on Straight line AA` and the middle point of segment AA` is point O with equal distance OA = OA` . From point O is drawn the only one circle (O,OA=OB)

on which exist infinite points forming any triangle ABC in the circle of this diameter AA′ .
Point A represents the Space and point A\` the Opposite Anti-space .
In E-geometry the two points ***equilibrium because of equal distances*** **OA , OA\`** from midpoint O while in Material-Geometry ***equilibrium because of equal Forces*** $\mathbf{P_A}$ , $\mathbf{P_{A`}}$ at end points A , A\` , from midpoint O . i.e. it is Dipole =[⊕⊖]=∅=AB .

Is shown also the relation between point **A\`** which is the Anti-space , with the three points A,B,C representing the Space-Plane .

Lines CA′, BA′ produced , intersect lines AB , AC at points $A`_C$ , $A`_B$ respectively .
Points $A`_C$ , $A`_B$ represent the Sub-space of , Space , Anti space A↔A\`.
A1 is any point on the circle between the points B , A′.
CA1 , BA1 produced intersect lines AB , AC at points A_{1C} , A_{1B} respectively.
Show that lines A_{1C} , A_{1B} are concurrent at the circumcenter K of the triangles $CA_{1C}A_{1B}$, $BA`_BA`_C$.

Proof :

Since angle $< ACA`_C = 90^\circ$ so angle $< A`CA`_B = 90^\circ$ also , therefore the circumcenter of triangle $CA`_CA`_B$ is point K , the middle point of diameter $A`_CA`_B$. Fig.4 -(2)
Considering angle $< A`_CCA`_B = 90^\circ$ as constant then all circles passing through points C , $A`_C$ , $A`_B$ have common radius KC .
Considering angle $< A`_CBA`_B = 90^\circ$ as constant then all circles passing through points B , $A`_C$ , $A`_B$ have their center on $A`_C A`_B$ line .

Considering both angles $< A`_CBA`_B = A`_CCA`_B = 90^\circ$ then lines $BA`_C$ , $CA`_B$ produced meet lines $AA`_C$ , $AA`_B$ at points A_{1C} , A_{1B} such that line $A_{1C} A_{1B}$ passes through point K which is (*the common to* $A_{1C} A_{1B}$, $A`_CA`_B$ *segments*) and when angle $< BAC = 0$ as extrema case then point K , coincides with Anti-space point A\` which are both on the circle ,

i.e. From all contrary cases ,

In an angle < BAC of triangle , ABC , exists a constant point K , such that all lines passing through this point intersect sides AB , AC at points $\mathbf{A_{1C}}$, $\mathbf{A_{1B}}$ ***so that internal lines*** $\mathbf{A_{1C}\ A_{1B}}$ ***concurrence on the circumcircle of triangle ABC and in Extrema case ,*** angle < BAC = 0 , ***this point becomes the Anti-point*** **A\`** ≡ $\mathbf{A_E}$ ***where then lies on line AK becoming the*** $\mathbf{AK_A}$ **sector .**
The case of an angle < A equal to 180° is next examined in *Fig.3* ***, as the general extrema cases in a Plane triangle .***

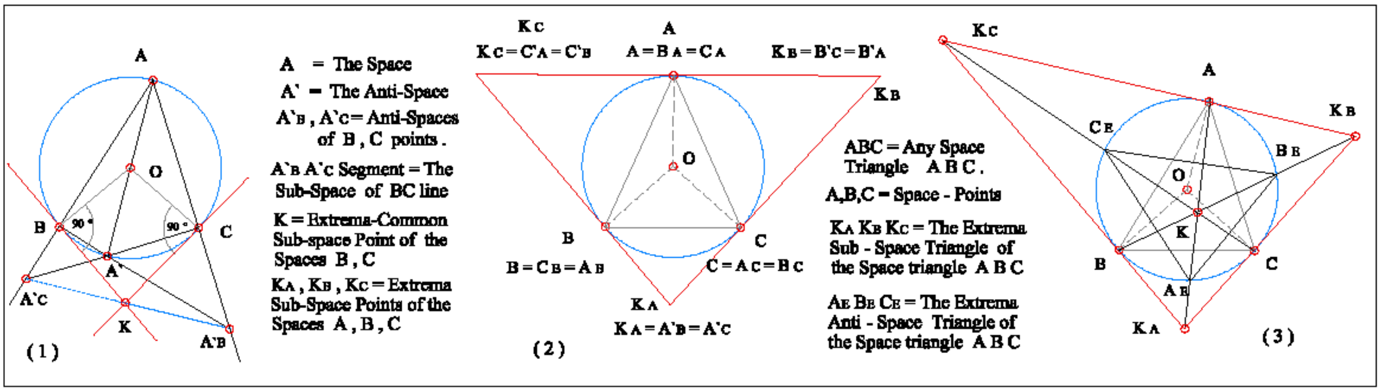


Figure.5.. In (1) Concurrency points in and out of any circumcircle of triangle ABC .
In (2) The Extrema Concurrency points of vertices of any triangle ABC .
In (3) The Extrema Sub-Space and Anti-Space of any Space Plane-triangle ABC.

2.. In Figure .5. Extrema of the circumcircle triangle ABC on its vertices :

In (1) , When any point A_1 coincides with point B (Superposition of points A_1 , B) , then line B A_1 is the tangent at point B , *extrema* , where then angle < OBK = 90° .
When any point A_1 coincides with point C , (Superposition of points A1 , C) then line CA_1 becomes the tangent at point C , where then angle < OCK = 90° .

Following the above logic for the three angles $\widehat{BAC}$, $\widehat{ABC}$, $\widehat{ACB}$, then ,

K_AB , K_AC are tangents at points B and C and angles < $OBK_A = OCK_A = 90$ °.

K_BC ,K_BA are tangents at points C and A and angle < $OCK_B = OAK_B = 90°$.

K_CA , K_CB are tangents at points A and B and angle < $OAK_C = OBK_C = 90°$. F.3-(2)
Since at points A , B , C of the circumcircle exists only one tangent then ,
The sum of angles $OCK_A + OCK_B = 180°$ therefore points K_A , C , K_B are on line K_AK_B .
The sum of angles $OAK_B + OAK_C = 180°$ therefore points K_B , A , K_C are on line K_BK_C .
The sum of angles $OBK_C + OBK_A = 180°$ therefore points K_C , B , K_A are on line K_AK_C

i.e.

The circle (O , OA = OB = OC) is the inscribed in triangle $K_AK_BK_C$ **and the circumscribed on triangle** ABC **.**

In all Plane levels of Euclidean Geometry , the Space points A , B , C , the Anti-Space points [A`, B`, C`] ≡ [A_E , B_E , C_E] , and Sub-Space points K_A , K_B , K_C lie on the Circumscribed circle and Circumscribed to ABC triangle and it is the Extrema of it , to its vertices .
This coexistence of the three Spaces in One , is the main property of Spaces , and the Stabilizer into this Mechanism , is the Work ≡ Energy as Glue-Bond between them . [58]

Theorem *: On any triangle* **ABC** *and the circumcircle exists one inscribed triangle* $A_EB_EC_E$ *and another one circumscribed* ***Extrema*** **triangle** $K_AK_BK_C$ *such that the* ***Six*** *points of intersection of the six pairs of* ***triple lines*** *are collinear* → (6+6+6) = 18 . Fig.5 –(3)

The six-triple points-line [STPL] is line → of Points D_A ,D_B ,D_C - P_A ,P_B ,P_C where ,
Triangle **ABC** → is the Space Triangle ,
Triangle $\mathbf{A_EB_EC_E}$ → is the Anti-Space Triangle ,
Triangle $\mathbf{K_AK_BK_C}$ → is the Sub-Space Plane Triangle .

Proof : Fig.4 - Fig.5. (3) - Fig.6.

Let ABC be any triangle (The Space) , the K_A , K_B , K_C are the points of intersection of tangents at A,B,C points of circumcircle (The Sub-Space) , A_E , B_E, C_E be the points of intersection of lines AK_A , BK_B ,CK_C and the circumcircle (The Anti-space) respectively .

1.. When points A_1 , A coincide , then internal lines CB_1 , BC_1 coincide with sides CA , BA , so line K_AA is constant . Since point A_E is on Extrema line AK_A then lines C_EB , B_EC concurrent on line AK_A . The same for tangent lines K_AK_B , K_AK_C of angle < $K_BK_AK_C$.

2.. When points A_1 , B coincide , then internal lines CA_1 , AC_1 coincide with sides CB , AB , so line K_BB is constant . Since point B_E is on Extrema line BK_B then lines A_EC , C_EA concurrent on line BK_B . The same for tangent lines K_BK_C , K_BK_A of angle < $K_C K_B K_A$.

3.. When points A_1 , C coincide , then internal lines AA_1, BA_1 coincide with sides CA , CB , so line K_CC is constant . Since point C_E is on Extrema line CK_C then lines B_EA , A_EB concurrent on line CK_C . The same for tangent lines $K_C K_A$, $K_C K_B$ of angle < $K_A K_C K_B$, i.e.

Triangles* ABC , $\mathbf{A_EB_EC_E}$, $\mathbf{K_AK_BK_C}$ *are Perspective between them ,

and consequently between the Spaces.

Since Triangles ABC , $A_EB_EC_E$ are Perspective between them , therefore the pairs of Perspective lines [AA_E, BC_E,CB_E] , [BB_E , CA_E , AC_E] , [CC_E , AB_E , BA_E] are concurrent in points P_A , P_B , P_C , respectively .
Since Triangles ABC , $K_A K_B K_C$ are Perspective between them , therefore the pairs of Perspective lines [K_BA , CB , C_EB_E] , [K_AB , AC , A_EC_E] , [K_BC , BA , B_EA_E] , are concurrent in points D_A ,D_B , D_C respectively .
Since lines (K_AK_B , $K_B K_C$, K_CK_A) are Extrema (tangents to circumcircle) for both triangles ABC and $A_EB_EC_E$, of sides (BC , B_EC_E) , (AB , A_EB_E) , (AC , A_EC_E) , then , the points of intersection of these lines lie on the same line . i.e.

This compact logic of the points [A , B , C] , [A_E, B_E, C_E] , [K_A, K_B , K_C] when is applied on the three lines (K_AK_B , $K_B K_C$, K_CK_A) then the SIX pairs of the corresponding lines which extended are concurrent at points P_A , P_B , P_C ***for the triple pairs of lines (Pascal`s Perspectivity of points in Euclidean geometry) , [AA_E, BB_E, CC_E] , [BB_E, CA_E, AC_E] , [CC_E, AB_E, BA_E] and at Points*** D_A , D_B , D_C ***for the triple pairs of lines [$K_B K_C$, BC , B_EC_E] , [K_AK_C , AC, A_EC_E] and [K_AK_B , AB , A_EB_E] , (Desargues`s Perspectivity of points in Euclidean geometry) and all the 18 common points lie on a straight line the → STPL Mechanism*** .

As proved **,** Straight line AA_E is continuous in ,ds, with ds = 0 as points of filling , and also discontinuous (*discrete*) with the dimensional Units , ds ≠ 0 , defining the Space , Anti-space at A ,A_E points and Sub-space at K_A , where , *ds = quantum* = AA_E/ n , (where n = 1,2,3 → ∞ , = [a+b.i] /n = complex number *and Infinitively divisible which is keeping the conservation of Properties at End Points* A , A_E) as filling , ***and continuous with points as filling*** *(and for n = ∞ then ds = 0 i.e. the ∞ Positions of points in ds)* . On line AA_E exists Euler-Savary mechanism for Couple-Curves.

2.3. Remarks on The Physical meaning of the Geometrical Properties.

The [STPL] ≡ Six Triple Points Line Mechanism.

The Geometrical mould on Physical world :

1.. [STPL] is a ***Geometrical Mechanism*** that produces and composite all opposite Space Points from Spaces (The three characteristic points A-B-C forming a Plane) , Anti-Spaces (The corresponding points $A_EB_EC_E$ of opposite direction through the Zero space) and the Sub-Spaces (The Zero Plane points K_A , K_B , K_C is similar to Positive axis which passes from Zero in order to pass to the opposite Negative axis) in a Common Circle , *Sub-Space* , line or a cylinder .

2.. Points A,B,C and lines AB , AC, BC of ***Space , communicate with*** the Extrema corresponding A_EB_E , A_EC_E , B_EC_E , of ***Anti-Space*** , separately or together with bands of three lines at points P_A , P_B , P_C , and with bands of four lines at points D_A , D_B , D_C , ***on common circumscribed circle*** (O , OA) , ***consisting the Sub-Space***. [17]

3.. If any monad AB (*quaternion or Vector*) , [s , $\bar{v}$.∇i] , *all or parts of it* , somewhere exists at points A,B,C or at segments AA_E , BB_E ,CC_E then [STPL] line or lines , is the Geometrical expression of the Action of the External triangle , $K_A K_B K_C$, *the tangents as extrema is the Subspace* , on the two Extreme triangles ABC and A_E , B_E, C_E (*of Space Anti-Space*) creating 1,3,5, spin , *the minimum Energy - Quanta* .(this is the How Opposites combine and produce the Material-Neutral-Points) . [29]

When the ***monad*** (quaternion with real part = s = 2r and Imaginary part $\bar{v}$ =∇i = $\overline{\Lambda}$ = Ω = m.v.r) is in the recovery equilibrium (*a surface of a cylinder with 2r diameter*) , and because velocity vector is on the circumference , then the two quaternion elements identify with points A,B,C (of the extreme triangles ABC of Space ABC) and Imaginary part with points A_E , B_E, C_E (of the extreme triangles $A_EB_EC_E$ (of Anti-Space) , on the same circumference of the prior formulation and are rotated with the same angular velocity vector $\bar{\mathbf{w}}$ = 2πf .

The inversely directionally is the rotated Energy $\pm\ \overline{\Lambda}$ and equilibrium into the common circle , so Spaces and Anti-Spaces meet in this circle which is the common Sub-space . Extreme Spaces (the Extreme triangles ABC) meet Anti-Spaces (the Extreme tangential triangles $A_E B_E C_E$) , through the only Gateway which is the center O of the Plane Geometrical Formulation Mechanism (mould) of the [STPL] line . [43]

Since the origin of Space [S] *becomes, through the Principle of Virtual Displacements as ,* $W=\int_A^B Pds= 0$ *from Primary Point* A *which is the Space , to* A_E *which is the Anti-space as the Inner distance ,ds, of Space and Anti-Space in all Layers then , Distance* $ds = AA_E$ *is the Work embedded in monads and it is the what is eternally moving and eternally stationary , and because of the Principal stresses* $\pm\sigma$ *, is vibrated .*

Since also Work of the Inner Impulse distance of Space and Anti-Space is embedded in all material points of universe , stationary points , *a Torsional Oscillation* $\overline{\Lambda}$ *in STPL mechanism happens and thus a Natural Wave-Frequency* $\mathbf{f_m = w/2\pi}$ *is embedded in Material-Geometry , from which exist the Euler-Savary equations with the rotating and Rolling curves , and thus become the figures of Conchoide to Spirals and all the others* . [58]

Point, which is nothing and has not any Position may be anywhere in Space , therefore , the Primary point A , being nothing also in no Space , is the only Point and nowhere , i.e. Primary Point is the only Space and from this all the others which have Position , therefore it is the only Space and so to exist point A at a second point B somewhere else , point A must move towards point B , where then $A \equiv B$.
Point B is the Primary Anti-Space which Equilibrium point A , [PNS] = [$A \equiv B$] .

The position of points in [PNS] creates the infinite dipole and all quantum quantities which acquire Potential difference and an Intrinsic moment $\pm\Lambda$ in the three Spatial dimensions (x , y , z) and on the infinite points of the (i) Layers at these points , which exist from the other Layers of Primary Space , Anti-Space and Sub-Space , and this is because Spaces = monads = quaternion [9] .
Again , since Primary point A , is the only Space then on this point exists the Principle of Virtual Displacements as $W = \int_A^B P.ds= 0$ or $[ds .(P_A + P_B)= 0]$, All points may exist with $P = 0 \rightarrow$ (PNS) and also with $P \neq 0 \rightarrow$ (Spaces) because , $(P_A + P_B=0)$ for all points in Spaces and Anti –Spaces , therefore [PNS] is self -created , and because at each point may exist also with force $P \neq 0$, then [PNS] is a (perfectly Homogenous , Isotropic and Elastic Medium , in spatial and Temporal domain) Field with infinite points which have a $\pm$ Charge with force $P = 0 \rightarrow P = \Lambda \rightarrow \infty$.
Work (W) is quantized on material-points as EM wave and spin $\pm(\overline{p})$ and from this , equilibrium and quantized angular momentum $\overline{\Lambda}$ which is independently of time and is capable of forming the Wave nature of Spaces , following the Boolean logic and distorting momentum $\overline{p}=\overline{\Lambda}$, as energy , on the intrinsic orientation position of points , on all points of the microscopic and the macroscopic homogeneity.
Since also in common circle rotational velocity ,$\overline{w}$, and momentum , $\overline{\Lambda}$, are constants , and because of these the constant velocity ,c, is created , so thus it consist a Pure quaternion which is the cause of their Inner motion , (This is the Electromagnetic wave which produces Spin) and of their Outer Spin (This is the screw helically Kinetic Energy wave Motion conjugation) .
Conjugation equation of the two constituents $\overline{w}$ and Λ , gives ,

$$(\partial/\partial t , \overline{w}) © (0 , \Lambda) = (- \Lambda , w x \Lambda) =$$
$$(- \overline{HxP}, \nabla x \Lambda) = [\lambda , \nabla \text{ x } \overline{\Lambda}] . [13\text{-}15] .$$

3.. The Material Geometry and Properties .

All above Geometric logic is simultaneously presented on Space , Anti-space and on the deep relation of the Material-Geometry and Physics , because by Considering $\rightarrow$ point A as the positive Space = $\oplus$, point A_E as the negative Anti-Space = $\ominus$, and point K_A as the Neutral = $\varnothing$ Space then , in Fig.7 ,

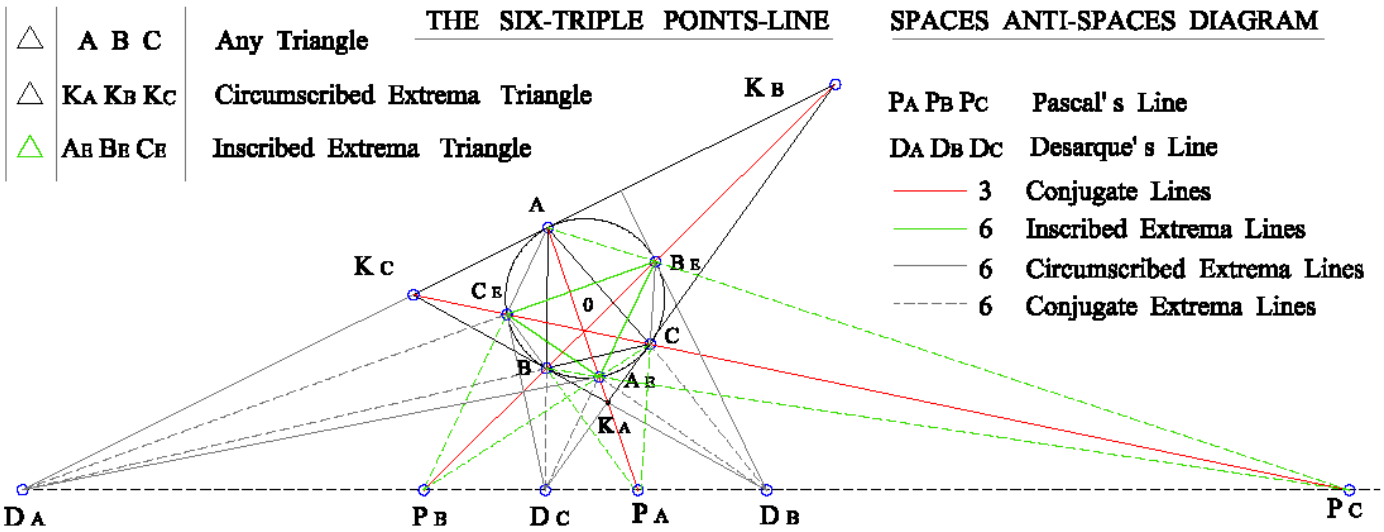


Figure.6.. *The Six , Triple Concurrency Points , Line* . [STPL] → D_A , D_B , D_C - P_A , P_B , P_C

[ABC ≡ The Space] , [A_E, B_E, C_E ≡ The Anti-Space] , [K_A, K_B , K_C ≡ The Sub-Space]

The Space ABC , The Anti-Space A_E, B_E, C_E coincide in The Sub-Space K_A, K_B , K_C .

This Property of links ,constitutes the Instaneous rotation of , Plane Space , Anti-space , [For point A is the Rotation of Triangles OAD_A , OAA_E with velocity , $\bar{\nabla}$, on the circumference of circle (O,OA)] *with Instaneous centers of rotation* D_A , P_A *on STPL Line , where then equilibrium happens on* AK_A *straight line . Simultaneously Euler - Savary equation relates three directed quantities lying on the path normal* AK_A and reduces to having K_AA_E , K_AP_A *always laid off in the same sense along the line* AK_A, *and also the converse of Positions since inflection circle* (O,OA) *is the location of couples points whose curves have an infinite radius of curvature as in Figure 7. where angle* < AOA_E = 180˚. *Euler-Savary equation gives the radius and the center of curvature of this coupler curve between the Instaneous Rotation of , Space and Anti-space .*

In Figure. 7-8-9 , ***is shown the Lorentz factor*** $\gamma \equiv sec.\varphi$ **,** ***becoming from*** **STPL mechanism and** ***related to All known Particles , following the Conchoide of Nicomedes to*** **COSC .** [58]

Gravity force is exerted on breakages [± $(\overline{\boldsymbol{w}}.r)^2$ = Material points = Dipole of the two ± quantized energy-spaces $(\overline{\boldsymbol{w}}.r)^2$] as velocity vector , $\bar{\boldsymbol{c}}$, which is then decomposed into two reverse velocities following the cycloidal motion , and consisting the intrinsic Stationary Electro-magnetic Wave of gravity, and which is binding points of this Homogenous- Isotropic, Rest and mass-less nature Field.

The total dispersion Rotating energy of dipoles is [± $\overline{\boldsymbol{\Lambda}}$ $]^2 = [p.c]^2 + [\mathbf{m_o}.c^2]^2$, which is the known relativistic energy- momentum equation of Lorentz transformation equations.

It has been shown [16] that Projective and Perspective geometry are Extrema in Euclidean geometry into [STPL] line , their boundaries becoming from common Space and Anti-space. Energy , *Motion*, follows this Euclidean moulds, because this Proposition , *Principl*e, belongs to geometry, and not to Energy which is only motion.

In [33-36] The Un-clashed Fragments through center O, consist the Medium-Field , and Material-Fragment → [± s^2] = [MFMF] is the Base for all motions, and Gravity as force [∇i] , while

the clashed with the constant velocity ,$\bar{c}$, consist the Dark matter [± $\bar{c}$.s] and the Dark energy [$\bar{c}$.∇i] ,

or from → Breakages [± s^2 = ± $(wr)^2$] and [∇i = $2(wr)^2$] where then become Waves { *Distance* ds=AA_E *is the Work embedded in monads and it is what is vibrated }* with Vibrating equations of motion becoming as

A → Particles, with Inherent Vibration ,

B → Gravity-Field-Energy, without Vibration

C → Dark-Matter-Energy constituents as,

A.. [$\pm\bar{v}.s^2$] → Fermions and [$\bar{v}.\nabla i$] → Bosons,

B.. [$\pm s^2$] → [MFMF] Field, and the binder Field , which is [∇i] → the Gravity force ,

C.. [$\pm\bar{c}.s^2$] → Dark matter , and the binder Gravity force [∇i] , [$\bar{c}.\nabla i$] → The Expanding Dark Energy.

From above is seen that in* , A , *and* , C , *case Energy as velocity* , $\bar{v}$, *exists in the Discrete monads* , $\pm\bar{v}.s^2$ *and* $\pm\bar{c}.s^2$. *Case* , *C* , *declares that → Antimatter-Galaxies and Antimatter – Asteroids can exist only as Dark-matter or and Dark-Energy and not as Antimatter light , **- c** .

B *case* , *is the transportation of Energy from Chaos* [PNS] , *to the Material points being* , *Linearly* [$+s^2 \leftrightarrow - s^2$] , [$\oplus s^2 \leftrightarrow \ominus s^2$] *or Rotationally* [$\oplus s^2$ ↻↺ $\ominus s^2$] as *shown* .

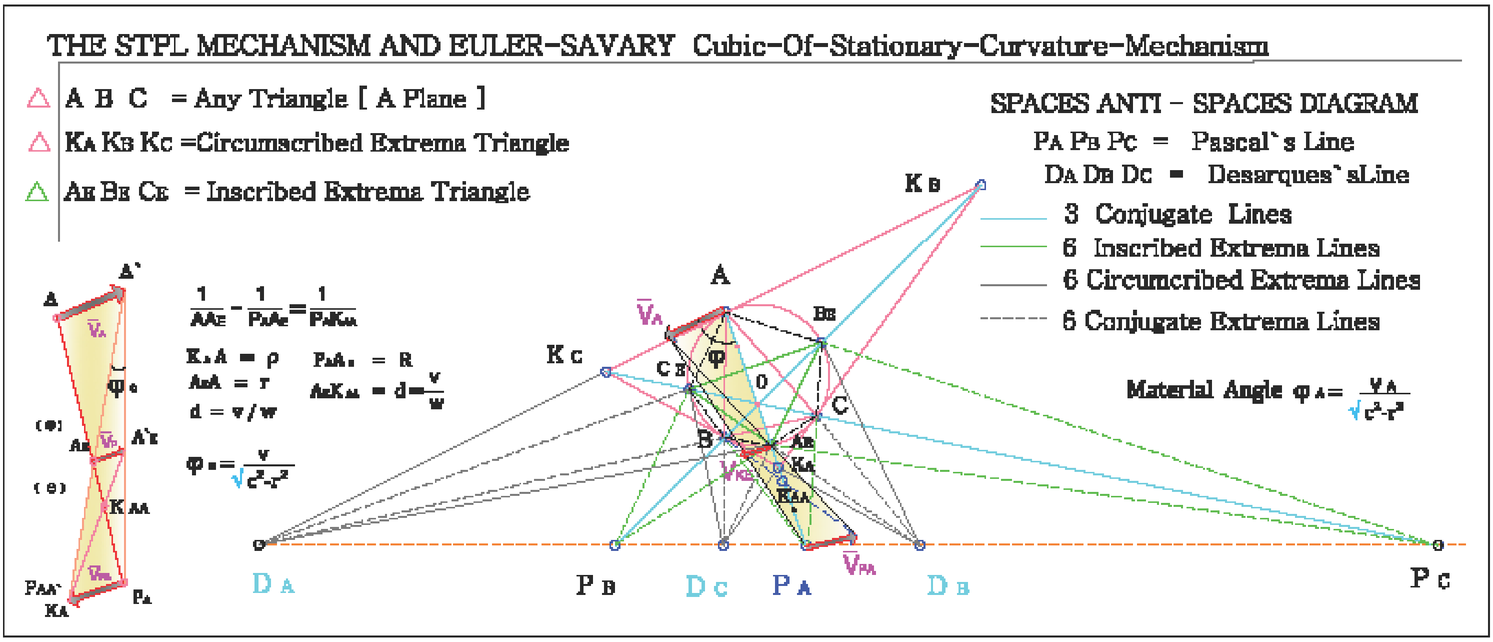
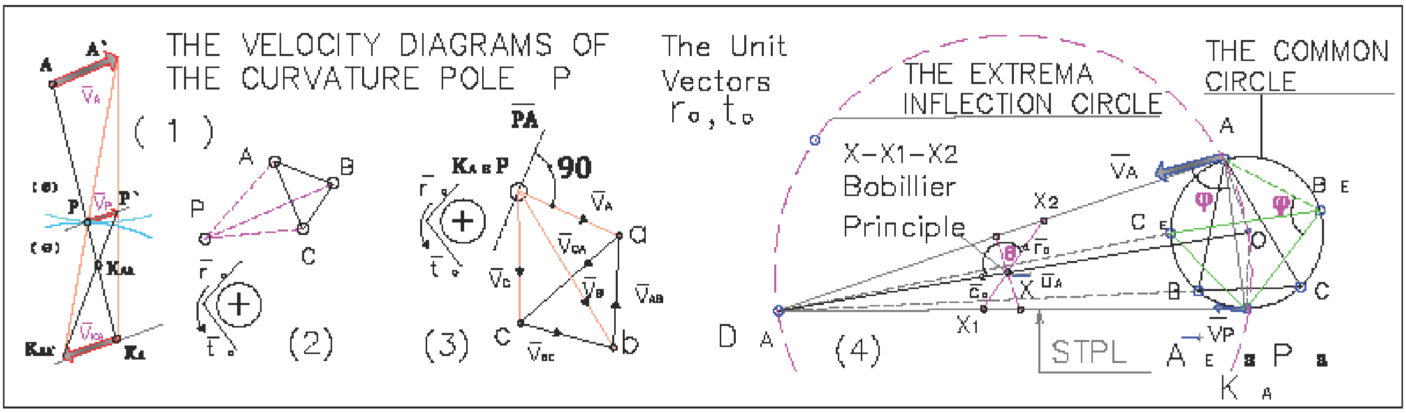


Figure.7.. ABC is any triangle (The Space) , $K_AK_BK_C$ triangle is the (The Sub-Space) , $A_EB_EC_E$ triangle is (The Anti-space) respectively . The Instaneous Pole **P** ≡ A_E of rotation is off the circle on AA_E axis .Inscribed to ABC circle is Common circle of STPL-{D_A-P_A} mechanism *The Reference System* {D_A- P_A}≡[R] (x',y',z', t') *moves with velocity* ,$\bar{v}$, *parallel to* , x-x', *axis with respect to the fixed and Absolute System* {D_A- O} ≡ [S](x,y,z, t) **.** *The* Space point , A , moving on (p) curve , and Anti-Space point A_E moving on (ε) curve are rolling on the same Sub-space circle (O,OA) ≡ (O,OA_E) which is the common cave-circles of Material Geometry in STPL - {D_A-P_A} mechanism .

3.1. The Instaneous Pole P ≡ A_E of rotation , on the Inflection-circle of Plane AD_AA_E of STPL



The How Energy from Chaos Becomes Discrete - Monads and Spin

Figure.8.. ABC ,is any triangle (The Space) , $K_A K_B K_C$ triangle is the (Sub-Space) , $A_E B_E C_E$ triangle is the(Anti-space) respectively. The Instaneous Pole **P** of rotation coincides with the Anti-space point A_E on the circumscribed to ABC circle .

The Velocity diagrams for the Instaneous Pole **P** of rotation in STPL≡ [O,ABC]-{ D_A-P_A} mechanism , on the inflection circle of the Plane points A , B , C .

In (1) point K_{AA} is the velocity instaneous center for point A , in S_o system .
In (2) point P is the Pole of rotation for points A , B , C .
In (3) Figure is the Velocity Diagram P – a ,b, c for points A , B , C
In (4) When STPL is Tangential to (O,OA) circle then the two circles , *The common-circle and Inflection circle* , cut on AP chord which is common to Velocities , and the Accelerations of points A , P , coincide with D_A , P_A Desargues and Pascal`s points . On triangle $AD_A A_E$, Material lines $X_1 XX_2$, formulate all referred curves . Any rotation in three dimensions can be represented as a combination of a vector $\bar{\mathbf{v}}_A$ and of a scalar angle ,φ, on AA_E≡AP axis which is the *Euler rotation theorem-axis* . [58]

3.2. The Angular Momentum of any Material point in STPL mechanism .

From Physics momentum $p = m.v = m\,\frac{ds}{dt}$ …………(1) where →
mass = the reaction to the change of velocity → |v| = the instant velocity equal to ds/dt which is the change of displacement ds , where ds = *l* , and which is the Dipole =|[⊕⊖]|=∅=*l*=AB . [40]
Angular Momentum **L = *l* x p** = |*l*|.|p|.sin φ ……..(2) where →
angle φ = Angle subtended between direction of *l* and p , as in [41] and *l* = a position vector .
Differentiating (2) then is ,
$\frac{dL}{dt} = \frac{d\,l}{dt}$ x p + *l* x $\frac{dp}{dt}$ = vxp + *l* x F = $\frac{pxp}{m}$ + *l* x F = 0 / m + *l* x F = *l* x F = J . $\bar{a}$ ……...(3) , where J = moment of Inertia , $\bar{a}$ = acceleration.
Since **p = m** x **v** , and which is a Torque acting on the particle about its axis through *l* , or
$\frac{dL}{dt}$ = *l* x F → is a Torque also , i.e. ***It is the Linear momentum .***
Remark : $\frac{dL}{dt}$ = *l* x F = Torque → which suggests that , equation (3) is the ***Extrema case between , the Linear and Angular Momentum*** , where then for instaneous velocity v = w.r , then L = m(w.r).*l*

i.e. Angular momentum is equal to the followings →

1.. To the reaction ,m, of the change of position vector ,*l*, through material point axis AB .
2.. To the Intrinsic angular velocity ,w, of the material Point as a cave of radius , r .
3.. To circular orbit of radius ,r, of material point.
4.. The length |*l*| of the position vector which is the wavelength λ = 4π.r of the material point .

Since any Monad , (Unit) $\overrightarrow{AB}$= L , is the ENTITY and [A,B – P_A , P_B] is the LAW , so Entities are embodied with the Laws.
Since Entity is quaternion $\overrightarrow{AB}$, and law |AB| = length = the Real part which is the Space of points A , B then imaginary part (i) are the forces P_A,P_B or the fields in AB .
By definition i =√-m.1 and(-m1)² = -1m i.e.
[Energy]² = - [Space] = Anti-space and since also exists Λ x Λ = - (- m.1) ² = ± Λ.∇i , the basic equation of quaternion becomes [-(ΛxΛ)/m ± Λx∇i] = [λ , ± Λx∇i]
i.e. wavelength λ = - (ΛxΛ)/m where m = a constnant depending on the reactions to the present or other conditions . Applying this in energy cavities then wavelength , λ , becomes ,

$$\lambda = e^{-i[\left(\frac{\pi}{2}\right)b]^2} = e^{-i[\left(\frac{2\pi}{2}\right).b]} = e^{-i[(\pi).b} \rightarrow \text{i.e.}$$

The Massive mechanism Diffraction and the Energy mechanism Diffraction , *The Quanta* , are Interchangable as , $e^{-i.(1{,}78.10{-}7)^2} = e^{-i.(3{,}56.10^{-}14)}$ and for Relativity massive Energy
(ΛxΛ) = (- m.i) x (- m.i) = m (i)² = - m .($\bar{v}$)^2 = - m..$\bar{v}^2$, where imaginary part , i = $\bar{v}$, i.e.

The Space aquires Energy as Velocity and becomes an Energy-monad .

Applying quaternion equation [-∇Λ ,∇xΛ] = 0 for point ,O, and constant velocity , $\bar{c}$, then [-∇c ,∇xc] = 0 where [-∇c] ⊥ [∇xc] meaning that it is a mechanism that instantly transports breakage masses in two directions dynamically and perpendicularly to all Inertial frames Layers .

From Velocity-Energy vector are produced the three breakages [$\pm s^2 = \pm (wr)^2$] and [$\nabla i = 2(wr)^2$] and from them Fermion and Bosons . [26]

3.3. The Absolute and Relative Motion .

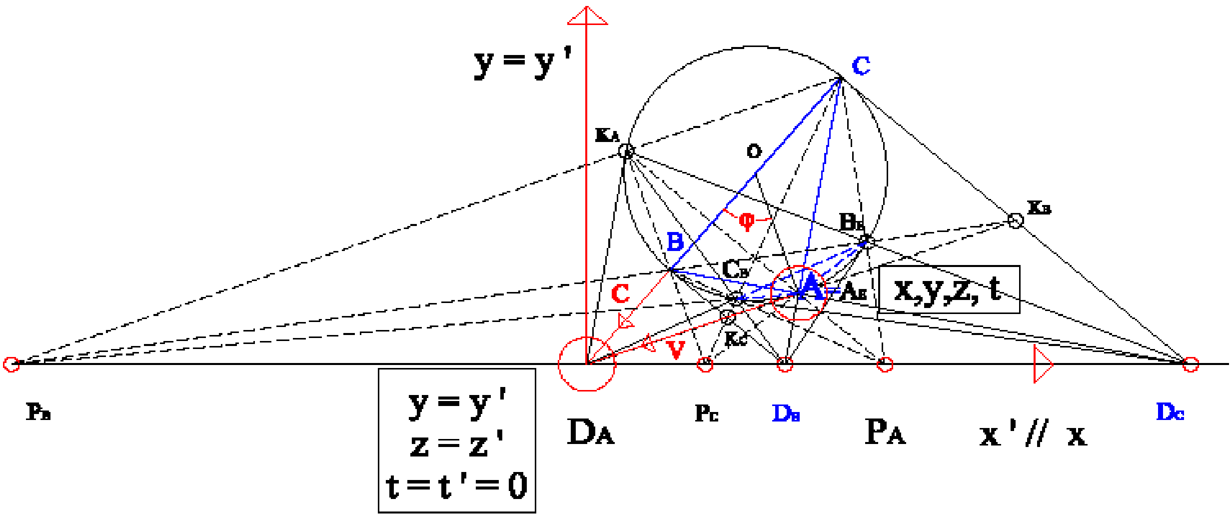


Figure.9.. ABC is any Right-angled triangle at A (The Space) ,$K_A K_B K_C$ triangle is the (Sub-Space), $A_E B_E C_E$ triangle is the(Anti-space) respectively. The Instaneous Pole **P** of rotation is off the Circle of diameter BC . The Poles of rotation lie on {D_A- P_A} Reference system.

Reference System {D_A- P_A}≡[R] (x',y',z', t') *moves with velocity ,$\bar{v}$, parallel to ,* x-x', *axis with respect to the fixed and Absolute System* {D_A- O} ≡ [S](x,y,z, t) .

The Geometrical expression of Lorentz factor ,γ, is as **sec φ** = γ = O**D**$_A$: A**D**$_A$ = ± 1 / [$\sqrt{1-(v/c)^2}$] and which is the Conchoide of Nicomedes , { s = a + b. sec φ } ,

and which acquires the material Angle $\varphi = \frac{v}{\sqrt{c^2-r^2}}$

The Relative Motion.

Because Properties In and On [STPL] line , are relative to the only one Equilibrium and Absolute system

$\pm\Lambda = r.m\bar{v} = r.m.\bar{w}.r = mr^2.\bar{w}$, so exists that what is called Relativity .

As Absolute System let it be [**S**] ≡ {D_A-O} ≡ STPL mechanism , and as

the Relative (Reference, Affine) System, [**R**] ≡ {D_A-P_A} . Fig - 9

The Relative motion [**S**] ≡{D_A-O} , [**R**] ≡{D_A-P_A} of the two above Systems :

It was shown , that in {D_A-O},(x,y,z, t) , System $\bar{c}$,$\bar{v}$, vectors are isochrones i.e. period T = L/V = 2πR/V = $2\pi/[c/r_c] = 2\pi/[v/r_c] \rightarrow c/r_c = v/r_v \rightarrow c.r_v = v.r_c$,where r_v , r_c are the radius of their intrinsic rolling circles . In F-7 , this relation is Geometrically expressed as →

sec φ = O D_A **:** A D_A = **γ** = **± 1/ [$\sqrt{1-(v/c)^2}$]** = **c / [$\sqrt{c^2 - v^2}$]** , and it is

a geometrical Cycloid property equal to Lorentz`s ,γ, factor. Newton`s laws are true into Reference System [**R**] ≡ {D_A-P_A} by ,

Considering {D_A-O},(x,y,z, t) , as the fixed frame [**S**] of the coordinate system in the Gravity cave (d=2r) , and point A(x,y,z) is fixed on circle (O,OA) which is rotating with a velocity $\bar{v} = \bar{w}r$, and of angular velocity $\bar{w} = 2\pi/T = 2\pi f$, where period of rotation ,T, then is also constant .

Since acceleration ,a, for a quaternion $z = (s + \bar{v}.\nabla i)$ is $a = [d^2z/dt^2] = (ds/dt.\bar{v}.\nabla i) + s.d(\bar{v}.\nabla i)/dt = 0 +$ $s.d(wr)/dt = 0 + 0$, *and this because* $\bar{w}$ *= constant for both* , therefore , velocity $\bar{v}$ = constant also **, i.e.** →

Centrifugal velocity of Absolute system* [S] *is any constant* , $\bar{c}$ *, and this because angular velocity* ,$\bar{w}$, *is constant also and thus , is not needed to accept apriori this constancy of velocity* $\bar{c} = 0 \rightarrow \bar{v} \rightarrow \infty$ *on circle* (O,OA) *to exist in frame , so

automatically *is defined the conversion factor t = time* , between the conventional time units (second) and length units (meter = $A.D_A$) or as $\bar{c}.\ r_v = \bar{v}.\ r_c$, → $\bar{c}$ (v)(T/2π) = $\bar{v}$(c)(T/2π) → $\bar{c}$(v)/w = $\bar{v}$(c)/w which is happening with the same ,**w**, without any restrictions , in contradiction to General Relativity which is an axiom apriori.

This is the why conversion factor , t = time , has not any essence in all universe , but it is a meter of changes only .

Because [STPL] line of the fixed frame is becoming from this system [S] , then this relative frame [R} is common to the fixed one (common D_A) and let it be [R](x',y',z', t') .

From figure Fig-7 , sinφ = ($\bar{v}/\bar{c}$) *meaning that the Relative system* , [R](x',y',z', t') , *(the Affine Frame) is the projection of Absolute Frame* [S] ≡ {D_A-O} - (x,y,z, t) *where exists as Simultaneity for all motions , i.e.*

[R] ≡ {D_A-A} ≡ [(x',y',z', t')] ,

[S] ≡ {D_A-O} ≡ (x,y,z, t) = [R] .γ ≡ (x',y',z', t')

Considering point D_A as the common center and [STPL] as the x-x axis of the two systems , then becomes D_A (x ,y=y ', z = z', t) and for all linear systems D_A (x', y'= y, z '= z , t') respectively .

This specific state of constancy , i.e., the Centrifugal velocity of Absolute system [S] to be a constant ,$\bar{c}$, and the rectilinear motion with respect to one another , defines the natural Inertial frames , and because of uniformity of Space and motion , therefore occupy the same meter of their changes , (i.e. the Time) .

Since also points O,A remove to point D_A isochrones by their intrinsic property motion , which is → their wavelengths are a Stationary wave in cycloid ← following Lorentz`s factor ,γ, then this following , happens also to all frames which make this motion , and so issues {D_A-O} = γ.{D_A-A} …....(2-0)
On this Relative system D_A(x', y'=y, z' = z , t`) are conveyed , the Breakages [± $(wr)^2$, $2(wr)^2$] of (O,OA) circle after the colliding with the rotating velocity $\bar{v} = \bar{w}.r$ of the [S] system , and are the fundamental particles , Fermions and Bosons, or by escaping consisting the Rest Field and Gravity , or Dark matter and Dark Energy , as analytically is shown . [39]

Remarks :

a.. Material point $A \equiv \pm |(\bar{w}.r)^2|$ of the Fixed System {D_A-O} travels with velocity $\bar{v}$ at point D_A , so geometrical distance $A.D_A$ in the Relative System [R] ≡ {D_A- P_A} is $A.D_A = x' + \bar{v}t'$, and because of the isochrones motion in the Fixed System [S] ≡ {D_A-O}, it is holding ,

$x = (x' + \bar{v}.t').\gamma$ or $x = (x' + \bar{v}.t')\gamma = [\,x' + \bar{v}.t'\,] / [\sqrt{1-(v/c)^2}]$ …. (2a)

Inversely, by using (2a) , where [S]≡{ D_A-A}≡ {D_A-O}/ γ , then if Material point A of the Fixed System{ D_A-O} travels with velocity $\bar{v}$ at point D_A , the geometrical distance AD_A in the Fixed System

[S] ≡ {D_A- O} is → $A.D_A = x - \bar{v}.t$ and in the Relative System ,

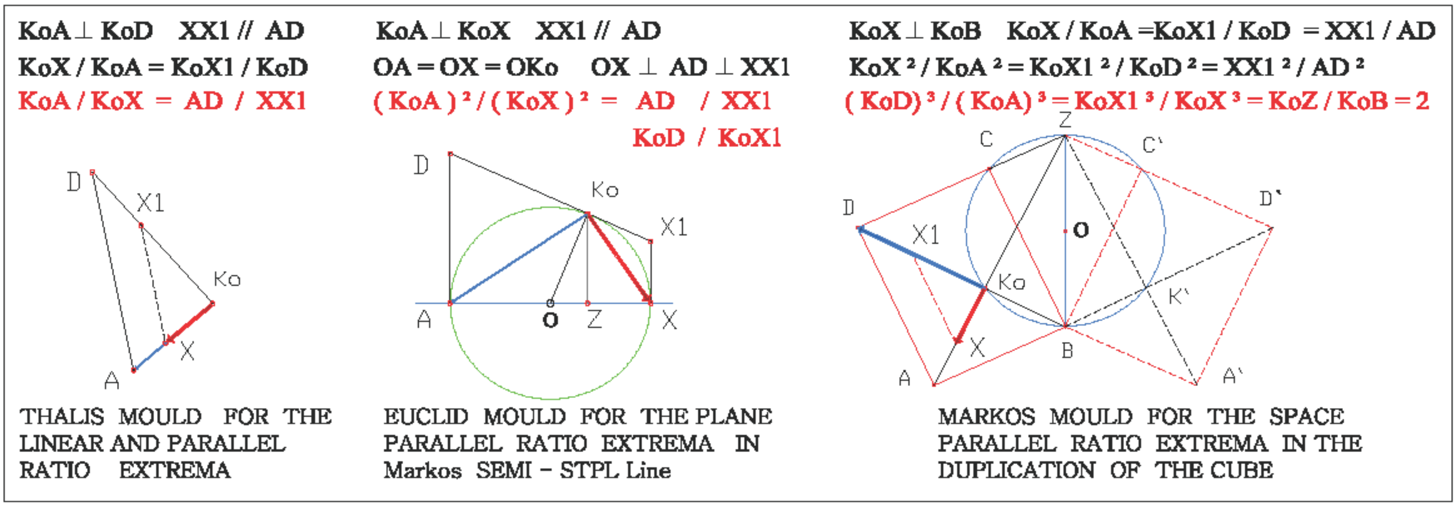
[R] ≡ { D_A- P_A} it is → $x' = (x-vt).\gamma = [x-vt] : [\sqrt{1-(v/c)^2}]$ …...(2b)

3.4. The *Quantization of E-Geometry and its moulds .*

It was shown in [58] that common-circle of radius , r_c , is the common source of vibration excitation for the Space , Anti-space , considered as rotating with constant angular velocity $\bar{w}$. The same also on all lines joining the Space , with Anti-space points , and the STPL line , and Particles acquire an Inherent Vibration , f , becoming from the material`s point property .

This vibration **,** the frequency ***,f, is the configuration of Conchoide of Nicomedes which is connecting the Glue-bond*** **, ±σ ,** ***of the Spaces*** **,** of this circular rotation **,** ***and Generally the changes on axis*** **,** $\overline{\mathrm{B}}$ ***, from the Instaneous circle of rotation of the Plane Space , and Anti-space*** **AA_E** ***through*** **, K_A ,** ***Neutral point*** **of the STPL mechanism.**

3.4.1 The Quantization Meter – Moulds



(1) (2) (3)

Figure.10.. The *Thales , Euclid , Markos Mould ,* *for the* ***Linear – Plane - Space*** , *Extrema Ratio , Meters .*

In (1) is the ***Linear - Ratio*** where , length K_oA *analogous* to monad K_oX is equal to AD / XX_1 following the Euclid`s parallels .

In (2) is the ***Squared - Ratio*** where , length K_oA *squared* to monad K_oX squared is equal to linear ratio AD / XX_1 following the Euclid`s parallels .

In (3) is the ***Cube - Ratio*** where , length K_oA *cub* to monad K_oX cube is equal to linear ratio K_oZ / K_oB following the Euclid`s parallels .

Quantization of E-geometry is the way of Points to become , *discrete* , as → (Segments , Anti-segments = Monads , Anti-monads) , (Segments ,Parallel-segments = Equal monads) , (Equal Segments and Perpendicular-segments ≡ The Plane Vectors) , (The Un-equal Segments twice-Perpendicular-segments ≡ The Space Vectors = Quaternion) . [15]

Monads and Segments being quaternion occupy Massive and Energy magnitudes called Meters . Since points A , B , C (of the extreme triangles ABC which denote the Space ABC) are in the recovery equilibrium with points A_E , B_E , C_E , (of the extreme triangles A_E B_E C_E which denote the Anti-Space) and meet also in the same common circle which is the Common Sub-space , therefore Energy between the two Spaces passes through Sub-space from Extreme Spaces (Extreme triangles ABC and Extrema Anti-triangle A_E B_E C_E in the Sub-triangle K_A K_B K_C meet in this circle which is the common to all spaces . i.e. common-circle of radius , r_c , is the common source of vibration excitation for the Space , Anti-space , considered as rotating with constant angular velocity **,w,** becoming from **, ± σ ..**

Since Space , Anti-space are on the same circle then their relative motion is the , Rolling of Space ABC on Anti-space A_E B_E C_E and since also this relative motion is applied on STPL line , then D_A , P_A , points are the corresponding linear links of vibrations and Poles of rotation . [58]

Anti-segments = Monads , Anti-monads) , (Segments ,Parallel-segments = Equal monads) , (Equal Segments and Perpendicular-segments ≡ The Plane Vectors) , (The Un-equal Segments twice-Perpendicular-segments ≡ The Space Vectors = Quaternion) . [1]

In [62B] was proved that , *By Scanning* Any Space-Monad KK_1 to a Space – Monad KK_2 of the points K , K_1 , K_2 on circle , the Work produced is conserved in a *Space - triangle* in the circle , and in one of equal area outside the circle , which is the *Anti-Space triangle* , meaning that , ***The above relation of this Plane Work ,*** *it is The Quantization of Geometry – Shapes into the Plane – Stores of Anti-Space* ***, consists the Unification of the*** *Geometry – monads* ***with those of*** *Energy monads* ***, and which were analyzed and have been fully described***

3.5. The Deduction of *Projective- Geometry* And *Perspectivity* in E-Geometry and further in *Material-Geometry*

Perspectivity and Projectivity of Points :

A.. For One point A perspective point A\`, lie on the straight line AA\` which Coincides to axis PP\` of Perspectivity . Since any Anti-point $A_E$ on Line PP\` lies also on the circle of radius AA\` , and since points P , P\` lie on the same circle therefore points A\` , P\` , A_E coincide with PP\` Axis of Perspectivity as this in Fig3-(1).

B.. For Two points A,B perspective points A\`,B\`, lie on the straight line A\`B\` which is Parallel to axis PP\` of Perspectivity . On Line PP\` lie the Anti-points A_E ,B_E which is the diameter *AOB of the circle* , and whose points P , P\` lie on the circle . The Infinite Axis PP\` of Perspectivity are Coinciding to Perspective lines of points A\`,B\` and are also Symmetrical to the center O as in Fig3-(3).

C.. For Three points A,B,C not coinciding , perspective points A\`,B\`,C\` lie on the straight line A\`B\`C\` which is Parallel to axis PP\` of Perspectivity . On Line PP\` lie the Anti-points A_E ,B_E ,C_E , which line PP\` is *Symmetrical to center O of the circumscribed to ABC triangle circle* , and whose points P , P\` lie on the circle . The Infinite Axis PP\` of Perspectivity are Parallel to Perspective lines of points A\`,B\`,C\` and also Symmetrical to center O as in Fig3-(3).

From above is seen that both Perspectivity and Projective - geometry are incorporated in Euclidean geometry and this because of the Anti-points of Material geometry .

Because the New logic , of Material Geometry responds to Physical reality , the consistent Systems of the Non - Euclidean geometries - have to decide the direction of the existing mathematical logic. This is the why conversion factor , t = time, has not any essence in all universe , but it is a meter of changes only .

Since Time in Theory of Relativity is the main substance of Space - Time , then must be a quantity which has magnitude and direction and must follow the vector addition $\vec{a}+\vec{b}=\overrightarrow{ab}$. Unlike , the time intervals follow the Algebraic addition for scalar quantities a +b = t .
Proper time is measured between two events in GR Space-time and it is the Lorentz scalar ,where there time , t , exists as a measure of changes in the velocity and distance vectors of an isochronous Vectors-racing .

3.6. Waves and the exponential form of Monads

Angular velocity $\overline{w}$, and rotational momentum , Λ , in a cave conjugate, and are represented as ,

$$\underline{(\partial/\partial t\ ,\ \overline{w})} \circledcirc (\ 0\ ,\ \Lambda\ ) = (\ -\underline{\Lambda}\ ,\ wx\Lambda\ ) \ = \\ (-\ \overline{H}x\overline{P},\nabla x\overline{\Lambda}) = \ [\ \lambda\ ,\nabla\ x\ \overline{\Lambda}\ ]. \ \ [13\text{-}15]\ .$$

Since points A , B of [PNS] coincide with the infinite Points , of the infinite Spaces , Anti-Spaces and Sub-Spaces of [PNS] and exists rotational energy ± Λ and since Motion may occur at all Bounded Sub - Spaces (±Λ , λ) , then this Relative motion is happening between all points belonging to [PNS] and to those points belonging to the other Sub-Spaces (A ≡ B) . The Infinite points in [PNS] form infinite Units (monads) $A_iB_i = d\bar{s}$, which equilibrium by the Primary Anti-Space by an Inner Impulse (P) at edges A , B where exists

$$P_iA + P_iB \neq 0 \text{ , and it is } \rightarrow \quad ds = 0 \rightarrow N \rightarrow \infty .$$

Monad , (Unit) $\bar{A}B$, Quaternion is the ENTITY and [A , B – $\bar{P}_A$, $\bar{P}_B$] ≡ Dipole = [⊕⊖] = ∅ = AB the LAW , the Material-point , so Entities are embodied with the Laws. Entity is quaternion $\bar{A}B$, and law |AB| = length = The Scalar and Real part which is the Space of points A,B and maybe any point A with its Pole B of rotation , and this since Space-curves are rolling on Anti-space curves , and Imaginary part the forces , $\bar{P}_A$, $\bar{P}_B$ or the Electromagnetic fields of AB . [58]

3.7. Cycloid → The Inner Isochronous motion of monads .

Isochronous motion of a point A , on cycloid happens in all Material-points , where the ,**y,** axis reach **x-x** axis at the same time , regardless of the height from which they begin. This property is used for breakages on Common-circle ***Before*** these reach STPL line isochrones. [31]
In quantum systems , the rotated energy **Λ = Ω** can be isolated as frequency (*in carbon monoxide molecule as integer multiples of 115 GHz = 115.*(10^9*Hz) = 1,15* .10^{11} *Hz = cycles / second and* $\lambda = 1{,}128.10^{-10}$ m) and then by using the formula for angular frequency related to Planck constant , **h** , then → Work ≡ W_d = (π/4). C_o .w. λ² = (π/4).1,6939.10^{34}.(2π) .1,15.10^{11}.1,4943.10^{-20} = **1,249 .10^{26} J** / 1,602.10^{-19} = **7,796. 10^{45} (eVs²/m²)** .
The Rotating Energy , Λ , is bounded (***flowing***) in the three Energy States say, k1 , k2 = the Plank Scale , and k3 as below ,

W=Λ.ds̄1= k2= **Λ . 10^{-35}** m = ET= √ [m.**v.Ē**²]² +[Λ.**v.**B +**Λ**x**v.B̄**]² = (π/4).**C**.w.λ² = (h/λ).λ= h = ET = **Λ. 10^{35}** m = k3 = Λ.ds̄3 = **W = Work**
i.e. The Work is embodied in the three regions k1 , k2 , k3 as the ***rotating Energy* Λ** .*s̄*
On dipoles $\bar{A}B$ = ds̄1, ds̄2 , ds̄3 in the Configuration of co variants **Λ , ds̄** , with constant $\mathbf{C_o}$ = 4.Λds̄/πwλ²) and ds̄ =10^{-35} m *to exist so simultaneously the Equation of Quaternion =* Space ds̄ = 10^{-35} m = z̄ = [s ± n̄.∇i] = [s ± n̄.i] = Work = Total Energy = ET = [Λ∇ +Λ x ∇] = [Λ.M +Λ x M] = √ [m.vĒ.²]² + [Λ.vB + Λx vB̄]² = √ [m.vĒ.²]²+S ² = √[m.v**Ē**²] +|√p1.vB1 |²+|√p2.vB2 |²+|√p3.vB3|² = $(\bar{z}_o)^w$ = (λ , Λ.∇i $)^w$ = $|\bar{z}_o|^w$. e^ [v̄wθ] = | $\bar{z}_o|^w$. e^ {[Λ̄ ∇i / √ Λ'Λ̄]. [ArcCos (**w**|λ|/2 |. √$\bar{z}_o$`.$\bar{z}_o$|] } ***is therefore of Wave motion and*** **w = 4.Wd / (π.C.λ²)** *with velocity* $\bar{v}$ of the Energy Ellipsoid in the two perpendicular curled fields **E = ∇. Λ** and **B = ∇ x Λ** . Both curled fields consist the quantized energy as the new monad , the curled fields .

***The Quantized Energy* ET ,** in the three quantized Regions **k1 , k2 , k3** as Monads ↺↻

with the length , **h** , boundaries are ,
k1 = [$\bar{A}B$] = Work = Energy = [PNS] , $\bar{z}_o$[**λ 1 , Λ**] with λ1 = 0 → 3,969.10^{-62} m
8,906 . 10^{-35} m and → k1→k2 = Co.λ2²wπ/4 = (h/2π)w = h.f = < 8,906. 10^{-35} m .
k2 = [$\bar{A}B$] = Work = Energy = [PNS] ,

[**λ2 , Λ**] = λ Λ = Rotational Energy = λ.(r̄.M.w.|r|) = Spin = Ω ≡ 8,906 . 10^{-35} m < **λ** < Planck Scale 1,78118. 10^{-7} m .
k3 = [$\bar{A}B$] = Work = Energy = [PNS] , [**λ3 , Λ**] with λ3 > = 1,78118. 10^{-7} m < ∞ .

3.8. The Flow Plan of the Space - Energy Universe .

(1). It was shown in [9 -18] what is Primary Neutral Space as well as Infinity [15] and rotational energy , Λ , in [22] , so

[PNS] → [A ,B – P $\bar{A}$, P $\bar{B}$] ≡ Work W = |ET | = [|Λ|.∇ + Λ x∇] → W = ∫ P.ds = 0 →

and **Time T= 0 is the Cause** ,because Primary **Point A** is nothing and ***is Quantized as*** →

Point B (where then is following the *Principle of Virtual Displacements as W =* ∫*P.ds = 0*) =

Force **x** Displacement = Energy **x** Space , *and according to the ancient Greek Philosopher* Anaximander → [**The non-existent (i.e Point A) , Exist when is Done , it occurs as (Point B)** = [Το μή Ον , Ον γίγνεσθαι] = [Τό τίποτα υπάρχει Όταν αυτό γίνεται] . [21]
The relative Range is Displacement |AB|

(2) → Space -Anti-space , **0 → k → Infinity .**

[PNS] → [|Λ|.∇ + Λ x∇] ≡ $\bar{\mathbf{z}}$ ≡
[λ , ± Λ x∇] ≡ $|\bar{z}_o|^{w}$. e^ { [$\bar{\Lambda}$ ∇I / √Λ'$\bar{\Lambda}$] . [Arc.Cos (w|λ|/2|. √$\bar{z}_o$`. $\bar{z}_o$|] } ,
which is the Beyond Gravity Forced- Field . [25]

(3) → No change of ds → **Time T = 0**

Cause is the moment Lever of Primary Forces and is Quantised as → Spin ≡
< is The Spin modelling of the microscopic description > . [19]
The relative Range is of Infinite Points in the Displacement |AB| , **Infinity .**

(4) [PNS] → [λ , ± Λ x∇] = zo = Λ = nRT/V(λ = C) → It is the Gas equation where →

No change of ds → **Time T = 0 .**
Cause is the Heat causing vibration on molecules and is Quantised as →
Intensity (Pressure) and the relative Range is of Infinite Points in Displacement |AB| = λ **.**

(5) → For region **k1** z = $|\bar{z}_o|$. $e^{- i. (9.\pi /2).10}$ = Energy Under Planck length , *The Tank Cavity of Gravity , where* **$\bar{\nabla}$ E = 0** and Total Energy ET = Λ.**v**B.+ Λ x **v**$\bar{B}$ and is the *accelerating removing , rotating energy* Λ to **v** $\bar{B}$.
For $\bar{\nabla}$m = **0** and ET = Λ.**v**B.+ Λ x **v**$\bar{B}$, it is the *linearly removing , energy* Λ , towards , **v** $\bar{B}$, where there is No change of ds i.e. → **Time T = 0** and ,
Cause is the High Heat Conservational Balanced Tank of gravity and is Quantised as →
The Fundamental particles (Bosons and Fermions). [29]

The relative Range is of Infinite Points in Displacement |AB| , i.e. Infinity .

(6). ↑↓ → **k2** z = |zo|.$e^{- i. (5.\pi /2).10}$ = Energy in Planck length to → ∞ .

The changes of ds presupposes →
Time T = t . The Cause are the Infinite changes of Space and is Quantised as , →
Matter , Energy and Existent . The relative Range is the **Planck`s - length .**

(7). → **k3** $\bar{z}$ = |Λ|. $e^{- i. (\pi \ /2) . 10}$ = In Black Holes Temperature Balanced Tank Energy length is as , PV = n.R.T and (PA = W_d = $\sigma.T^4$)
→ No change of ds → and **Time T = Constant**

Cause is the **Very high Heat** causing Vibration on molecules and ***is Quantized as*** →
Intensity ≡ (*Pressure* = Fd = C.ẋ = ± C_o.w.[√ A^2 - x^2] **)**
i.e. ***Cause*** → (***Constant Co***) → ***Quantized as New monad .***
The relative Range is **Infinity . i.e. *The meter of Space-Energy changes* (** *The time* = T **)**
exists in* k2 *quantized Region only .

(8). → Quaternion and Regular Polygons :

De Moivre´s formula for the nth roots of a quaternion, where q = k.[cos.φ+ [∇i].sin.φ] is for w = 1/n , $q^w = k^w$.[cos.wφ + ε .sin.wφ] where q = z = ± (x+y.i), decomposed into its scalar (x) and vector part (y.i) and this because all the inscribed Regular-Polygons in the unit circle have this first vertex at points 1or at -1 (for real part φ = 0, φ = 2π) and all others at imaginary part where, k = Tz = Tensor (the length) of vector ,z, in Euclidean coordinates and which is

$$k = Tz = \sqrt{x^2+y1^2+y2^2+ yn^2}\ .$$

For imaginary unit vector ā(a1,a2,a3,a.n.w), the unit vector ε of imaginary part is →
ε = (y.i/Ty) = [y.∇ i] / [Ty] = ±(y1.a1+y2.a2+) / (√+y1²+y2²+yn²) the rotation angle
$0 <= φ < 2π$, $φ = ± \sin^{-1}$(Ty/Tz), cosφ = x/Tz, which follow Pythagoras theorem for them
and for all their reciprocal quaternions ā' (ā. ā' = 1).
Since also the directional derivative of the scalar field y(y1, y2, yn.) in the direction ,i, is→ i (y1, y2, yn.) = i1.y1+ i2.y2.+ i n.yn and defined as i.Grad y = i1.(∂y/∂1) + i2.(∂y/∂2) +…. = [i.∇].y, which gives the change of field ,y, in the direction → i , and [i.∇] is the single coherent unit , so coexistence between Spaces Anti-spaces and Sub-Spaces of any monad $\bar{z}$ = x+y.i = $\overline{AB}$ is happening through a general equation , *Identical with the Plane stores in Anti-Space and to those of Energy monads* . [33]

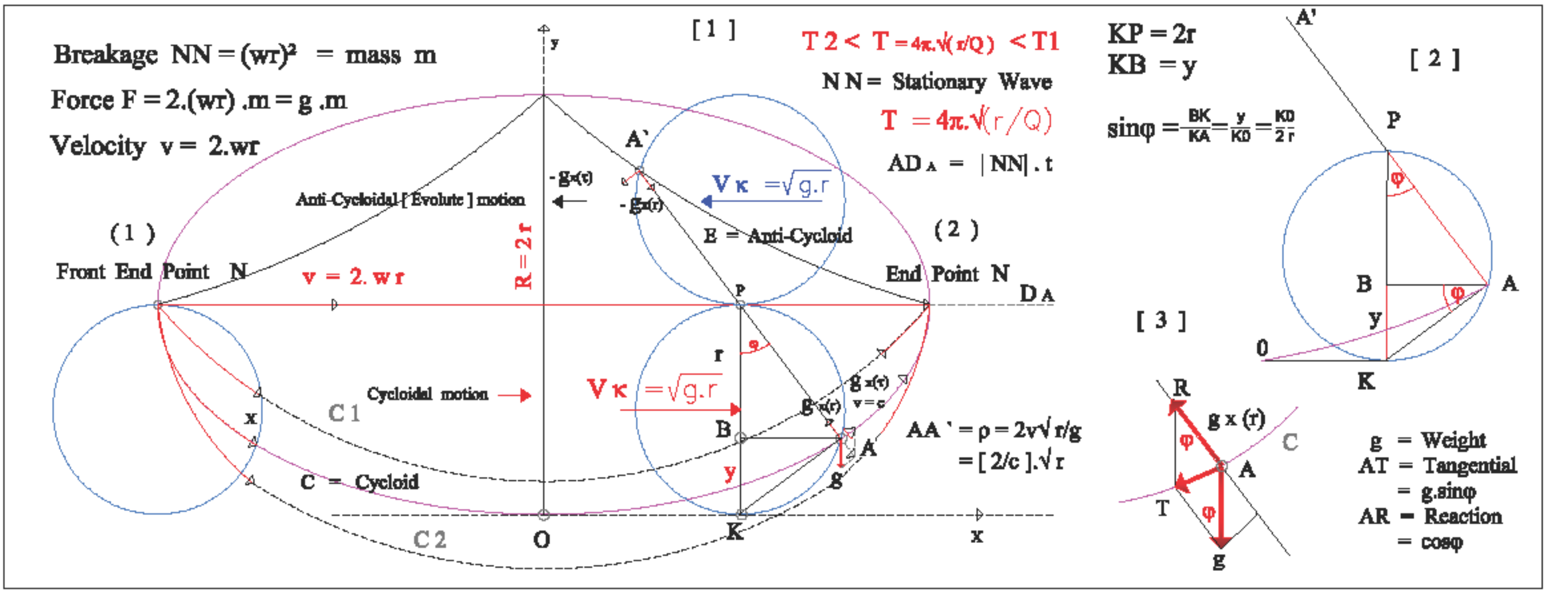


Figure.11.. *The Cycloidal motion in , Material Point ≡The monad is* Dipole ≡ [⊕⊖]= ∅ =AA\`
where → A≡ [⊕] →A\`≡ [⊖] → |AA\`|≡ ∅ ≡*The Brachistochrone Curve* C ≡ N1→N2.
Motion on Curve C1 acquires a period $T1 > 4\pi\sqrt{r/g}$ while on C2 $T2 < 4\pi\sqrt{r/g}$
which is not Isochronous .

Monad (1) –(2) = NN is The Electromagnetic Wave in NN , *and is the Energy Distance* .
Motion of point A on cycloid [C] , equilibrium from the opposite motion of point A\` .
on Evolute {Anti-cycloid } . Vibration happens on AA\` where the Mechanical motion
(*the velocity* ,v) is transformed to Electricity (*the Electromagnetic wave* E⊥P).

Space point A on cycloid [C] , is rolling on Anti-space point A\` of Evolute curve as the Instaneous-Curvature Pole. [58] STPL line is the circular Rolling motion of , Space , Anti-space , is the cause of Vibration on the Instaneous Radius (diameter) of curvature centre of rotation through Sub-space , and or , on every couple of lines between Spaces and Anti-spaces .
Extrema case of , *Pascal\`s line-rolling of any two circles* , is Euler-Savary mechanism where Instaneous -circle and Common-circle acquire the common Space , Anti-space Chord on where , *Rolling motion of the two curves is transformed to Vibration curves* .

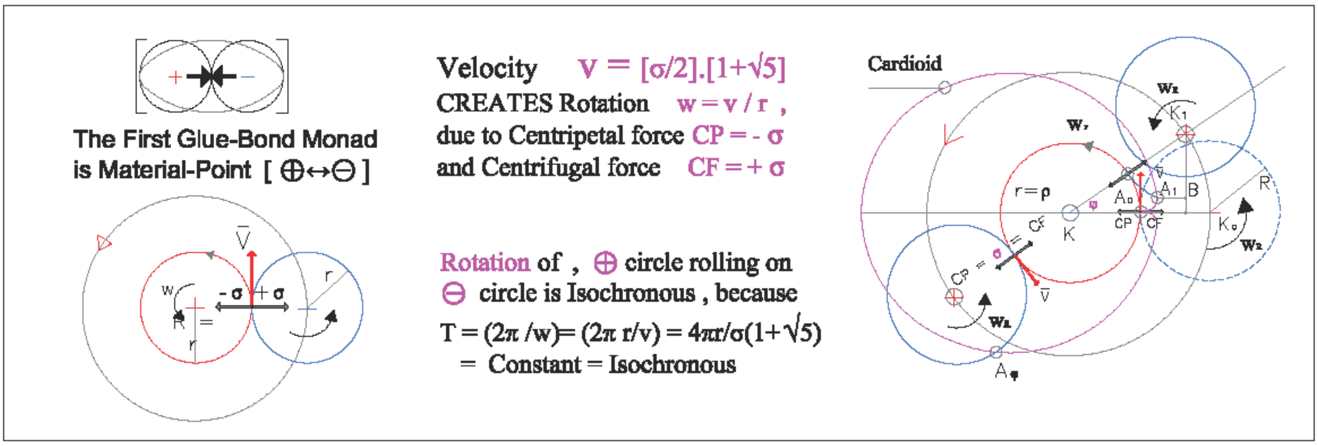


Figure.12.. *The Isochronous Rolling of* circles[⊕⊖] (*in Material Point , due to Glue-Bond* {+σ-σ }) , happens because the period $T = \frac{4\pi r}{\sigma(1+\sqrt{5})}$ = Constant , therefore and Isochronous .

Properties (Fig.11) :

Cycloid is the curve described (traced) by a point **P**, on the circumference of a circle of radius , **r**, as this rolls along a straight line AA without slipping on an orthogonal coordinate system (x,y) at **O** . Let find the equation of this curve using the geometry logic in mechanics .

In absolute magnitudes $\frac{dy}{dx} = \frac{KB}{KA} = \frac{BA}{BP} = \frac{BA}{2r-y}$ and $(BA)^2 = (BP).(BK) = (2r-y).y$ and

by squaring $\rightarrow$ $\left(\frac{dy}{dx}\right)^2 = \frac{y}{2r-y}$ …….(a) which is the differential equation of cycloid ,

and or as $\rightarrow$ $\left(\frac{dx}{dy}\right)^2 + 1 = \frac{2r}{y}$

For any element on trace ,ds , issues (a) and Pythagoras theorem as

$(ds)^2 = (dx)^2+(dy)^2 = \left(\frac{2r}{y} - 1\right).(dy)^2 + (dy)^2 = \left(\frac{2r}{y}\right).(dy)^2$ and $ds = \sqrt{2r}.y^{-1/2}.dy$, and by integrating ,

$\int ds/dy = s = \sqrt{2r}\,.\int_0^y y^{-1/2} = \sqrt{2r}.\frac{y^{+1/2}}{-1/2} = 2.\sqrt{2ry} + C$ and since in axis for y=0 *exists* s=0 and C=0,

so $\mathbf{s} = 2\sqrt{KP.KB} = 2.\sqrt{KA^2} = 2.KA = 4r.\sin\varphi$ ………(b)

i.e. the length of Cycloid* Curve *, from point O to point A , is twice the* Segment *of chord KA

and when point A is at the end point (2) then → 2.KA = 4r for the semi-cycloid.

The area between the curve and the straight line is $A=3\pi r^2$ and the arc length $l = 8r$.

For motion on cycloid , we consider a Weight Q , at point A , moving with free motion . Since reaction N is vertically acting , doesn`t give any Tangential component therefore the only one becomes from Q which is equal to AT= g. sin φ , and since from (b) , $\sin\varphi = \frac{s}{4r}$ then $AT= g.\frac{s}{4r}$.

Since acceleration = $\frac{d^2s}{dt^2} = \frac{dv}{dt} = \frac{d}{dt}(\frac{ds}{dt}) = - g.\frac{s}{4r}$ then $\frac{d^2s}{dt^2} = -g.\frac{s}{4r}$ ***or*** $\{\ddot{x} = -w^2\dot{x}$ *where* $w = \frac{2\pi}{T}\}$ …(c)

Equation (c) is a Harmonic Oscillatory motion showing that Acceleration is proportional to displacement and is directed towards the origin with a period $T= \frac{2\pi}{w} = 2\pi.\sqrt{\frac{4r}{g}} = 4\pi.\sqrt{\frac{r}{g}}$ ……(d)

and this since $w^2 = \frac{g}{4r}$. In Material-point $w^2 = \frac{g}{4r} = \frac{\sigma}{4r}$ = constant i.e.

Equation (d) denotes that the Harmonic Oscillation due to any Force or Weight which follows the free motion on cycloid , is Independent of the amplitude of oscillation and , is Isochronous .

Since total period of oscillation T= 4π√r/g and which does not depend on speed of rolling, (Huygens cycloid pendulum) but only from rolling radius ,r, means that the arc length l=8r is completed for faster , as one revolution in less time than the slower one , meaning that ,

On cycloid all points of y axis reach x-x axis at the same time , regardless of the height from which they begin (isochrones) .This property is used for breakages to reach STPL line isochrones. Evolute also of a cycloid is a cycloid itself , (apart from coordinate shift) . Velocity vector of any motion is directed along the tangent and is the sum of the velocity vectors of the constituent motion , thus at each point A , of a cycloid , the line joining that point , to the point P, that circle is , then at the top of the generative circle is tangent to the Anti-cycloid and the line joining point A`, that is to that of bottom (of circle) is normal to the cycloid .

Evolutes of a cycloid is the balancing cycloid, and called Anti-cycloid.

The *Tangential component of Acceleration* is $AT = g.\sin\varphi = \frac{g}{4r}.s$ and analogous to OA arc ,

While the *Centrifugal component of Acceleration* $\frac{v^2}{\rho}$, is dependent on initial point of motion.

Any Material point moving from A to P point , acquires velocity $v^2 = 2.g.PB = 2g(2r-y)$ and

$$\frac{v^2}{\rho} = \frac{2g(2r-y)}{2.PA} = g.\cos\varphi = g.\frac{PA}{2r} = \frac{g}{4r}.\rho \quad ....(e)$$

i.e. The *Centrifugal component of Acceleration is proportional to curvature radius* ,ρ, *with the same proportionality ratio* g/4r .

The velocity $v = \sqrt{g/4r}.\rho$ is proportional to curvature radius ρ, with proportionality ratio the root of g/4r.

On cycloid , all moving points on y axis reach x-x axis at the same time (isochrones motion) regardless of the height from which they begin (they do not depend on the oscillation amplitudes) , or if , a particle of mass $m=|(wr)^2| = 1$ tied to a fix point A executes a Simple harmonic motion under the action (Thrust) of the tangential velocity $\bar{v}=\bar{w}.\bar{r}$, and since →linear momentum $\bar{p}$= [Breakage x Velocity] = $|\bar{w}.r|.\sqrt{g/4r}.\rho = \bar{w}.\sqrt{gr}.\rho = \sqrt{gr}.\rho.|\bar{w}|$, then follows

a Cycloid`s trajectory with , a Total time period

$T = 4\pi\sqrt{(r/)g} = = \frac{r}{2v}.\sqrt{\frac{r}{g}}$ which is dependent on angular velocity $\bar{w} = \bar{v}/r = \bar{c}/r$ only and it is the Spin of particle |AA|.

Remarks **:**

a.. [Breakage **x** Velocity] = $\sqrt{gr}.\rho.|\bar{w}|$, and force $F = [(\bar{w}.r)^2.(\bar{w}.r)] = 2(mg/\bar{c}).\bar{w} = 2mg.(\frac{\bar{w}}{\bar{c}})$,

This property is used to show that the wavelength of norm $|\bar{v}|$, of vectors ,$\bar{v}$, is a Stationary wave, with the two edges as Energy material nodes , Cycloidally carried on wavelength |λ| = 2|A1-A2| twice the norm.

In Fig.11, KA= 2.r.sin φ and KA.sin φ = y so $\sin^2 \varphi$ = y/2r and $\cos^2 \varphi$ = 1-y/2r = $\frac{2r-y}{2r}$ and by division becomes $\frac{v}{\cos\varphi}=\sqrt{4gr}$, which means that any Weight , *Force* , falling , or rolling on Cycloid from upper point A , ratio $\frac{v}{\cos\varphi}$ remains constant, and for the center of PK v_K= v. $\frac{r}{PA}$ = $\frac{1}{2}\cdot\frac{v}{\cos\varphi}=\sqrt{gr}$, i.e. the rolling circle has a constant *velocity* and with an area of moving circle A = π.r² = π.(2r. cos φ)² = πR².$\cos^2$ φ.

b.. Thrust is the velocity vector $\bar{v}=\bar{w}$.r on the circumference of common circle of the inversely rotating Space, anti-Space becoming from the rotational energy vector ±Λ of PNS. The wavelength of norm of velocity $|\bar{v}|$ is the static equilibrium position vector of amplitude, ds, of dipole |AB| =$|\bar{v}|$ =ds and in terms of the static deflection, ds, then T =1/f= 2π/w , where ds = z = $\bar{v}$ = A.$e^{\,i.wt}$= $\bar{v}$.cos wt + i.$\bar{v}$.sin wt.

i.e. Breakages acquire different velocities and different Energy , and because are following cycloid trajectories , thus , need the same time (isochrones) to reach [STPL] line. Simultaneity is a property of Absolute system and the intrinsic property of vectors and Poinsot's ellipsoid now becomes → a

< Cycloidal ellipsoid >, since on c1(T1) > c > c2(T2).

Any material point [Medium - Field Material - Fragment] →[± s²]=$|\bar{w}x\bar{r}|^2$ →[MFMF] Field following trajectory ,in=(c1), or ,out=(c2) , Cycloid=(c)=|A1-A2| needs more or less time T(2) < T = 4π √(r/g) <T(1) to reach end A2.

And since frequency f = 1/T and energy E = h.f , then Cycloid motion Controls constancy of Energy by changing velocity, $\bar{v}$ = $\bar{w}$.r , and period ,T, of monads.

Breakage quantity 2.(wr)² under the tangential action $\bar{v}$ = wr becomes 2.(wr)³ acting on point A → 2wr.**m** of common circle. The same also for points A,B,C of Space and A_E,B_E , C_E of Anti-Space . Because all velocity vectors AA,BB,CC carry material points A,B,C at points D_A , D_B , D_C ,in time ,t, isochrones , then material points follow a cycloid with period the norm of wavelength of velocities |AA|,|BB|,|CC| . Fig.5

This Simultaneity is succeeded by Lorentz factor where transformations between Inertial frames that preserve the velocity of light will not preserve simultaneously.

c.. Work W , by a constant force F = 2(wr)² exerted on an object [breakage ±(wr)²] which moves with a distance times dx=|(wr)²| is capable of Vibration and is calculated in two perpendicular Formulations (dx⊥dy) which is as, Stiffness k = N/m → velocity vector **v1** → *Electric field E* → and Flexibility f = m/N → velocity vector **v2** → *the Magnetic field P* . For more in [39-40] . The why Energy is transformed into velocity , and velocity to a field is explained also through Extrema Principle . [41]

Cycloid of Figure.11. is a cave and let this be IN Common-circle of STPL mechanism .

[1] *The applied force on this* NN *cave is*

E = h.f = **w**.(h/2π) = w . Spin , and **Spin** = $\frac{\mathbf{E}}{\mathbf{w}}$ = [±$\bar{v}$.s²]/w = (r.s²)

[2] **For E =** ±$\bar{v}$ then → **Spin** = $\frac{\mathbf{E}}{\mathbf{w}}$ = [± $\bar{v}$.s²] / w =**(± r . s²)** → Producing ± ***Fermions with spin*** $\frac{\mathbf{1}}{\mathbf{2}}$.

[3] **For E =** [∇i=2(wr)² = 2.$\bar{v}$s²] = **2.(r.s²)** then **Spin** = $\frac{\mathbf{E}}{\mathbf{w}}$ =[2.$\bar{v}$.s²]/w = **2.(r.s²)** → Producing ***Bosons of spin* 1 .**

i.e. **Double energy** **[2.(r.s²)]** on a constant cave creates **2** crests and doubling the frequency **(h) ,** with **Spin 1.**For **N-times energy [N.(r.s²)]** on a constant cave creates **N** crests N-times the frequency **(h)** with **Spin N/2** .

Since Energy in cave is an Electromagnetic Wave **[$\bar{\mathbf{E}}$x$\bar{\mathbf{H}}$] =** Pressure = Spin **S = ρ.c.w ,** or **[εE² + μH²] / 2 = 2rc. sin.2φ** → then Energy / sin2φ = **[εE²+μH²] / sin 2φ** = 2rc/ ρw = 4r² /ρ = constant , happening only on Cycloidal motion , where **ε** = Permittivity and **μ** = Permeability in cave .

Above property happens in *Piezoelectric-effect* where *the Mechanical Energy* as { pressure or vibration} , executed on a material point or on a Dipole = [⊕⊖]=∅=AB , *is converted into an Electric or transverse Magnetic wave* . [58]

Work from deformation is $dW = \frac{\sigma^2}{2E}(dx.dy.dz)$.

It was shown that the Intensity is $I_d = \frac{\rho^2\pi^2c^3}{2\lambda^2}$, and for ρ =1 then is $I_d = \frac{\pi^2c^3}{2\lambda^2}$. [58]

Applying this to light-velocity-vector then Electromagnetic Wave $\{I_d = \frac{\pi^2c^3}{2\lambda^2}\}$ in vector |c| , is creating a Mechanical deformation on Material point |c| { as ***Outer - Spin*** = $\frac{E}{w}$ = h.f }, which is then converted to an ***inner*** Electromagnetic Wave and which is recycled .

The linear electrical behavior of a Material point is , D = **ε** E , where D = the Electric displacement field , E = the Inside Electric field strength and then according to Maxwell`s equations ∇ . D = 0 , ∇xE = 0 and since in Elasticity , Hook`s law is → s = m. σ and m = Young modulus then ,

Strain(s) ≡ m **x** Stress(σ) and ∇. σ = 0 , $s = \frac{\nabla u+u\nabla}{2}$ where u = displacement .

All above when combined in *coupled equations* then s = m.σ +∂E and D = **ε** E +∂σ .

In case of a Dipole =[⊕⊖]=∅=AB in a Cave 2r , ON or OFF STPL , is $[(+(wr)^2) \leftrightarrow (-(wr)^2)]$ or $[(+(wr)^2)$ ↻↺ $(-(wr)^2)]$ and is oscillated in itself as ***monad .*** Fig.5-6 -12 , i.e.

The Free vibration of monad AB = $\bar{q}$ = [s+$\bar{v}$∇i]

oscillating under the action (a thrust) inherent in itself , subject to , *damping* , because energy is dissipated by the *stiffness* ,**k** , of monad and from a *constant of proportionality* ,**c**, regarding the motion of *mass* ,**m**, when placed into motion , the oscillation will take place at the natural frequency , $\boldsymbol{f_n}$, which is a property of monad. ***For Displacement*** , x = AP_A , ***The homogenous differential equation of this motion is*** ,

$$m\ddot{x}+c\dot{x}+kx = 0 \qquad \text{.......} (1)$$

which corresponds physically to the free damped vibration , where m = mass = a reaction coefficient to the change of velocity $\dot{x}$ and k = stiffness = a reaction coefficient to the change of length ,|x|, x = the displacement , $\dot{x}$ = velocity of monad , k and c constants as above ,with general solution given by the equation → $x = A\,.e^{s1.t} + B.e^{s2.t}$ where

$$s1,2 = -[c/2m] \pm \sqrt{\left[\frac{c}{2m}\right]^2 - \left(\frac{k}{m}\right)} \quad \text{and ,} \quad S = \sqrt{\left(\frac{k}{m}\right) - \left[\frac{c}{2m}\right]^2}, \text{ a constant coefficient ,}$$

and for initial conditions $x(0)$, $\dot{x}(0)$ → A , B then displacement ,x, is ,

$$x = e^{-i.(c/2m)t}.[\,A.e^{S.t} + B.e^{-S.t}] = e^{-i.(c/2m)t}.[\,x(0).e^{S.t}+\dot{x}(0).e^{-S.t}] \text{ and}$$

$$\text{Oscillatory} \quad x = e^{\pm i\sqrt{\left(\frac{k}{m}-\left[\frac{c}{2m}\right]^2\right)}\,.\,t} = \cos\sqrt{\left[\frac{c}{2m}\right]^2 - \left(\frac{k}{m}\right)} \pm i.\sin\sqrt{\left[\frac{c}{2m}\right]^2 - \left(\frac{k}{m}\right)} \quad .....(2)$$

where ,

1.. For coefficients $[\frac{c}{2m}]^2 > [\frac{k}{m}]$, no oscillations are possible , *is the Over-Damped ≡ The Particle like nature of monad* .

2.. For coefficients $[\frac{c}{2m}]^2 < [\frac{k}{m}]$ the exponent becomes an imaginary number and the terms are Oscillatory , *it is the Under - Damped ≡ The Wave like nature of monad* , and this because of space rotation only ↻ .

3.. For $[\frac{c}{2m}]^2 = [\frac{k}{m}]$ then oscillatory , non-oscillatory and radical motion is zero , *It is the Critical Dumping in monads ≡ The Critical-Energy-Quantity* → CEQ *as in M-point* .

The Particle and or the Wave nature of monads , or when $\rightarrow C_c = 2m\sqrt{[\frac{k}{m}]} = 2mw_n = 2.\sqrt{k.m}$

is a relation depending on the three reactions c , k , m .

Electromagnetic fields of monads :

Any damping can then be expressed in terms of the critical damping by the non-dimensional number

$\zeta = C/C_c$ and **S** in terms of ζ , $[\frac{C}{2m}] = \zeta\,[\frac{Cc}{2m}] = \zeta w_n$ is $S = [-\zeta \pm \sqrt{(\zeta^2-1)}].w_n$ and
the differential equation of motion becomes ,

$\ddot{x} + 2\zeta w_n\dot{x} + w_n{}^2x = 0$ ……….(1- n)

with the general solution given by the following three cases and equations ,

For $\zeta < 1$ is the Oscillatory motion , *The Under-damped case ≡ Wave like nature .*

$x = e^{-\zeta.wn.t}.\,[A.e^{i\sqrt{(1-\zeta^2)}.wn.t} + B.e^{-i\sqrt{(1-\zeta^2)}.wn.t}] =$
$e^{-\zeta.wn.t}.\{\{[(\dot{x}(0)+\zeta.w_n.x(0)).\sin\sqrt{(1-\zeta^2)}.w_n.t] / [w_n.\sqrt{(1-\zeta^2)}]\} + x(0).\cos\sqrt{(1-\zeta^2)}.w_n.t\}\}$ …………(**2a**)

which indicates that the frequency of the damped oscillation is equal to $w_d = \frac{2\pi}{\tau d} = w_n.\sqrt{(1-\zeta^2)}$

and according to Planck`s formula $E = h.f_n = h\,\{\frac{w_n}{2\pi}\}$ represents the energy in monads .

For $\zeta > 1$ is the Non-oscillatory motion , the *Over-damped case ≡ The Particle like nature*
with the two roots increasing and decreasing with the general solution , $\dot{x} = \vec{v}$

$x = A.e^{[-\zeta+\sqrt{\zeta^2-1}].wn.t} + B.e^{[-\zeta-\sqrt{\zeta^2-1}].wn.t}$ where

$A = \{\dot{x}(0) + [\zeta+\sqrt{(\zeta^2-1)}].w_n.x(0)\} / [2w_n.\sqrt{(\zeta^2-1)}]$
$B = \{-\dot{x}(0)-[\zeta-\sqrt{(\zeta^2-1)}]\,.w_n.x(0)\} / [2w_n.\sqrt{(\zeta^2-1)}]$ ………..…(**2b**)

which indicates that the frequency of the damped oscillation is equal to $w_d = \frac{2\pi}{\tau d} = w_n.\sqrt{(1-\zeta^2)}$
and according to Planck`s formula ,
$E = h.f_n = h\,\{\frac{w_n}{2\pi}\} = h\{\frac{\vec{v}}{2\pi r}\} = M.v_n$, *and since also* $\vec{v}_n = w_n.r$, *and* M = The complex mass ,
thus represents the Kinetic energy in monads depending on velocity $\vec{v}_n$ and M.

For $\zeta = 1$, is the Internally Isochronal oscillatory motion , (*the Inner cycloidal motion of monads*) is *The Extrema , critical damped motion case* and displacement , **x** , is as $\rightarrow x = e^{-w_n.t}.\,[A + B.t] =$
$= e^{-w_n.t}.\{x(0) + [\dot{x}(0) + x(0).w_n].t\}$ …………(**3b**)
i.e. a double root S1 = S2 = - w_n which is according to the Newton`s second law , the deformation of the real part ,|s|, which is k.|s| = - w = - mg and frequency $f_n = (1/2\pi).\sqrt{g/|s|} = 2\pi\sqrt{m/k}$ depending on the mass and stiffness of monad , being its properties.
Above indicate that Extrema-frequency of this critical damped oscillation is equal to ,
$w_d = \frac{2\pi}{\tau d} = w_n.\sqrt{(1-\zeta^2)} = 2\pi.f_n$ and according to Planck`s formula $E = h.f_n = h\,\{\frac{w_n}{2\pi}\} = h\{\frac{\vec{v}}{2\pi r}\} = M.v_n$, *and since also* $\vec{v}_n = w_n.r$, *and* M = The complex mass , then represents the Kinetic energy in monads depending on velocity $\dot{x}(t)=\vec{v}_n$ and M , and for any position , x = x(t) , of vibration , and → When Velocity $\dot{x}(t)$ is ,

$\dot{x}(t) > 0$ then the type of response is Over x ,
$\dot{x}(t) = 0$ then the type of response is From x ,
$\dot{x}(t) < 0$ then the type of response is Under x ,

and the rate of decay of oscillation is measured on logarithmic decrement , *meaning that* ,

The Conservation of Energy in an** , Free - Vibration Un-damped system , **happens when

Energy is partly ***Kinetic T and*** ,

a.. Because of the existence of *velocity vector* $\vec{v}_n$ it follows existence of mass , m , also { *m = mass = the reaction to the velocity change , which is a scalar quantity*} and Energy-System quantity is stored in velocity vector $\vec{v}_n$ by virtue of its ***velocity - vector - cave*** and not in the scalar quantity .

b.. In the absence of velocity vector , mass is not existing {*mass ,which is the reaction to the constant velocity change , is zero* } and Energy-System is stored in velocity vector $\vec{v}_n$ by virtue of its ***velocity -vector - cave*** , although the scalar quantity is zero ,

And for the Energy partly ***Potential U ,***

In the Absence of velocity vector , mass is not existing {*mass ,which is the reaction to the constant velocity change , is zero* } and Energy is stored in velocity vector $\vec{v}_n$,

a.. ***In the form of Strain - energy in Elastic Deformation for the Work done and which is a Force-field for Solids*** , which is reverted to an Electromagnetic field .

b.. ***Strain - energy in monads is the Velocity - Cross-Product-vectors in the Homogeneous Deformation of the Work done and which is an Electromagnetic - field in the*** $|\vec{v}_n|$, ***Stationary - Wave – cave***] .

In [22-23] , any Monad NN = N(1) ↔ N(2) is the dipole , $(P_1 \leftrightarrow P_2)$, or **[{N(P_1) ← 0 → (P_2)N}]**
It is the symbolism of the two opposite forces (P_1) , (P_2) which vibrate perpendicularly in monad (*Resonance-cave with an Electromagnetic Response*) and are created Mechanical forces at the edge points N1 , N2 . Balancing of Monads ≡ *Quaternions* , happens on Evolutes *Cycloid* , *Anti-cycloid* .
For velocity $\bar{v} = \bar{c}$ = light velocity , curvature radius is

$\rho = XX` = 2c\sqrt{r/g}$ , and Spin S is , $\bar{S} = \bar{V}x(\tau) \text{ x } XX` = [g.\sin\varphi].\rho = [g.\sin\varphi].2c\sqrt{r/g}] = 2c.\sin\varphi.\sqrt{rg}$ =

$2c . \sqrt{r.g} . \sin\varphi$, *i.e. Energy* → c , *as Spin* $\bar{S}$ ***, is Unified with the Space-Energy*** *as radius ,r*.

3.8. The Glue-bond of stresses in Material-point Causes Rotation and motion .

In Figure.13-(3) , common point A executes a ± pressure on the two points of the circles K_r , K_R which is a Piezoelectric-effect , by causing a Centripetal force , C_P , and an equal and opposite Centrifugal force , C_F , which in turn creates rotation of the positive ,+, to the negative ,-, with Lever-arm Displacement , AP_A on AA_o.

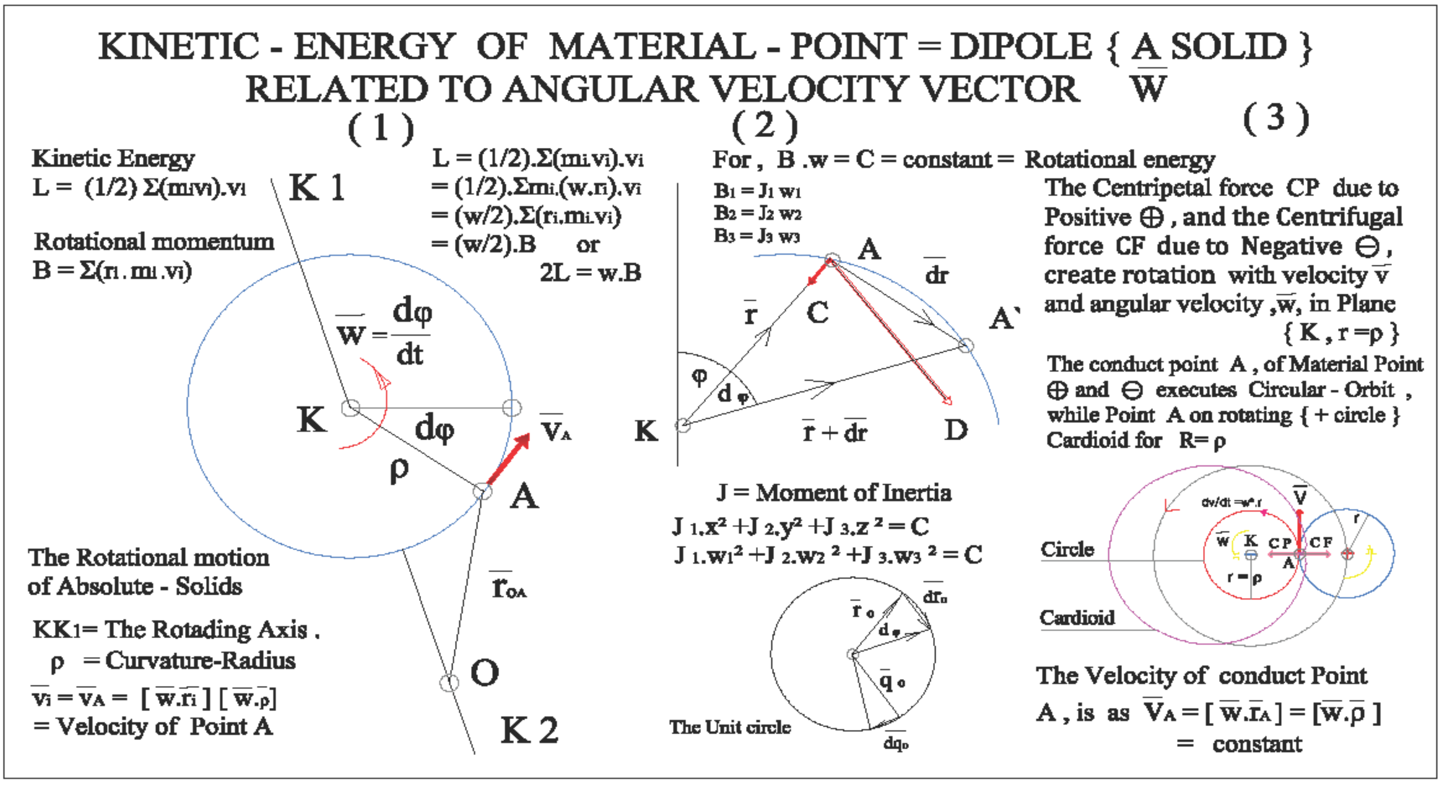


Figure.13.. *The Cycloidal motion in , Material Point ≡The monad is* Dipole ≡ [⊕⊖] = ∅= K_r $AK_{R=r}$ *where* → K_R ≡ [⊕]↔ K_r≡ [⊖] → ≡ 0 . The total torque becomes from ± Spin which equilibrium in System of *circle* K_r , *Evolute circle* K_R , as *Cardioid of the same center.*

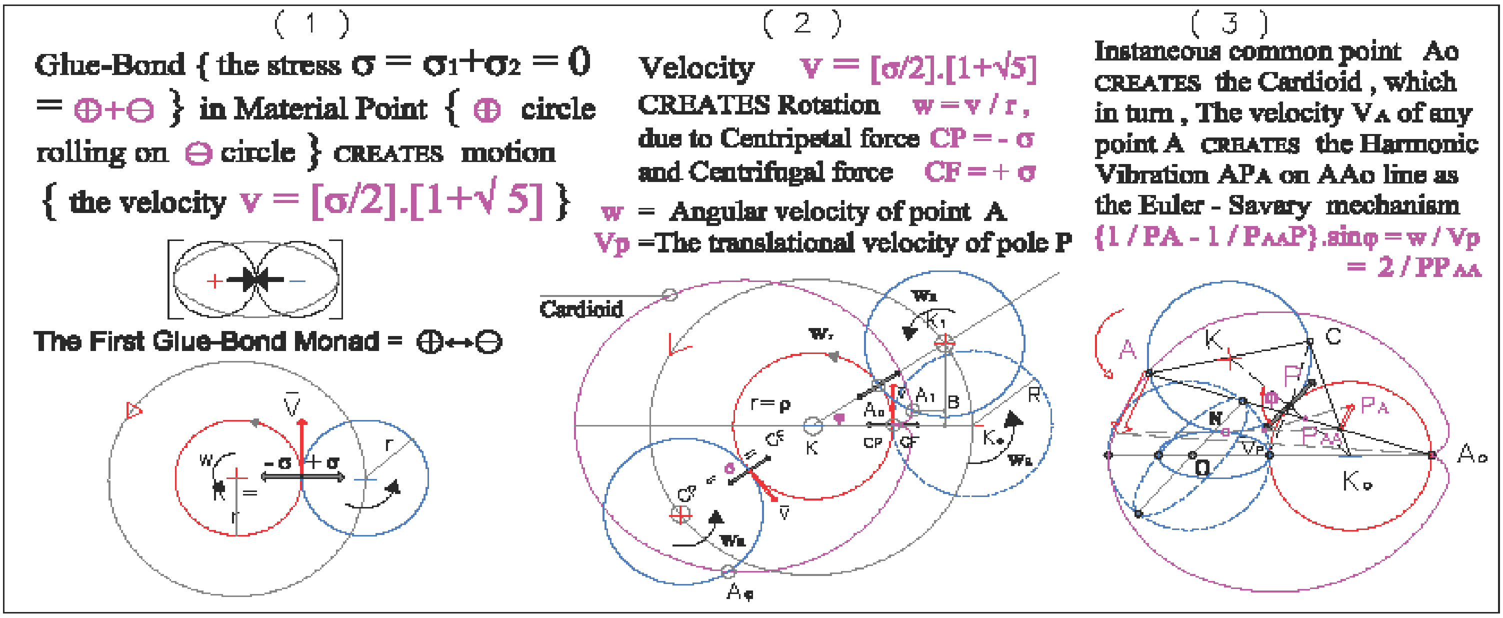


Figure.14.. Pole of rotatation P , **on STPL line AP_A ,** is the Instaneous centre of rotation for [⊕] , Space on [⊖] Anti-space , through Sub-space ,∅, and or , every couple of lines between Spaces and Anti-spaces . Cardioid is the envelope of circles (K_o,R) , (K ,r = R) whose centres K_o , K lie on a given circle (P, PA_O) which pass through a fixed point , A_O, on the given circle (P , PA_O) .Nutation happens at ,N, common point. Analytically in [58] .

In (1) GLUE-Bond becoming from opposite ± stresses σ1= - σ2 and create Velocity $\bar{v} = \frac{\sigma}{2}$ [1+ $\sqrt{5}$]

In (2) velocity $\bar{v}$ = w.r creates Rotation which becomes , according to Newton`s third law,

from the Centripetal ,C_P, and the Centrifugal force , C_F , and w is the angular velocity of point A.

In (3) velocity v_A=w.(AP_{AA}) of point A creates the Free Harmonic Vibration on AP monad following

the Euler-Savary mechanism where , *Rolling motion is transformed to known Vibration curves* .

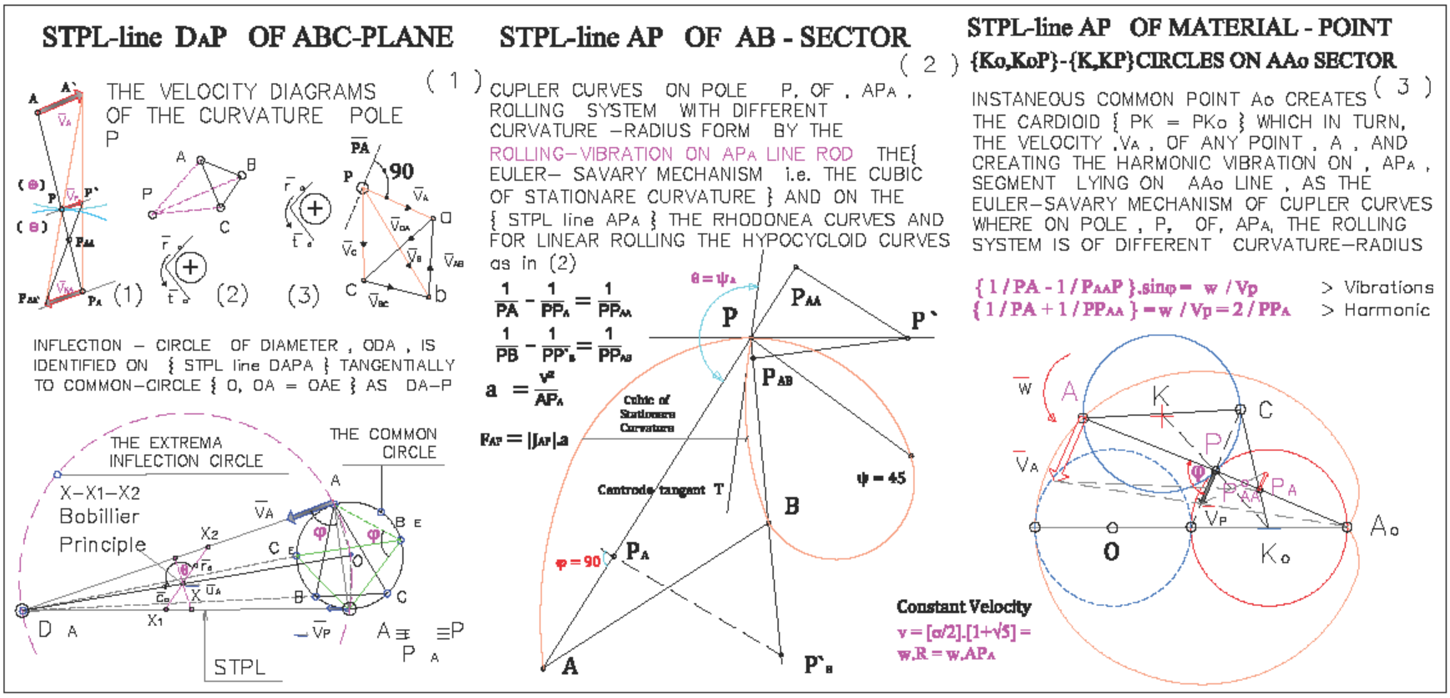


Figure.15.. The STPL line , **In** *a Material point* {⊖≡ K_o,K_oP – ⊕≡K , KP} , **In** *a Material-Segment* {AP} , *and* **In** *a Material-Plane triangle* { ABC } is as in (3),(2),(1) .
(±) Breakages { *in STPL lines* } become the , *Vibrating Curves of Material points* .

In (1) STPL line ***of Plane ABC*** , *extrema* D_AP_A≡ D_AP ≡ D_AA_E ≡ ,r, is tangential to Common-circle , and ***Inflection- circle*** passes through Space-point , A≡ [⊕] , Anti-space point A_E ≡ [⊖] ,which coincides with the Instaneous curvature-centre of rotation , *the Pole P* , and thus forming the material angle , $\vartheta = \vartheta_A . t = (\frac{v_A}{\sqrt{c^2-r^2}}) . t$, on angle < AD_AP .
All chords through the Sub-space Plane-triangle A D_AP , follow Bobillier-Principle for curvature centres D_A and CREATE the Vibrating Energy-Geometry-Segments D_AA , D_AP .
Velocity of point A , is $v_A = w_A . r_A$, *where* , w_A= the angular velocity of point A ,
r_A= the distance , AP, between the moving (+) point A and (-) point P the Pole .

In (2) STPL line , ***of sector AB*** *which two points* , *A* , *B* , are OFF Common-circle , and lie on the circumference of Envelope-circles , O,OA= OB , with the common Anti-space point , P(-) , and thus forming the material angle , $\vartheta = \vartheta_A . t = (\frac{v_A}{\sqrt{c^2-r^2}}) . t$, with centrode tangent T.
Euler-Savary mechanism establishes the relation among points A , P, P_A and P_{AA} and CREATE the Envelope curves , *Stationary-curvature paths* , generated by the Vibrating →
Velocity-Energy - Geometry Segment A P_A , on AP line .

In (7) STPL line , **of *Material point AP*** , {⊖ ≡ K_o,K_oP – ⊕ ≡ K , KP} of Space point A(+) and Anti-point P(-) is rotating through point A_o , which is the center of common-circle and forming the material angle , $\vartheta = \vartheta_A . t = (\frac{v_A}{\sqrt{c^2-r^2}}) . t$, CREATE the Cardioid-Envelope curves generated by the above Vibrating Velocity-Energy-Geometry-Segment A P_A , on AA_o rotating line .
Remarks in Figure 15 :

a.. It was shown in [58] that *Clashed Breakages which are located* IN *the* STPL *Cylinder* , *Acquire Oscillation from their inherent Vibration as in* (1) – (2) , *and consist the Moving Particles while* , *Un-clashed Breakages located* OUT *the STPL Cylinder* , *Acquire Oscillation from their between Glue-bonding and consist the Rest Particles* (3).

In all cases , STPL line mechanism consists the < Energy-Geometry-Length ≡ Quantum ≡ AP >

The Space as Velocity-vector-energy V , in the cavity of the Common-circle of radius ,r, and constant angular velocity ,w , is transported as Energy from point A to Pole P , coinciding , with Point P as ,

P ≡ A_E≡ P_A , where then the two conjugate points ,T,J, lie on STPL line as Pascal`s P_A and Desargues

D_A points with the constant angle < φ = < D_AAP_A ≡ < D_AOA , on Common circle and on Extrema circle.

b.. Since all properties of Physical entities exist only in Pairs and exists the scientific notion that
< Opposites Attract >
< Similar Repel > then ***considering*** , Material point A≡ [⊕] - Anti-space point A_E ≡ [⊖]
or AA_E = AP as a ***Physical System*** which has only one physical property which is ***Stress*** ≡ ***σ***
can predict measurements produced , and also results which are according to the Newton`s second law , the Forces of Circular motion and tangential and angular velocities $\bar{v}$,$\bar{w}$, $\bar{\mathbf{v}} = \mathbf{w.r}$
which is the ***Hidden - variable of the System*** .

This continuously equal velocity $\bar{v}$, creates on any Material-point [Point , A–Anti-point P=A_E]
≡{Energy-Geometry-Length ≡ Quantum ≡ AP } the envelopes of Cardioids which are of Wave function , whose domain is the configuration space in ***Material - Point – Energy - equilibrium***.
Since also an Isolated system does not loses or gain Energy so , this Material-point is self - consisted and constitutes , ***The First Eternal < Self – Moving – Energy – Dipole >*** ≡ ≡ ≡
The Rotating and Stationary Energy - Quantum , of this cosmos .

c.. It was proved in [58] that , in case of a curve rolling on its constant envelope curve , then the curvature center of the envelope curve coincides to that of the rolling curve .
In Figure 14-3,Euler-Savary mechanism on AP is

$$[\ \frac{1}{PA} - \frac{1}{Paa\ P}\ ].\sin\varphi\ = \frac{w}{Vp} = \frac{Angular\ \ Velocity}{Tangential\ Velocity}$$

, i.e. a *Geometry-energy-motion relation in the Material-Point* , where energies become from ,
w , → is the angular velocity of point A and
$\mathbf{v_P}$ → is the translational velocity of pole P , and Creating the curves , Free Harmonic Vibration .

d.. It was shown in [14-16] that , *in The Elastic material Configuration the Strain energy is absorbed as Support Reactions and displacement field in the three dimensions* [∇**ε** (ū,v̄,w̄)] *upon the deformed placement* , (these alterations of shape by pressure or stress is the equilibrium state of the Configuration) , *as* G.∇². **ε** + [m.G / (m-2)] **.** ∇ [∇. **ε**] = F , *where*

E = Young modulus of elasticity.
G = Shear modulus = E.m/2(m+1)
m = Poisson`s ratio = 1 / μ ≈ 10/3
σ = Stress = Force / Area.
ε = Strain = change of length / length .
F = External forces .
The linear electrical behavior of a Material point is , Ď = **ε** Ê , where
Ď = the Electric displacement field , Ê = the Inside Electric field strength and then according to Maxwell`s equations ∇ . Ď = 0 , ∇xÊ = 0 and since in Elasticity , Hook`s law →
ε = E . σ and then ,
∇. σ = 0 , $\boldsymbol{\varepsilon} = \frac{\nabla u + u\nabla}{2}$ *where* u = displacement .
All above when combined in *coupled equations then* → **ε** = E . σ +∂Ê and Ď = **ε** Ê +∂σ …….(1)
and since in Material-point σ = 2(1+√5).v̄ = constant , *and since* *v = w.r* , then (1) becomes ,
ε = E . σ +∂Ê = 2.E(1+√5). v̄+∂Ê
Ď = **ε** Ê +∂σ = **ε** Ê +0 = **ε** Ê ………(2)
System (2) defines the Strain **ε** ,and the Electric displacement field Ê = [⊖] ,in Material-point .

4.. The Geometry of STPL .

In Figure.5-(3), the tangents at points A,B,C formulate triangle $K_A\ K_B\ K_C$, the inscribed to it largest circle O,OA=OB=OC , which incenter is
the intersection of the three internal angle bisectors at K . Because the internal bisectors of angles are perpendicular to their external bisectors , it follows that the centers of the incircle together with the three excircle centers form an orthocentric system .On this coordinate
system is possible any geometrical analysis.

By using the Trilinear coordinate system on ABC Space –triangle then for ,

Incenter is → 1 : 1 : 1
Excenters is → -1 : 1 : 1 , 1 : -1 : 1 , 1 : 1 : -1

Incentral triangle Vertex opposite A = 0 : 1 : 1
Incentral triangle Vertex opposite B = 1 : 0 :1
Incentral triangle Vertex opposite C = 1 : 1 : 0

External triangle Vertex opposite A = -1 : 1 : 1
External triangle Vertex opposite A = 1 : -1 : 1
External triangle Vertex opposite A = 1 : 1 : -1

Defining the lengths

$a = K_B K_C$, $b = K_C K_A$, $c = K_A K_B$, $d = [\frac{a+b+c}{2}]$ = The semi-perimeter then

Inscribe radius $r = \frac{\sqrt{d(d-a)(d-b)(d-c)}}{d}$ = |OA|

Coordinates for point K are, $\frac{bc}{b+c-a} : \frac{ca}{c+a-b} : \frac{ab}{a+b-c}$

Coordinates for point O are, $\frac{b+c-a}{a} : \frac{c+a-b}{b} : \frac{a+b-c}{c}$

The STPL mechanism is the Mould consisted from any Common circle O,OA= [OA`≡ $OA_E$] , O,OB = [OB`≡ OB_E] , O,OC = [OC` ≡ OC_E] , ***and the common lines*** D_A-P_A , D_B-P_B , D_C-P_C all on a line of STPL . ***On the infinite sectors*** AD_A-AP_A , BD_B-BP_B , CD_C-CP_C ***vibrate the breakages*** [± s² ≡ ± (wr)²] and [∇i = 2(wr)²] , ***forming all families of curves and the Euler - Savary Coupler - curves of the Cubic – Of - Stationary - Curvature mechanism of Space , Anti-space Vibrating end-curves .*** Dimensioning of the mechanism is possible by using analytical geometry.

Synopsis 2 :

Point in E-Geometry , which is nothing and dimensionless , i.e. the Zero , can be derived from the addition of a Positive (+) *and a Negative* (-) *number , while* ***Material point has dimension ,ds, and Energy the Work W*** *, the Segment* **ds** = [⊕⊖] *and Work* **W** = P.ds , *and originates in the the same way . Adding it as this to numbers i.e. to Monads ,* ***creates the Primary Particles , the Rest-Gravity constituent and the Atoms of the Periodic System*** *in Planck`s Space-Level .* *Monads are Spinning because of the* ***Inner Electromagnetic Waves*** , E ⊥ P , *which* ***create the External Spin*** *and again the* ***Inner Electromagnetic Waves*** , E – P , *continuing this eternal Cycle.* In Mendeleyev`s Periodic Table , chemical properties of the elements are a periodic function of their atomic weight and in [58] was shown that ***, any Next - Atom Energy , is equal to Prior + the distributed .*** *Since* all material points are produced from (±) Breakages which consist the

[⊕ ,⊖ ,☼] Energy-Units as follows ,

Breakage s² = +(wr)² = The Positive. ⊕ Unit ,
Breakage - s² = - (wr)² = The Negative ⊖ Unit ,
[⊕↔⊖] = ∅ = The Rest Energy Quanta ≡ 0 The Zero Unit ,
Breakage 2s² = 2(wr)² = The Energy ☼ Unit , then ,

Primary Segment of Material-point *is of the* ***Form*** [⊕↔⊖] = ∅ = 0 , *and its* ***Content*** $\bar{v} = \frac{\sigma}{2}[1+\sqrt{5}]$

Finite |⊕↔⊖| *and* ***Infinite*** , v̄=w̄.r= ∞.0 , *to all Monads* $L_v = e^{i.(\frac{N\pi}{2})b=10^{-N}=-\infty}$, *and for* N≡ w̄=∞ → 0 , *the* ***Atraction*** [⊕↔⊖]*and the* ***Repulsion*** ⊕→ ←⊕ , *the* ***Quantity*** *in Real part* Form AB=L_v=|⊕↔⊖| *and in Imaginary part* [⊕↔⊖] = 0 , *and the* ***Quality*** [⊕↔⊖ = σ] ≠ 0 *by differentiation , and so on .*

Since also ***Imaginary Part*** *is always* [⊕↔⊖] = 0 *then Form and Content are absolutely inseparable and pass from zero for all Opposites , so all Entities are embodied with the Laws , and since also valid* [⊕↔⊖] ≠ 0 *then , the* ***Zero equality is the Constant and Critical-Energy-Quantity*** → CEQ ← *and is* {{ Stress , σ = CEQ is Producing velocity **v̄ = w.r** , and consists the ***Hidden-variable of this tiny and Self– Moving– Energy– Dipole , System*** }}, *for any transition in Quality , a kind of Constant-Catalyst which is not changing the composition of Primary Material-Segment ,* the unity of opposites *and also the Work ≡ Energy involved in all levels . In this way in nature nothing remains constant because by changing ,w,r, in an eternally existing constant velocity vector* **v̄** *then everything is in a perpetual state of transformation , motion and change . The Rest Energy-Quanta acquire a Resistance in motion which is Stress ,* σ = CEQ , *i.e. a meter , a number measuring this magnitude and it is that what is called* ***Matter*** *which has nothing to do with energy.* **GR *considering Energy and Mass equivalent*** *creates a great confusion because , Energy is motion it is* ***Content*** $\bar{v} = \frac{\sigma}{2}[1+\sqrt{5}]$≡[⊕↔⊖] , *while Mass* ***is a Number*** *measuring the changes in velocity-vector motion* |**v̄**| , *and it is the law ,* ***while Content*** |AB| ≡ |v̄| ≡ [⊕↔⊖] ≡ *The Energy length (* ***the energy - quanta*** *) of opposite points* |A ,B| .

In Primary-material-point , ***Form*** (r) *is the cave* ***and Content*** , [⊕↔⊖] *is the energy , and both are constant while in all others issues the laws of transformation of* ***Quantity into Quality*** *, extended from the smaller particle to the largest phenomena are also constant .*
Since Material-point is of Form [⊕↔⊖] = ∅ = 0 , it is with binding points with no energy released . Since mass is the meter of Energy-velocity-vector changes , then this meter cannot exceed the frequency of light-velocity . The why light-velocity $\bar{v}$ *is the maximum and constant in* [58] .

Changing the Form(r) *means much more the Content* ⊕ *or* ⊖ *, or* [⊕↔⊖] ≠ 0 *,* ***is Negative-Energy ,*** *while the ,* ***Changing of Content ,*** *is an increasing in frequency which occurs in standing-waves and where then decreases the reaction to the motion (the mass) , because* $v = w.r = \frac{2\pi r}{T} = 2\pi r.f$ = constant .
It was shown in [58] *that ,* ***any Next-Atom , Energy*** *, is equal to Prior* **+** *the distributed i.e.* ***the law of Quality and Quantity*** *. The same also in Chemistry from gas to liquid or solid which is usually related to variations of temperature and pressure . Anti-Energy or Negative-energy is not existing because it is the Difference between the two* (+) ≡ ⊕ *and* (-) ≡ ⊖ *Contents , in Energy-Form , and this in direction only* ← → *clockwise or anticlockwise , i.e. it is a meter of the difference between the two magnitudes .*

Energy *, motion , and* ***the reaction to the change of velocity-vector*** *, mass , are absolutely inseparable.*

B.. *How , The Energy from Chaos becomes Monad .*

1.. General :

It was shown [33-36] that Un-clashed Fragments through center O , consist the Medium-Field Material-Fragment →[± s²] = [MFMF] as base for all motions , and Gravity as force [∇i], while the clashed with the constant velocity ,$\bar{c}$, consist the Dark matter [± $\bar{c}$.s] and the Dark energy [$\bar{c}$.∇i] , or from → Breakages[± s² = ± (wr)²] and [∇i = 2(wr)²] where then become Waves { *Distance* ds = A A_E *is the Work embedded in monads and* ***it is what is vibrated , because for this is the angular velocity vector*** } with Vibrating equations of motion becoming ,

A → Particles, with Inherent Vibration ,
B → Gravity-field-energy, without Vibration
C → Dark-matter-energy constituents and as ,

A.. [±$\bar{v}$.s²] → Fermions and [$\bar{v}$.∇i] → Bosons ,
B.. [± s²] → [MFMF]= Field = ***The Chaos*** , and the binder , Field is [∇i] → ***is Gravity force*** ,
C.. [±$\bar{c}$.s²] → Dark matter , and the binder Gravity force [∇i] , [$\bar{c}$.∇i] → and Expanding Dark energy.
From above is seen that in , A *, and ,* C *, case* { *Energy as velocity ,* $\bar{v}$ *,* } *exists in the Discrete monads ,* ± $\bar{v}$.s² *and* ± $\bar{c}$.s² .
B *case , is the transportation of Energy , from Chaos to Material points* [+s² ↔ - s²]. The How ??

2.. The Kinetic - Energy in Material- Point [+s² ↔ - s²] and the Central Axial-Ellipsoid .

It was referred that the Constant and Critical-Energy-Quantity becomes from Stress , **σ** , between the two opposite Contents [⊕↔⊖] which in turn Produces velocity $\bar{v} = \frac{\sigma}{2}\left[1+\sqrt{5}\right]$ and $\bar{v}$ in turn the angular velocity $\bar{w}$ on ⊖ sphere of radius ,r, where $\bar{v}$= w.r , and consisting the Hidden-variable of this tiny *Content , which is a* **Self –Moving –Energy–System** . The circular Rotational-motion of this ⊕ Material-sphere on the ⊖ sphere , is as that of a Rigid-body . [57]
Following Euler-Lagrange classical-mechanics for the solution of equations in tautochrone-problem and Energy is expressed as a function of positions and velocities , i.e. *During Space-Energy-motion* exist ,

2.1. *Angular Velocity and Rotational Kinetic Energy .*

In Figure.14-3 and Figure.15 , ⊕ sphere is composed of (i) material-points A_i , of discrete mass m_i=1 rotating with velocity ,$\bar{v}_i$, about center-point ,O, of ⊖ sphere and angular velocity w_i and ,w, the angular velocity for the center of mass K . Mass m_i is constant ,m, at every point of ⊕ sphere.

In Mechanics , Kinetic-Torque is identity $\frac{d}{dt}[r\bar{v}]$ {=[$\frac{dr}{dt}\bar{v}$] +[$\bar{r}\frac{d\bar{v}}{dt}$] = [$\bar{v}\,\bar{v}$] + [$\bar{r}\frac{d\bar{v}}{dt}$]} = [$\bar{r}\frac{d\bar{v}}{dt}$] , and since

$\bar{v} = \frac{\sigma}{2}[1+\sqrt{5}]$ and $\frac{d\bar{v}}{dt} = \frac{d\sigma}{2}[1+\sqrt{5}]$ then $\frac{d}{dt}[r\bar{v}] = \frac{d}{dt}[r\frac{\sigma[1+\sqrt{5}]}{2}] = \frac{d}{dt}[\frac{r.\sigma[1+\sqrt{5}]}{2}] = [r.\overline{dw}] = [r.\ Force] = [r.F]$
Momentum $\bar{B} = [r.mv]$ and Moment $\bar{M} = [\ \bar{r}.\bar{F}\ ]$, so Moment $\rightarrow \bar{M} = [\ \bar{r}.\bar{F}\ ] = \frac{d\bar{B}}{dt}$, i.e.
The Moment $\bar{M}$ of the moving force $\bar{F}$, from a constant point ,O, is equal to the change of Momentum to , O center , and for (i) points ,

Rotational momentum is expressed as $\rightarrow \quad \bar{B} = \quad \Sigma[\ \bar{r_i}.\ m_i\bar{v_i}\ ]$
Rotational Velocity , is expressed as $\rightarrow \quad \bar{v_i} = [\ \bar{w}.\bar{r_i}\ ]$

From above equations is defined ,
a) the momentum of , ⊕ sphere as the Summation of linear momentum $m_i\bar{v_i}$ of material points A_i rotating about center ,O, and **b**) the velocity $\bar{v_i}$ for every point A_i related to angular velocity $\bar{w}$ of mass-center K , as ,

$\bar{B} = \Sigma m_i.\{\bar{r_i}.[\bar{w}.\bar{r_i}]\} = (\Sigma m_i.r_i^2)\bar{w} - \Sigma\,(m_i\,\bar{r_i}\,.\bar{w}\,\bar{r_i})$ ……….. (1)

The referred magnitudes m_i , $\bar{r_i}$ of the ⊕ sphere and center-point ,O, are fixed to ⊖ sphere.
Considering $\{\bar{B}$ and $\bar{w}\}$ as ***two rotating vectors*** $\{\ \bar{\rho}\ ,\ \bar{a}\ \}$ then , (1) becomes

$\bar{\rho} = (\Sigma m_i.r_i^2)\ \bar{a}\ - \Sigma(m_i\,\bar{r_i}\ .\ \bar{a}\,\bar{r_i})$ …….. (1a) , then ,
$\bar{\rho}^{\,\bar{a}} = (\Sigma m_i\ r_i^2)\ a^2 - \Sigma\ m_i(\bar{a}\bar{r_i})^2$

and since $\bar{a}\bar{r_i} = a.(\ \overline{a_o}\ \bar{r_i}\ )$ where $\overline{a_o}$ is the unit vector on radius $\bar{a}$ then ,
$\bar{\rho}^{\,\bar{a}} = a^2\,\Sigma m_i\ [\ r_i^2 - (\overline{a_o}\ \bar{r_i})^2\ ]$

The meaning of terms $\overline{a_o}$, $\bar{r_i}$, $\sqrt{r_i^2 - (\overline{a_o}\,\bar{r_i})^2}$ are shown , and the last one denotes the distance of point A_i from $\bar{a}$ axis , therefore $\bar{\rho}^{\,\bar{a}} = J_a.a^2$, where J_a is Moment of Inertia of ⊕ sphere and ,a, distance related to , $\bar{a}$, axis . Denoting as moment of inertia of ⊕ sphere to $(OKoK)$ Plane, the Sum of products of $m_i\bar{r_i}^2$, $\bar{r_i}$ perpendicular to , $(OKoK)$ plane then is , $\Sigma m_i.(\overline{a_o}\ \bar{r_i})^2 = J_{(a)}$
Considering rotating vectors $\{\bar{\rho},\bar{a}\}$ as in (1a) the changeable vectors $\{\bar{B},\bar{w}\}$ become
$\bar{B}\bar{w} = J_w w^2$ ………(2a) where $J_w =$ the moment of inertia to Instaneous axis of rotation .
Since also the *Rotational Kinetic Energy* $L = \frac{1}{2}J_a w^2$, then $\rightarrow \bar{B}\bar{w} = 2\,L$
In a three Dimensional Coordinate –System where $r_i^2 = x_i^2+y_i^2+z_i^2$

$(\Sigma m_i.r_i^2) = \Sigma m_i.(\ x_i^2+y_i^2+z_i^2\ )$ and $\Sigma m_i\ (y_i^2+z_i^2\ ) \equiv J_x$, $\Sigma m_i\ (z_i^2+x_i^2\ ) \equiv J_y$, $\Sigma m_i\ (x_i^2+y_i^2\ ) \equiv J_z$ ….(3)

where J_x , J_y , J_z are the moments of Inertia of, ⊕ sphere , on the three ,x,y,z axis and (3) to the three Planes , becomes $\rightarrow \ \Sigma m_i x_i^2 = J_{(x)}$, $\Sigma m_i y_i^2 = J_{(y)}$, $\Sigma m_i z_i^2 = J_{(z)}$ …………(3a) where $J_{(x)}$, $J_{(y)}$, $J_{(z)}$ are the moments of Inertia of, ⊕ sphere , to the three Planes , i.e. to the yz , zx , xy .
$\Sigma\ m_i.\,y_i z_i = J_{yz}$, $\Sigma\ m_i.\,z_i x_i = J_{zx}$, $\Sigma\ m_i.\,x_i y_i = J_{xy}$ …………(3b)
Magnitudes J_{yz} , J_{zx} , J_{xy} and the equivalent J_{yz} , J_{xz} , J_{yx} are the *Diverted-Moments* or Centrifugal to Planes (y)-(z) , (z)-(x) , (x)-(y) respectively .

$\Sigma\ m_i r_i^2 = \Sigma m_i\ (x_i^2+y_i^2+z_i^2) = J_p$ ………….(3c)

where J_p magnitude is the Polar-moment of Inertia to center , O . Equalities are proved as ,
$J_{(y)}+J_{(z)} = J_x$, $J_{(z)}+J_{(x)} = J_y$, $J_{(x)}+J_{(y)} = J_z$ and $J_x + J_y + J_z = 2\,J_p$ ……(3c) where x, y, z are projective of vector , $\bar{a}$, on coordinate axis and x_ρ , y_ρ , z_ρ those of vector $\bar{\rho}$.
Projective vectors of (1a) on , x , axis is holding $x_\rho = (\Sigma m_i\ r_i^2)\,x - \Sigma\ m_i\ x_i.\bar{a}\bar{r_i}$ and since $\bar{a}\bar{r_i} = xx_i + yy_i + zz_i$, then $\rightarrow x_\rho = x\,\Sigma m_i\ (r_i^2 - x_i^2\ ) - y\,\Sigma m_i\ x_i\ y_i - z\,\Sigma m_i\ x_i\ z_i$ and according to symbolism then $\rightarrow x_\rho = x.J_x - y.\,J_{xy} - z.\,J_{xz}$. Analogically to ,y, and ,z, axis exists,

$x_\rho = x.J_x - y.\,J_{xy} - z.\,J_{xz}$, , $y_\rho = -\,x.J_{yx} + y.\,J_y - z.\,J_{yz}$, $z_\rho = x.J_{zx} - y.\,J_{zy} + z.\,J_z$ ……..(4)

Working Analogous on $\overline{B}$, $\overline{w}$ vectors then ,

$B_1 = J_x w_1 - J_{xy} w_2 - J_{zx} w_3$, $B_2 = J_{xy} w_1 + J_y w_2 - J_{yz} w_3$, $B_3 = -J_{zx} w_1 - J_{yz} w_2 + J_z w_3$ ……..(4a)

where B_1 , B_2 , B_3 w_1 , w_2 , w_3 Projections of vectors $\overline{B}$,$\overline{w}$ on ,x,y,z, axis .

The equivalent to (1) equations define Torsional-momentum $\overline{B}(B_1,B_2,B_3)$ from angular velocity $\overline{w}(w_1 ,w_2 ,w_3)$, through the parameters J_x , J_y , J_z and through Tensor T , as ,

$$T = \begin{pmatrix} J_x & -J_{xy} & -J_{zx} \\ -J_{xy} & J_y & -J_{yz} \\ -J_{zx} & -J_{yz} & J_z \end{pmatrix}$$ and (4a) becomes $\overline{B} = T\overline{w}$

Equations (4) ,(4a) give a new relation between $\overline{\rho}^{\,\bar{a}}$, $\overline{B}\overline{w}$, and since $\overline{\rho}^{\,\bar{a}} = x_\rho x + y_\rho y + z_\rho z$ and $\overline{B}\overline{w} = B_1 w_1 + B_2 w_2 + B_3 w_3$ then $\overline{\rho}^{\,\bar{a}}$ $(=J_a a^2) = J_x\ x^2 + J_y\ y^2 + J_z\ z^2 - 2J_{yz}\ yz - 2J_{zx}\ zx - 2J_{xy}\ xy$ ...(5)

and $\overline{B}\overline{w}$ $(= Jw^2 = 2L) = J_x w_1^2 + J_y w_2^2 + J_z w_3^2 - 2(J_{yz} w_2 w_3 + J_{zx} w_2 w_1 + J_{xy} w_1 w_2)$ ……..(5a)

From equations (4a) , then (5a) becomes ,

$$\frac{\partial L}{\partial w_1} = B_1 \ , \quad \frac{\partial L}{\partial w_2} = B_2 \ , \frac{\partial L}{\partial w_3} = B_3 \quad \text{or} , \quad \overline{B} = \bar{\imath}\frac{\partial L}{\partial w_1} + \bar{\jmath}\frac{\partial L}{\partial w_2} + \bar{k}\frac{\partial L}{\partial w_3} \qquad \text{……....(5b)}$$

Considering a changeable radius $\bar{a}$ and constant the product $\overline{\rho}.\bar{a} = C$ = constant then equation (5)

$$\overline{\rho}^{\,\bar{a}} \ (=J_a a^2) = J_x\ x^2 + J_y\ y^2 + J_z\ z^2 - 2J_{yz}\ yz - 2J_{zx}\ zx - 2J_{xy}\ xy = C \qquad \text{…..……(6)}$$

Equation (6) defines a second degree surface , *Ellipsoid* , by the Radius-spearhead $\bar{a}$ and when ,

1… From (1a) and for any radius $\bar{a} = \infty$ then $\overline{\rho} = \infty$ also , therefore $\overline{\rho}\bar{a} = \infty$, although this product was considered as constant , $\overline{\rho}\bar{a} = C$.

2… This Inertial Ellipsoid of , ⊕ sphere is referred to O center , it is a body dependent on constant C

3… The ⊕ sphere is moving , then Inertial Ellipsoid is moving also because it a body .

From equation (6) $J_a a^2 = C$ and also (Σm_i). $i^2 a^2 = C$ therefore → $i = \frac{1}{a}\sqrt{\frac{C}{\Sigma m_i}}$ ……..(7)

i.e. *the rotational radius* ,i, *on* ,a, *radius is equal to the inverse value of this radius* ,i .

During displacement , $\delta\bar{a}(\delta x , \delta y , \delta z)$ on Ellipsoid , equation (6) is equal to zero so ,

$J_x x\ \delta x + J_y y\ \delta y + J_z z\ \delta z - J_{yz} y\ \delta z - J_{yz} z\ \delta y - J_{zx} z\ \delta x - J_{zx} x\ \delta z - J_{xy} x\ \delta y - J_{xy} y\ \delta x = 0$ and in case of radius $\bar{a}$ coincides with one of x,y,z, axis say ,x, then $y = z = 0$ and , $J_x x\ \delta x - J_{xy} x\ \delta y - J_{zx} x\ \delta z = 0$ and in case of radius $\bar{a}$ coincides with one of the principal axis of Ellipsoid where then $\delta x = 0$ then

$x\ (J_{xy} x\ \delta y + J_{xz}\ \delta z) = 0$ valuing for any variable , δy , δz and simultaneously $J_{xy} = J_{zx} = 0$.

Proceeding above logic for all principal axis then , The Centrifugal-moments are zero for any coordinate System on the Principal axis of Inertial-Ellipsoid and equations (4) become ,

$$x_\rho = x\ .J_1 \ , \ y_\rho = y\ .\ J_2 \ , \ z_\rho = z\ .\ J_3 \qquad \text{…..…..…(8)}$$

where , J_1 , J_2 , J_3 are the Moments of Inertia of Ellipsoid related to Principal axis , and so

$\overline{\rho} = \bar{\imath}\ J_1 x + \bar{\jmath}\ J_2 y + \bar{k}\ J_3 z$, ….(8a) $\overline{\rho}^{\,\bar{a}} = J_a.a^2 = J_1 x^2 + J_2 y^2 + J_3 z^2$, …….(8b)

and if a,b,c are the directional cosines of $\bar{a}$ then , $J_a = J_1\ a^2 + J_2 b^2 + J_3 c^2$ …….(8c)

and equation of Inertia $\overline{\rho}^{\,\bar{a}} = C$, becomes → $J_1 x^2 + J_2 y^2 + J_3 z^2 = C$, $\overline{B}\overline{w} = C$ ….. (8d)

Inserting restriction $\overline{B}\overline{w} = C$ in (5a) then we have the equation ,

$$J_x w_1^2 + J_y w_2^2 + J_z w_3^2 - 2(J_{yz} w_2 w_3 + J_{zx} w_3 w_1 + J_{xy} w_1 w_2) = C \qquad \text{…..(9)}$$

Equation (9) defines angular velocity , $\overline{w}$ (w_1 , w_2 , w_3) in all directions of constant, $\overline{B}\overline{w}$, *Therefore issues and for the Constant Kinetic-Energy* ,L, of ⊕ sphere {$\overline{B}\overline{w}$ = 2L} .

Equation (9) defines the same Ellipsoid as equation (6) **, i.e.**

Every radius of Inertial-Ellipsoid acquires meter , the angular velocity which ⊕ sphere must be rotated, so that kinetic energy remains constant and $\equiv \frac{1}{2}$ **C**

Because of above property Inertial-Ellipsoid coincides to Angular-Velocity-Ellipsoid.

The shape of ellipsoid does not change the motion of sphere because behaves as a Rigid-body.
Considering in (4a) coordinate axis the Principal axis of Ellipsoid , then

$B_1 = J_1 w_1$, $B_2 = J_2 w_2$, $B_3 = J_3 w_3$, …………(10) , therefore

$\overline{B} = \overline{\imath}\, J_1 w_1 + \overline{\jmath}\, J_2 w_2 + \overline{k}\, J_3 w_3$ and ($B^2 = J_1^{\,2} w_1^{\,2} + J_2^{\,2} w_2^{\,2} + J_3^{\,2} w_3^{\,2}$) ….…..(10a)

$\overline{B}\overline{w} = 2L = Jw^2 = J_1 w_1^{\,2} + J_2 w_2^{\,2} + J_3 w_3^{\,2}$ ……(10b)

The equation of Ellipsoid of Angular velocity becomes , $J_1 w_1^{\,2} + J_2 w_2^{\,2} + J_3 w_3^{\,2} = C$ ......(10a)

This Changeable relation between Angular – Velocity - Ellipsoid and Rotational - Momentum as in (1a) , allows equations of motion to coincide with those of the solid ⊕ Sphere .

Product $\overline{\rho}\ \overline{a}$ of (1a) variables $\overline{\rho}$ and $\overline{a}$ is constant defined in x,y,z coordinates of $\overline{a}$, and when defined in x_ρ , y_ρ , z_ρ coordinates by choosing Principal-axis of Inertial-Ellipsoid then

$x = \frac{1}{J_1} x_\rho$, $y = \frac{1}{J_2} y_\rho$, $z = \frac{1}{J_3} z_\rho$,

$\overline{\rho}\ \overline{a}$ ($= x_\rho x + y_\rho y + z_\rho z$) $= \frac{1}{J_1} x_\rho^{\,2} + \frac{1}{J_2} y_\rho^{\,2} + \frac{1}{J_3} z_\rho^{\,2}$ and considering $\overline{\rho}\ \overline{a} = C$

$\frac{1}{J_1} x_\rho^{\,2} + \frac{1}{J_2} y_\rho^{\,2} + \frac{1}{J_3} z_\rho^{\,2} = C$ …………….....(11)

Equation (11) consists another Ellipsoid with the same positions of Principal-axis .
The two surfaces of (8d),(11) are Interchangeable .
Considering $\overline{\rho_1}$, $\overline{a_1}$, $\overline{\rho_2}$, $\overline{a_2}$ as in (1) as radii vectors and as the equal (8a) then

$\overline{\rho_1} = \overline{\imath}\, J_1 x_1 + \overline{\jmath}\, J_2 y_1 + \overline{k}\, J_3 z_1$, $\overline{\rho_1} = \overline{\imath}\, J_1 x_2 + \overline{\jmath}\, J_2 y_2 + \overline{k}\, J_3 z_2$ and for

$\overline{a_1} = \overline{\imath}\, x_1 + \overline{\jmath}\, y_1 + \overline{k}\, z_1$, $\overline{a_2} = \overline{\imath}\, x_2 + \overline{\jmath}\, y_2 + \overline{k}\, z_2$, then become

$\overline{\rho_1}\ \overline{a_2} = J_1 x_1 x_2 + J_2 y_1 y_2 + J_3 z_1 z_2 = \overline{\rho_2}\ \overline{a_1}$ …………….....(12)

Considering two radii $\overline{\rho}$, $\overline{a}$ and their bordering $\overline{\rho} + \delta\overline{\rho}$, $\overline{a} + \delta\overline{a}$ with $\delta\overline{\rho}$, $\delta\overline{a}$ zero variations i.e. replacing $\overline{a_1}$,$\overline{a_2}$, $\overline{\rho_1}$, $\overline{\rho_2}$ of (12) with responding , $\overline{a_1}$, $\overline{a}+\delta\overline{a}$ and $\overline{\rho}$, $\overline{\rho}+\delta\overline{\rho}$ then $\overline{\rho}.\delta\overline{a} = \overline{a}\delta\overline{\rho}$..(12a) and because variable is not under restriction $\overline{\rho}\overline{a} = C$, then $\overline{\rho}.\delta\overline{a} + \overline{a}.\delta\overline{\rho} = 0$ ……….....(12b)

and from (12a),(12b) is concluded $\rightarrow \overline{\rho}\ \delta\overline{a} = 0$ and $\overline{a}\ \delta\overline{\rho} = 0$ …..…...(12c)

Condition $\overline{\rho}.\overline{a} = C$ defines as (1a) two surfaces : ***First-Surface*** is the end points of radii $\overline{a}$, of the Inertial Ellipsoid and the ***Second-surface*** is the end points of radii $\overline{\rho}$, for the changeable Ellipsoid as in (11). The two surfaces are joint through (12c) as in Figure.16-2.

Remarks :

1..Since radii $\overline{a}$ Surface , consist the Inertial-Ellipsoid , i.e***. the Reaction to the Angular-Velocity-Ellipsoid and which is the Mass of Space of the*** ⊕ **sphere** , so ***radii*** $\overline{\rho}$, consist the Changeable Momentum-Ellipsoid , i.e. ***the Angular-Velocity-Ellipsoid ,****monad* ***, which is the Energy in Sphere. This Ellipsoid is not conserved when in Principal-axis even in the absence of applied torques.***

2.. Since in radii $\bar{a}$ Surface , of *Inertial-Ellipsoid* due to Angular-Velocity corresponds the radii $\bar{\rho}$, perpendicular to ,$\delta\bar{a}$, vectors , therefore it is a ***Tangential-Plane of*** $\bar{a}$ ***Surface*** , on spearhead of $\bar{a}$.
3.. Since in radii $\bar{\rho}$ Surface , of *Energy-Ellipsoid* due to Angular-Velocity corresponds the radii $\bar{a}$, perpendicular to , $\delta\bar{\rho}$, vectors , therefore it is a ***Tangential-Plane of*** $\bar{\rho}$ ***Surface*** , on spearhead of $\bar{\rho}$.
4.. The two Ellipsoids that of , *Angular-velocity-Ellipsoid*, and that of , *Momentum≡Energyy-Ellipsoid* are Interchangeable , meaning that ***Energy*** ≡ ***Momentum from Chaos*** ≡ ***monad*** , sweeps out a cone centered on the Ecliptic-pole of Angular-velocity Ellipsoid as Spin in this tiny Energy-ellipsoid .
The Two magnitudes in the absence of Principal axis are both conserved .

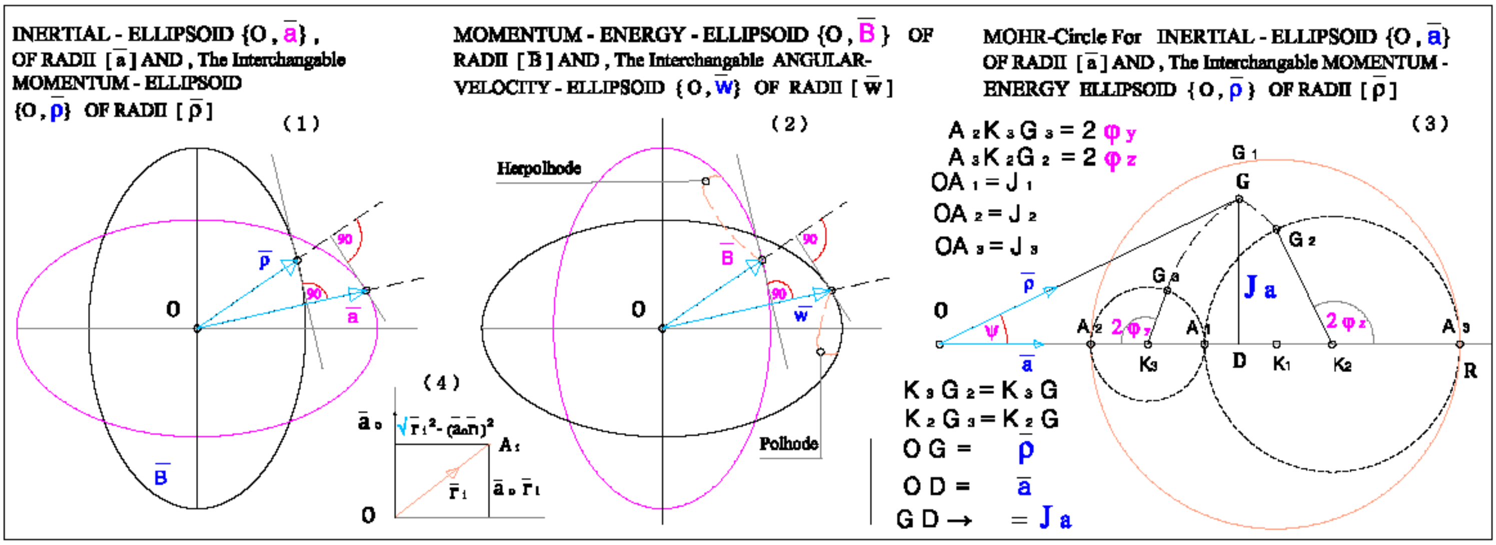


Figure.16.. In (4) is shown the Geometrical-meaning of $\overline{a_o}\ \overline{r_1}$ and $\sqrt{r_i^{\,2} - (\overline{a_o}\ \overline{r_1})^2}$ terms.
In (1) is shown the *Inertial - Ellipsoid* (O, $\bar{a}$) of Radii , $\bar{a}$, and the Interchangable Momentum – Ellipsoid (O , $\bar{\rho}$) of Radii , $\bar{\rho}$. (O , $\bar{\rho}$)
In (2) is shown the *Momentum - Energy - Ellipsoid* (O, $\bar{B}$) of Radii , $\bar{B}$, and the Interchangable Angular Velocity – Ellipsoid (O , $\bar{w}$) of Radii , $\bar{w}$.
In (3) is shown in Mohr-method , the Geometrical construction from the two Interchangable Ellipsoids → *The Energy – Rotational Momentum–Ellipsoid* (O , $\bar{\rho}$) , { ***Work*** } and the Angular-Velocity-vector -Unit-sphere → *The Inertial- Ellipsoid* (O , $\bar{a}$) , { ***Force*** } and the reaction to the velocity-change-motion → *The Mass - Ellipsoid* (GD=J_a≡$\bar{M}$) , { ***Mass*** }

The above property of the two Interchangable-Ellipsoids defines the deep relation between ,

The Angular-velocity-Ellipsoid → $J_1 w_1^{\,2} + J_2 w_2^{\,2} + J_3 w_3^{\,2} = 2L = C$ ……..(13) *and*
The Momentum-Energy-Ellipsoid → $\frac{1}{J_1}\,B_1^{\,2} + \frac{1}{J_2}\,B_2^{\,2} + \frac{1}{J_3}\,B_3^{\,2} = 2L = C$ …….(13a)

Above equation (13) Fig.14-2 defines that, in radii $\bar{w}$, Angular-Velocity of ⊕ **sphere** , corresponds Radii $\bar{B}$ of (13a) Fig.14-3 defining Rotational-Angular-Momentum from the common point , O, of ⊖ ***sphere*** . Radii $\bar{B}$ is perpendicular on spearhead $\bar{w}$ tangential-Plane , of the Angular-velocity-Ellipsoid and radii $\bar{w}$, is perpendicular on spearhead $\bar{B}$ tangential-Plane , of the Rotational - Momentum-Energy –Ellipsoid as in Figure 14-3.

It was shown in ***Material-Geometry*** [58] , that Velocity-vectors and that of light–velocity becomes from geometry as *expression of Lorentz factor ,γ, from* **sec φ** = γ = O$\mathbf{D_A}$: A$\mathbf{D_A}$= ± 1 / [√1 – (v/c)²].
It was accepted in (1a) that the correlated vectors , $\bar{\rho}$,$\bar{a}$ follow restriction $\bar{\rho}\bar{a}$ = constant C .
From Pythagoras theorem in Euclidean-geometry the equation of Unit-Sphere in a ,x,y,z, coordinate System is → $a^2 = x^2+y^2+z^2 = 1$ (14) , and in vector form , $\bar{a}\bar{a}$ = 1 . (14a)

5.. Let see variation ,*motion*, of , $\bar{\rho}$ vector-radii , to the corresponding vector-radii $\bar{a}$, as in (1a) under Premise → the spearhead $\bar{a}$, lies on Unit-Sphere as in (14)-(14a) ←
Choosing Principal axis as the coordinate system of Inertial-Ellipsoid , equalities of (8) are ,

$x = \frac{1}{J_1} x_\rho$, $y = \frac{1}{J_2} y_\rho$, $z = \frac{1}{J_3} z_\rho$ *and from* (14) *follows* $\frac{1}{J_1^2} x_\rho^2 + \frac{1}{J_2^2} y_\rho^2 + \frac{1}{J_3^2} z_\rho^2 = 1$ …...(15)

as equation of the surface on which , spearhead of radii $\bar{\rho}$ $(x_\rho , y_\rho , z_\rho)$, is displaced .
This surface is responding to (1a) Ellipsoid which semi-axis are the distances J_1 , J_2 , J_3 .
The geometrical meaning of this view is seen when in (2) is placed the relation $a^2 = 1$ and $\bar{\rho}\bar{a} = J_a$

i.e. The Orthogonal-Projection of , $\bar{\rho}$ radii on the corresponding $\bar{a}$ radii of Unit-Sphere , provides the meter of Moment of Inertia of , The Unit-Spheres which are monads **.**

Above conclusion demonstrates the method of Geometric-presentation of Sphere`s Moment of inertia to different axis through constant point O , and this because the Ellipsoid-radii -length acquires the Reciprocal meter-length of the corresponding Inertial-radii –Sphere-meter .

Mohr method impresses on Unit-Sphere , $\bar{a}$, the Projection of the Rotational-Momentum , $\bar{\rho}$, and finds the Inertial momentum J_a , i.e. in Unit-Energy-Sphere , Kinetic – Energy as Momentum , defines the Reaction to this Energy-motion .

6..For the center , K , of ⊕ sphere , issues $\overline{v_K} = [\ \bar{w}.\overline{r_K}\ ] = [\frac{\sigma[1+\sqrt{5}]}{2r}2r] = \sigma\,[1+\sqrt{5}]$ ......(a)
and $\bar{B} = [\bar{r}\ .\ m\bar{v}\ ] = [\ rm.\ \sigma(1+\sqrt{5})]$ and for m = 1 then $\bar{B} = [\ r\,\sigma\,(1+\sqrt{5})\ ]$ ....(b)
Interchangable Ellipsoids of Angular velocity (13) , and Momentum (13a) for the same Moment of Inertia $J_1 = J_2 = J_3 = J$, Angular Velocity $w_1= w_2= w_3=w$, and Momentum $B_1=B_2=B_3= B$ become $3J\,w^2 = C$ and $3B^2/J = C$ and since for circle $J = \frac{\pi r^4}{4}$ then $\frac{3\pi r^4}{4}w^2 = C = (\frac{3\pi r2}{4})\,w^2 =$
$(\frac{3\pi r^2}{4})(rw)^2 = (\frac{3\pi r^2}{4})[\frac{\sigma}{2}\,(1+\sqrt{5})]^2 = \frac{3\pi r^2.\sigma^2}{8}[3+\sqrt{5}]$ → ***The Ellipsoid of Angular velocity*** $\bar{\mathbf{a}}$ …….(c)

and $3B^2/J = \frac{3(rmv)^2}{J} = \frac{3(rv)^2}{J} = \frac{3r^2.\sigma^2[3+\sqrt{5}]}{2}(\frac{4}{\pi r^4}) = \frac{6.\sigma^2[3+\sqrt{5}]}{\pi r^2}$ → ***The Momentum-Ellipsoid*** $\bar{\boldsymbol{\rho}}$ …….(d)
Equations (c),(d) define the two interchangeable Ellipsoids related to Sphere-radius , r , Stress , σ .
The what is measured in Material point is the Momentum Ellipsoid , which is soon proved that is the Spin of particles. The mass of the M-P , i.e. *the reaction to the change of velocity*, is proved to be the Inertia of the cave . From equation $3J\,w^2 = C$, is seen that in Material point *Moment of Inertia* and *Angular velocity* are two interchangeable magnitudes defining the *Space part* , $J = \frac{\pi r^4}{4}$ and the *Energy part* , $w = \frac{v}{r} = \frac{\sigma}{r}[1+\sqrt{5}]$, depending on radius ,**r**, of the cave and on Principal Stress ,**σ**, of the two opposite constituents ⊖ , ⊕ , of the cave .

2.2. *Mohr - circle , method* :

1.. On OR straight-line and from initial point ,O, sectors OA_1 , OA_2 , OA_3 are taken equal to J_1 , J_2 , J_3 respectively .
2.. On diameters A_2A_3 , A_3A_1 , A_1A_2 are drawn semicircles with K_1 , K_2 , K_3 centers .
3.. Let angles φ_y , φ_z , be the , $\bar{a}$ vector to , y , z , axis , and draw the circles K_3G_3 , K_2G_2 from K_3 , K_2 centers forming to K_3A_2 , K_2A_3 , angles $2\varphi_y$, $2\varphi_z$.

4.. Draw the circles G_3G , G_2G , with centers K_2 , K_3 and G their intersection .

5.. Vectors , **OG** define the Magnitude of , $\bar{\boldsymbol{\rho}}$, *Rotational -Momentum-Energy -Ellipsoid vector* , **OD** define the Magnitude of , $\bar{\mathbf{a}}$, *Angular-Velocity-Radius-spearhead-Ellipsoid vector* , with angle , ψ = GOR = GOD , between $\bar{\rho}$ and $\bar{a}$ vectors ,

GD define the Magnitude of , $\bar{\mathbf{M}} = \mathbf{J_a}$, which is *The meter of the Change = Reaction* , *the Orthogonal-projective of* $\bar{\rho}$ Radii to $\bar{a}$ Radii , of the Unit-sphere , and which consists the moment of inertia of Sphere , i.e. that what we call , ***mass*** , in Classical mechanics .

Remarks :

Moment of inertia , $J_{(a)}$, of a perpendicular to $\bar{a}$ Plane passing through O is used Ellipsoid (1a) from relation $\bar{\rho} = \Sigma\,(m_i\,\bar{r_i}\,.\,\bar{a}\,\bar{r_i})$ ……………. (16) , and for $\bar{\rho}\,\bar{a} = \Sigma\, m_i(\bar{a}\,\bar{r_i}\,)^2 = \bar{a}^{\,2} J_{(a)}$ and if $\bar{a}(\,x\,,y\,,z\,)$ defines the Unit-Sphere-Radii , then $\bar{\rho}\bar{a} = J_{(a)}$ Equations in (4) become ,

$$x_\rho = J_{(x)}\,x + J_{xy}\,y + J_{zx}\,z\,,\; y_\rho = J_{xy}\,x + J_{(y)}\,y + J_{yz}\,z\,,\; z_\rho = J_{zx}\,x + J_{yz}\,y + J_{(z)}\,z \quad \text{….. (16a)}$$

and when defining the Principal-axis $J_{xy} = J_{yz} = J_{zx} = 0$ as coordinate axis for Ellipsoid then ,

$$x_\rho = J_{(1)}\,x\,,\quad y_\rho = J_{(2)}\,y\,,\quad z_\rho = J_{(3)}\,z \quad \text{……………….. (16b)}$$

and the Perpendicular *Ellipsoid* becomes , $\frac{1}{J_{(1)}{}^2} x_\rho{}^2 + \frac{1}{J_{(2)}{}^2} y_\rho{}^2 + \frac{1}{J_{(3)}{}^2} z_\rho{}^2 = 1$ ..….. (16c)

Mohr method is applied for sectors OA_1 , OA_2 , OA_3 and are equal to $J_{(1)}$, $J_{(2)}$, $J_{(3)}$, which are the moments of Inertia to Principal-Planes .

1.. Angle , ψ = GOD = 0 → defines $\bar{\rho} \equiv \bar{a}$ and , $\bar{M} = J_a \equiv 0$, meaning that Energy-Momentum-Ellipsoid , $\bar{\rho}$, coincides with that of Angular-Velocity-Ellipsoid vector , $\bar{a}$, and the Velocity-Reaction-Ellipsoid $\bar{M} = J_a \equiv 0$

2.. Angle , ψ = GOD = 90° → defines $\bar{\rho} \equiv \bar{M}$ and , $\bar{a} \equiv 0$, meaning that Energy-Momentum-Ellipsoid , $\bar{\rho}$, coincides with that of Velocity- Reaction-Ellipsoid $\bar{M}$.

Since Work $\bar{W} = \bar{F}.\overline{ds} = (\,F.\cos\psi\,).\overline{ds} = F\,.\,(\overline{ds}.\,\cos\psi)$, then Force , F , defines the ***Kinetic-Energy*** ≡ ***Energy*** , and Displacement ($\overline{ds}$. cos ψ) defines the ***Discrete-Monad*** ≡ ***Space*** which represent the two magnitudes , $\bar{\rho}$ and $\bar{a}$ i.e. → $\bar{\mathbf{W}} \equiv \bar{\boldsymbol{\rho}}$ *and* $(\overline{\mathbf{ds}}.\,\mathbf{cos}\,\boldsymbol{\psi}) \equiv \bar{\mathbf{a}}$.

In trigonometry $\cos\psi = -\,\cos(90+\psi) = \sin(90-\psi)$, so from figure , $\sin(90-\psi) = GD$, i.e. ***in Extrema case*** , where Space = ($\overline{ds}$. cos ψ)=0 , Kinetic-Energy does not vanish since then holds $\bar{W} = \bar{F}$ = Constant = GD = J_a = *The reaction to the velocity-motion = The Mass-Ellipsoid* = M

3.. Angle , ψ = GOD ≇ 0 → defines $\bar{\rho} \ncong \bar{a} \ncong M \ncong 0$, meaning that exist the magnitudes ,

Rotational-Momentum Ellipsoid ≡ Work ≡ $\bar{\rho}$, → ***the Energy-vector***
Angular-Velocity–Inertial-Ellipsoid ≡ Force ≡ $\bar{a}$, → ***the Space - vector***
Reaction to velocity-change-motion ≡ Mass- scalar M ≡ J_a , → ***the Mass – meter***

i.e. The three meters of ***Energy-monads*** *, which are* ***the Energy-vectors*** *and* ***the Mass –meter*** .

It was shown in [58] *that the maximum velocity in a closed system occurs in Common circle , when the two velocities ,* $\bar{c}$ *,* $\bar{v}$ *are perpendicular between them , and not producing Work , from where then dispersion follows Pythagoras theorem and the resultant Quantized linear Space length ,r, becomes , as the Resultant of Energy Vectors ,* $r = |(\bar{c}.T)| = \sqrt{v^2 + c^2}$ *and by using Space Vector* $r = |(\bar{c}.T)| = \sqrt{v^2 + c^2}$ *then , The total Rotating energy is* →

$\pm\ \overline{\Lambda}\ =\ \overline{\mathrm{p}}.\mathrm{r} = (\mathrm{M.c}).\mathrm{r} = (\mathrm{M.c}).\sqrt{\mathrm{v}^2+\mathrm{c}^2}$ *and squaring both sites then ,*

$[\pm\ \overline{\Lambda}\ ]^2 = \mathrm{p}^2.\mathrm{r}^2 = \mathrm{M}^2.\mathrm{c}^2.(\mathrm{v}^2+\mathrm{c}^2) = (\mathrm{M}^2.\mathrm{v}^2).\mathrm{c}^2 + \mathrm{M}^2.\mathrm{c}^4 = (\mathrm{p}^2.\mathrm{c}^2) + \mathrm{M}^2.\mathrm{c}^4 = [\ \mathrm{p.c}\ ]^2 + [\ \mathrm{m_o}.\mathrm{c}^2\ ]^2$….(c)

*The Geometrical-analogous happens in Figure.*14.-3 *where according to Pythagoras-theorem holds ,*

$$(\ \overline{\rho}\ )^2 + (\ \overline{\mathrm{a}}\ )^2 = (\ \overline{\mathrm{M}} = \mathrm{J_a}\ )^2 \qquad \text{.........(d)}$$

Equations (a) and (b) are Identical in Energy-Space content and define ,

[Work ≡ Energy ≡ Torsional-momentum] ^{2} = [Moving-Space-Energy] ^{2} + [Rest-Space-Energy] ^{2}.

2.3. *Second-degree Moments in Sphere and Planes* :

Considering Density of ⊕ sphere the same for the (i) points then mass $\mathrm{m_i}$ at every point is (m) for the tiny volume ,dV, and the different elements become , m.dV , and for m=1 ,dV, and for Plane ,dF. Placing x=0 in (5) and $\overline{\mathrm{a}}$ in ,yz, Plane , then $\mathrm{J_a\, a^2 = J_y\, y^2 + J_z\, z^2 - 2J_{yz}\, yz}$ ………….. (17)

or $\mathrm{J_a} = \mathrm{J_y}\ \cos^2\varphi + \mathrm{J_z}\ \sin^2\varphi\ -2\ \mathrm{J_{yz}}\ \cos\varphi.\sin\varphi$ ………….. (17a)

where φ , is the angle of $\overline{\mathrm{a}}$ radii to , y axis , and give the moment of inertia $\mathrm{J_a}$ of the Sphere to the axis on Plane through initial point , O , of rotation . In case that coordinate axis coincide with the Principal axis then equations (17) and (17a) become , ,

$\mathrm{J_a\ a^2 = J_2\ y^2 + J_3\ z^2}$ ……….. (17b) and $\mathrm{J_a} = \mathrm{J_2}\ \cos^2\varphi + \mathrm{J_3}\ \sin^2\varphi$ …….. (17c)

Equations denote Moment of inertia for all Planes to axis on Planes , and in case of Plane surfaces the Inertia-Ellipsis which is $\mathrm{J_2\ y^2 + J_3\ z^2 = C}$ ……..….. (18)

2.4. *Euler-Lagrange , equations of motion* :

I.. For the positioning of a rotating Solid around a Fixed-Point O , with a three coordinate system x,y,z at ,O , is chosen a second three coordinate system x\`, y\`, z\` at , O , joint to the moving solid and rotated to O . Its position define the nine -(9) Directional-cosines of the axis i.e. the products , $\overline{\mathrm{ı̀ı}}$, $\overline{\mathrm{ȷ̀ȷ}}$, $\overline{\mathrm{k̀k}}$. The six identities joining cosines , degrade the six to three parameters and Solid acquires Three-degrees-of freedom around the fix point O. Euler-method-System is consisted of three parameters which are the three angles between axis .

Let be Unit-vector $\overline{\mathrm{s_o}}$ on x y - x\`y\` Planes section , such that system ($\overline{\mathrm{k̀}}$, $\overline{\mathrm{k}}$, $\overline{\mathrm{s_o}}$) is right-turned . Euler angles are in Figure.17-(1) , *Angle ,φ,* for, $\overline{\mathrm{ı̀}}$ to $\overline{\mathrm{s_o}}$ axis , *Angle ,ϑ* , for, $\overline{\mathrm{k̀}}$ to $\overline{\mathrm{k}}$ axis and *Angle , ψ* , for, $\overline{\mathrm{s_o}}$ to $\overline{\mathrm{ı}}$ axis . Angles φ ,ϑ , ψ , follow the Right-hand-rule-direction along the axis $\overline{\mathrm{k̀}}$, $\overline{\mathrm{s_o}}$,$\overline{\mathrm{k}}$, of rotation respectively . Angle φ , defines the position of $\overline{\mathrm{s_o}}$ section in , x\` , y\` plane . On perpendicular to $\overline{\mathrm{s_o}}$ plane angle ,ϑ , defines the position of ,z, axis while on perpendicular to z , plane angle , ψ , defines the position of ,x, axis . In this way angles φ ,ϑ , ψ , define the position of the moving-system , x , y , z related to the fixed , x\` , y\` , z\`.

The Directional-cosines $\overline{\mathrm{ı̀ı}}$, $\overline{\mathrm{ȷ̀ȷ}}$, $\overline{\mathrm{k̀k}}$,of $\overline{\mathrm{ı}}$, $\overline{\mathrm{ȷ}}$, $\overline{\mathrm{k}}$ axis related to $\overline{\mathrm{ı̀}}$, $\overline{\mathrm{ȷ̀}}$, $\overline{\mathrm{k̀}}$, axis is done by the displacement of , x , y , z system , from $\overline{\mathrm{ı̀}}$, $\overline{\mathrm{ȷ̀}}$, $\overline{\mathrm{k̀}}$ position to , $\overline{\mathrm{ı}}$, $\overline{\mathrm{ȷ}}$, $\overline{\mathrm{k}}$, in three stages as ,

1.. By rotating on $\overline{\mathrm{k̀}}$ axis , according to , φ , angle , such that ,x, axis moves from $\overline{\mathrm{ı̀}}$ to the $\overline{\mathrm{s_o}}$ position where then issue as in F.17- (2) the equalities ,

$\overline{\mathrm{s_o}} = \overline{\mathrm{ı̀}}.\cos\varphi + \overline{\mathrm{ȷ̀}}.\ \sin\varphi$ and $\overline{\mathrm{q_o}} = -\ \overline{\mathrm{ı̀}}.\sin\varphi + \overline{\mathrm{ȷ̀}}.\ \cos\varphi$ …………..….. (a)

where $\overline{\mathrm{q_o}}$ index is perpendicular to $\overline{\mathrm{k̀}}$, and { $\overline{\mathrm{s_o}}$ and $\overline{\mathrm{q_o}}$ } , { $\overline{\mathrm{k̀}}$ and $\overline{\mathrm{s_o}}$ } , Right-hand-rule direction system .

2.. By rotating on $\overline{\mathrm{s_o}}$ axis , according to , ϑ , angle , such that ,z, axis moves from $\overline{\mathrm{k̀}}$ to the $\overline{\mathrm{k}}$ position where then issue as in F.17- (3) the equalities ,

$\overline{\mathrm{t_o}} = \overline{\mathrm{k̀}}.\sin\vartheta + \overline{\mathrm{q_o}}.\cos\vartheta$ and $\overline{\mathrm{k}} = \overline{\mathrm{k̀}}.\cos\vartheta - \overline{\mathrm{q_o}}.\sin\vartheta$ …………..….. (b) where $\bar{t_o}$ index is perpendicular to $\bar{k}$, and { $\bar{s_o}$ and $\bar{t_o}$ } , { $\bar{k}$ and $\bar{s_o}$ } , Right-hand-rule direction system .

3.. By rotating on $\bar{k}$ axis , according to , ψ, angle , such that ,x, axis moves from $\bar{s_o}$ to the $\bar{\imath}$ position where then issue as in F.17- (4) the equalities ,

$$\bar{\imath} = \bar{s_o} . \cos\psi + \bar{t_o} \sin\psi \quad \text{and} \quad \bar{\jmath} = - \bar{s_o}. \sin\psi + \bar{t_o} \sin\psi \qquad \text{…………..….. (c)}$$

Thus axis ,z, and ,x, arrive to { $\bar{k}$, $\bar{\imath}$ } final positions carrying the (x,y,z) Solid to ($\bar{\imath}$, $\bar{\jmath}$, $\bar{k}$) Position , and if between equalities (a) (b) (c) delete Unit-vectors $\bar{s_o}$, $\bar{q_o}$, $\bar{t_o}$, by placing in (b) , the ($\bar{q_o}$ } of (a) and then in (c) the { $\bar{s_o}$ and $\bar{t_o}$ } of (a) (b) , then acquire expression of equations in $\bar{\imath}, \bar{\jmath}, \bar{k}$ from those of $\bar{\imath}`, \bar{\jmath}`, \bar{k}`$ *and* of angles , φ ,ϑ , ψ . The Directional-cosines are

$$\begin{aligned}
\overline{\imath`\imath} &= \cos a_1 == \cos\varphi.\cos\psi - \sin\varphi.\cos\vartheta.\sin\psi \\
\overline{\imath`\jmath} &= \cos a_2 == - \cos\varphi.\sin\psi - \sin\varphi.\cos\vartheta.\cos\psi \\
\overline{\imath`k} &= \cos a_3 == \sin\varphi.\sin\vartheta. \\
\overline{\jmath`\imath} &= \cos b_1 == \sin\varphi.\cos\psi + \cos\varphi.\cos\vartheta.\sin\psi \qquad \text{…………..….. (d)} \\
\overline{\jmath`\jmath} &= \cos b_2 == - \sin\varphi.\sin\psi + \cos\varphi.\cos\vartheta.\cos\psi \\
\overline{\jmath`k} &= \cos b_3 == - \cos\varphi.\sin\vartheta \\
\overline{k`\imath} &= \cos c_1 == \sin\vartheta.\sin\psi \\
\overline{k`\jmath} &= \cos c_2 == \sin\vartheta.\cos\psi \\
\overline{k`k} &= \cos c_3 == \cos\vartheta
\end{aligned}$$

II.. For the rotation of a Solid with ,**w**, angular velocity is used the following equation ,

$$\bar{w} = \bar{k`} \frac{d\varphi}{dt} + \bar{s_o} \frac{d\vartheta}{dt} + \bar{k} \frac{d\psi}{dt} . \qquad \text{………..….. (19)}$$

composed of ***one*** Rotation , *around* , z`, *axis with angular velocity* $\frac{d\varphi}{dt}$, ***a second*** , *around* , $\bar{s_o}$, *axis with angular velocity* $\frac{d\vartheta}{dt}$, and ***a third*** , *around* , z , *axis with angular velocity* $\frac{d\psi}{dt}$.
Since is needed Angular-velocity , $\bar{w}$, tobe related to the Fix to Solid directions of x , y , z , axis then the three components w_1 , w_2 , w_3 of vector $\bar{w} = \bar{\imath}\, w_1 + \bar{\jmath}\, w_2 + \bar{k}\, w_3$ are related to angles , φ ,ϑ , ψ , and to angular velocities $\frac{d\varphi}{dt}$, $\frac{d\vartheta}{dt}$, $\frac{d\psi}{dt}$.

Projecting (19) on $\bar{\imath}$, $\bar{\jmath}$, $\bar{k}$ axis then become the equations ,

$$\begin{aligned}
w_1 &= \bar{w}.\bar{\imath} = \frac{d\varphi}{dt}. \overline{k`\imath} + \frac{d\vartheta}{dt}. \overline{s_o\imath} + \frac{d\psi}{dt} .\overline{k\imath} \\
w_2 &= \bar{w}.\bar{\jmath} = \frac{d\varphi}{dt}. \overline{k`\jmath} + \frac{d\vartheta}{dt}. \overline{s_o\jmath} + \frac{d\psi}{dt}. \overline{k\jmath} \qquad \text{……….. (19a)} \\
w_3 &= \bar{w}.\bar{k} = \frac{d\varphi}{dt}. \overline{k`k} + \frac{d\vartheta}{dt}. \overline{s_o k} + \frac{d\psi}{dt}. \overline{kk}
\end{aligned}$$

and since holds , $\overline{kk} = 1$, $\overline{k\imath} = \overline{k\jmath} = \overline{ks_o} = 0$, $\bar{s_o}.\bar{\imath} = \cos\psi$, $\bar{s_o}.\bar{\jmath} = - \sin\psi$

then from (d) exists $\overline{k`\imath} == \sin\vartheta \sin\psi$ , $\overline{k`\jmath} = \sin\vartheta \cos\psi$, $\overline{k`k} = \cos\vartheta$

and replacing above to (19a) then become Euler equations ,for Angular-Velocity-components ,

$$\begin{aligned}
w_1 &= \frac{d\varphi}{dt} \sin\vartheta \sin\psi + \frac{d\vartheta}{dt} \cos\psi \\
w_2 &= \frac{d\varphi}{dt} \sin\vartheta \cos\psi - \frac{d\vartheta}{dt} \sin\psi \qquad \text{……….. (20)} \\
w_3 &= \frac{d\varphi}{dt} \cos\vartheta + \frac{d\psi}{dt}
\end{aligned}$$

which are related to the three angles , φ ,ϑ , ψ of rotation.

III. Euler equations , for Angular-Velocity $\overline{w}$ and Momentum $\overline{B}$:

In (10)-(10a) Angular-velocity-Ellipsoid and Momentum $\overline{B}$ are simplified when defined by the projections of, w_1 , w_2 , w_3 and B_1 , B_2 , B_3 as ,

$$B_1 = J_1 w_1 \ , \quad B_2 = J_2 w_2 \ , \quad B_3 = J_3 w_3 \ ,$$

$$\overline{B} = J_1 w_1 \bar{\imath} + J_2 w_2 \bar{\jmath} + J_3 w_3 \bar{k} \qquad \text{………..} (10)$$

$$B^2 = J_1{}^2 w_1{}^2 + J_2{}^2 w_2{}^2 + J_3{}^2 w_3{}^2 \qquad \text{………..} (10a)$$

$$\overline{Bw} = Jw^2 \ (= 2L\ ) = J_1{}^2 w_1{}^2 + J_2{}^2 w_2{}^2 + J_3{}^2 w_3{}^2 \qquad \text{………..} (10b)$$

Placing Momentum-equation (10a) in equation $\frac{d\overline{B}}{dt} = \overline{M} = \bar{\imath}\ M_1 + \bar{\jmath}\ M_2 + \bar{k}\ M_3$ then ,

$$\bar{\imath} J_1 \frac{dw_1}{dt} + \bar{\imath} J_2 \frac{dw_2}{dt} + \bar{\imath} J_3 \frac{dw_3}{dt} + \frac{d\bar{\imath}}{dt} J_1 w_1 + \frac{d\bar{\jmath}}{dt} J_2 w_2 + \frac{d\bar{k}}{dt} J_3 w_3 = \bar{\imath}\ M_1 + \bar{\jmath}\ M_2 + \bar{k}\ M_3 =$$

$= \ \overline{M} = \bar{\imath}\ M_1 + \bar{\jmath}\ M_2 + \bar{k}\ M_3$ where M_1 , M_2 , M_3 are the Momentum-components .

Since from vector-calculus ,

$$\frac{d\bar{\imath}}{dt} = [\ \overline{w}\ \bar{\imath}\ ] = \bar{\jmath} w_3 - \bar{k} w_3 \ , \quad \frac{d\bar{\jmath}}{dt} = [\ \overline{w}\ \bar{\jmath}\ ] = \bar{k} w_1 - \bar{\imath} w_3 \ , \quad \frac{d\bar{k}}{dt} = [\ \overline{w}\ \bar{k}\ ] = \bar{\imath} w_2 - \bar{\jmath} w_1 \ , \text{ then}$$

$$J_1 \frac{dw_1}{dt} - (\ J_2 - J_3\ ).\ w_2 w_3 = M_1$$

$$J_2 \frac{dw_2}{dt} - (\ J_3 - J_1\ ).\ w_3 w_1 = M_2 \qquad \text{………..} (21)$$

$$J_3 \frac{dw_3}{dt} - (\ J_1 - J_2\ ).\ w_1 w_2 = M_3$$

Equations (21) are differential equations of the first order when external moments are given related to time and define ***Angular-velocity-components*** { w_1 , w_2 , w_3 } and the ***Position*** { φ ,ϑ , ψ } from (20) . If moment $\overline{M}$ is given related to position only , then w_1 , w_2 , w_3 } are placed in (21) where then position is produced by differential equations of second order .

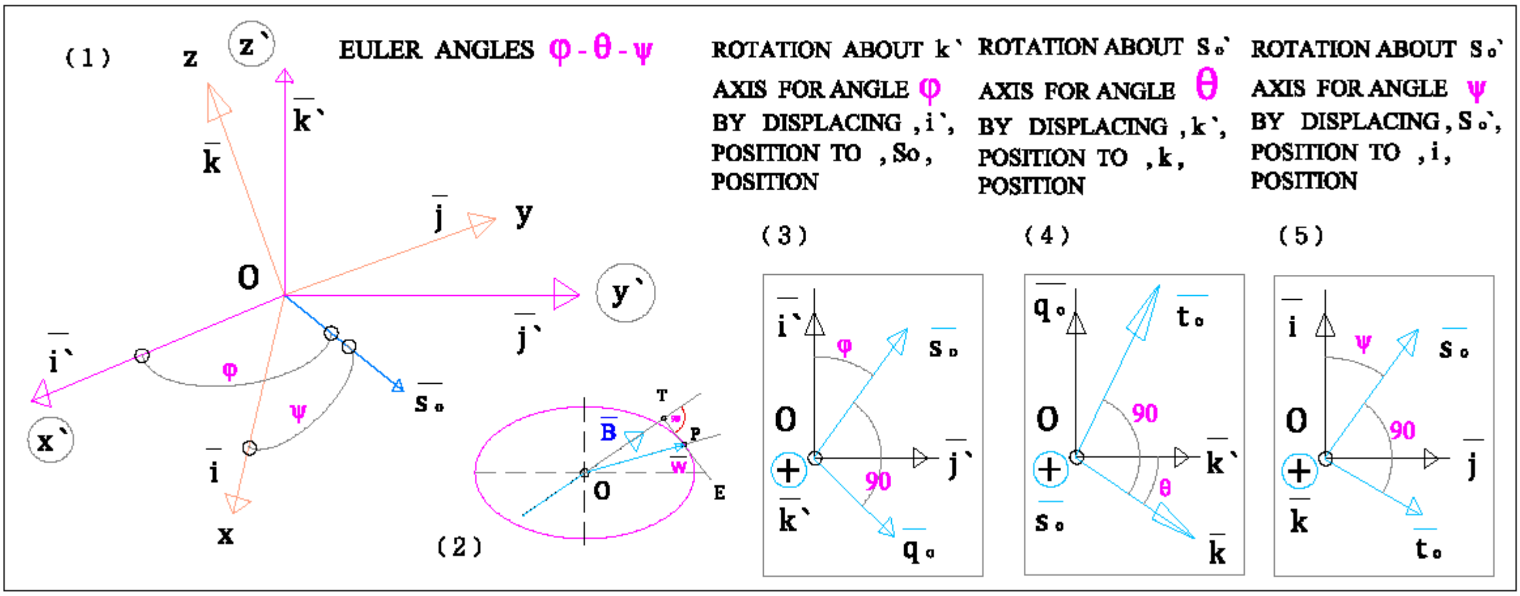


Figure.17. . In (1) are shown Euler angles { φ ,ϑ , ψ } in a *Fix*-Three-Coordinate-System x , y , z through ,O, and one *Movable* x`, y`, z` at , O .
In (2) is shown the Spearhead , P , of OP Angular-velocity $\overline{w}$ vector , and the Tangential Plane ,E ,to Angular-velocity-Ellipsoid $\overline{w}$, on Momentum vector OT = $\frac{2L}{B}$

In (3) , (4) , (5) are shown the Three-Stages nedded for transforming $\bar{\imath}`$ , $\bar{\jmath}`$, $\bar{k}`$, axis to the $\bar{\imath}$, $\bar{\jmath}$, $\bar{k}$ axis .

IV. Zero Static - Moment :

For $\bar{M}$=0 , i.e. the Solid is supported through center of mass and then Euler equations become ,

$$J_1 \frac{dw_1}{dt} - (J_2 - J_3).\, w_2 w_3 = M_1 = 0$$
$$J_2 \frac{dw_2}{dt} - (J_3 - J_1).\, w_3 w_1 = M_2 = 0 \qquad \text{.......... (21a)}$$
$$J_3 \frac{dw_3}{dt} - (J_1 - J_2).\, w_1 w_2 = M_3 = 0$$

and for rotation through Principal axis of Inertial-Ellipsoid [for ,z, axis $w_1 = w_2 = 0$] then
w_1 =constant (= 0) w_2 =constant (= 0) w_3= constant

i.e. rotation is continued through this axis with constant angular velocity $\bar{w} = \frac{\bar{v}}{r} = \frac{\sigma}{2r} [1 + \sqrt{5}]$ ***of that of material-point and the three axis are called Free-axis*** .

V.. The Poinsot`s Geometrical-motion :

I.. Multiplying the first equation of (21a) by w_1 , the second by w_2 , and the third by w_3 , and adding each other then , Static-Moment $\bar{M}$ is ,

$$J_1 w_1 \frac{dw_1}{dt} + J_2 w_2 \frac{dw_2}{dt} + J_3 w_3 \frac{dw_3}{dt} = 0$$
$$\frac{1}{2} J_1 {w_1}^2 + \frac{1}{2} J_2 {w_2}^2 + \frac{1}{2} J_3 {w_3}^2 = \text{constant} \qquad \text{.......... (21b)}$$

i.e. for $\bar{M} = 0$, kinetic energy $\frac{\partial B}{dt}$ = constant , as in (10b).

Also multiplying the first equation of (21a) by $J_1 w_1$, the second by $J_2 w_2$, and the third by $J_3 w_3$, and adding each other then , Rotational-Moment $\bar{B}$ is ,

$$ {J_1}^2 w_1 \frac{dw_1}{dt} + {J_2}^2 w_2 \frac{dw_2}{dt} + {J_3}^2 w_3 \frac{dw_3}{dt} = 0$$
$$ {J_1}^2 w_1 + {J_2}^2 w_2 + {J_3}^2 w_3 = \text{constant} \qquad \text{........... (21c)}$$

i.e. for $\bar{M} = 0$, Rotational-momentum $\bar{B}$ = constant , as in (10b).

As Kinetic energy cannot be changed , the same also for Momentum $\bar{B}$ which is constant .

The Tangential Plane E , of Angular-velocity-Ellipsoid $\bar{w}$ Spearhead point P , on Momentum vector OT , remains unmoving and this because ,

a.. Plane E , is perpendicular to the unmovable Momentum-vector $\bar{B}$,

b.. Cuts the constant sector OT = $\bar{w}\bar{b}o$, where $\bar{b}o$ is the Unit-vector on momentum $\bar{B}$,

and this because $\bar{w}\bar{b}o = \frac{\bar{w}\bar{B}}{B} = \frac{2L}{B}$ = constant , therefore

Angular-velocity-Ellipsoid ***is Rolling on the unmovable plane*** **E** , *the point of conduct* **P** *lyies on* OP *axis , has zero velocity , and aquires* OT *distance such Geometry positions from* O *for the unmovable plane* E , *to remain unchanged* , always by following the Solid`s-motion .

Some points of the moving Ellipsoid , which are common to unmovable E , plane , define the each one rotating axis , and are those which are of equal distance Tangential-Planes from center O .

This geometrical locus on Ellipsoid is called *Polar-axis* , ***the Polhode*** , while on Plane E , the *Unti-Polar-axis* , ***the Herpolhode*** , ***on where Vector-radius*** $\bar{w}$ is tracing the , *Polar-axis* on the moving-solid and the , *Unti-Polar-axis* on the Fix-system .

Remarks :

Applying above to Material-Points [⊕↔⊖] of Figure.12 then all referred are becoming ,and since , between the two consituents , exists only Pressure , σ , which is turned to velocity , $\bar{v}$, no other External forces exist to create any Moment to the initial point **O** of rotation .
Because of Zero-Moment , the motion of the , ⊕ , ***Content , is the only motion ,*** w ***, and it is the Rolling of the Angular-Velocity-Ellipsoid , on Plane , E ,*** (*the Polar-axis* on the *Unti-Polar-axis or the , Polar-Plane on the Unti-Polar plane*) , *Polhode on Herpolhode , where ,*
Momentum-Ellipsoid , $\bar{\mathbf{B}}$ ***,*** is perpendicular to ***, Angular -velocity-Ellipsoid ,*** $\bar{\mathbf{w}}$ ***,*** which Planes are both circles and the , ***Unmovable plane*** **E** , Tangential to the each one circle through the three axis , ***and Parallel to Principal –axis-Plane of Ellipsoid .***

From Euler-Lagrange Mechanics and Vector analysis ,

Position vector , $\bar{\mathbf{r}}$, always points radially from the origin O .

Velocity vector , $\bar{\mathbf{v}}$, always tangent to the path , direction , of motion .

Acceleration vector , $\bar{\mathbf{a}}$, not parallel to the radial motion but offset by the angular and Coriolis accelerations , nor tangent to the Path but offset by centripetal and radial acceleration .

II. Above analysis was presented by by Poinsot without being sufficient for the complete motion description , because does not define the positions of Solid relating to time .

On Angular-velocity-Ellipsoid exists ,

$J_1 w_1{}^2 + J_2 w_2{}^2 + J_3 w_3{}^2 = 2L$ (L = constant) and Polar position is defined from relation

$J_1{}^2 w_1{}^2 + J_2{}^2 w_2{}^2 + J_3{}^2 w_3{}^2 = B^2$, where , B , is the constant Momentum value .

On a constant Angular-velocity-Ellipsoid , by changing Momentum , is possible of infinite Polar-Paths according to the different motions of the Solid . Paths near maximum or minimum Principal axis become ring-shaped while near the center of axis extend to a couple of ellipses.

Rotation happens near maximum or minimum axis , continuing motion about these , and round Instaneous axis of the Polar-path , in contrary to the middle axis which are not continued , but rounded to axis off Polar-path around Ellipsoid . A complete identity of the rotated axis and the Principal axis doesn`t happen as this happens on Earth .

A.. The Integration of (21a) differential equations results to Elliptic-functions , except that of Inertial-moment- Ellipsoid and which becomes of rotation . In case of Material-Point both Momentum and Angular velocity are constants for all motions . Placing ,z, axis as the rotating then $J_1 = J_2$ and equations are simplified as ,

$$\frac{dw_1}{dt} = \frac{J_1 - J_3}{J_1} w_1 w_2 \;,\; \frac{dw_2}{dt} = \frac{J_3 - J_1}{J_1} w_3 w_1 \;,\; \frac{dw_3}{dt} = 0 \;, \qquad \text{……...(21d)}$$

And placing $\frac{J_1 - J_3}{J_1} = \gamma$, then $\frac{dw_1}{dt} = \gamma\, w_2 w_3$, $\frac{dw_2}{dt} = -\gamma\, w_3 w_1$, $\frac{dw_3}{dt} = 0$ ……...(22)

From the first becomes w_3= constant , while by multiplying w_1 with its components and w_2 for the second one and adding , then $w_1 \frac{dw_1}{dt} + w_2 \frac{dw_2}{dt} = 0$ therefore , $w_1{}^2 + J_2 w_2{}^2 = a^2$ and a = the constant of integration , i.e. during motion Angular velocity value is constant unchanged and equal to $w^2 = a^2 + w_3{}^2$, becoming also from Poinsot`s solution . In reality since Angular velocity-Ellipsoid is symmetrical to ,**z**, axis , all of equal distance from , O, tangential planes , are symmetrically placed around ,**z**, axis and so the Polar-Paths are parallel circles .

The algebraic value of angular-velocity-vector remains unaltered and thus , ***is drawing the Solid regular-Cone as Polar-surface*** *around symmetrical* , z , *axis* , and in Fixed system at O , *on the unmovable Momentum-vector another Solid-regular-Cone , as* ***Anti-Polar-surface*** .

Since $w_1^2 + w_2^2 = a^2$, *a circle* , by introducing parameter ,u, then is holding ,
$w_1 = a \sin u$, $w_2 = a \cos u$ and the two first equations of (22) are satisfied *when* $\frac{du}{dt} = \gamma. w_3$
and also since w_3 = constant , *when* $u = \gamma. w_3 t + b$ (where ,b, is the constant of integration),
i.e. equations (22) are solved by the new system ,

$$w_1 = a \sin(w_3 t + b) , \quad w_2 = a \cos(w_3 t + b) , \quad w_3 = \text{constant} \qquad \text{..........(22a)}$$

Angular-velocity-vector is rotating the Cone-Polar-surface , and returning to initial position

in period $T = \frac{2\pi}{w}$, or $T = \left[\frac{2\pi}{\gamma w_3}\right] = \left[\frac{2\pi J_1}{w_3(J_1 - J_2)}\right]$ ....(22b)

B.. Integrating equations (21a) became the projections of angular velocity w_1 , w_2 , w_3 related to time ,**t** . Integrating (20) on unmovable axis ,**z`**, of Momentum , then on symmetrical axis ,**z**, projection of B_3 is according to (10) , equal to $B_3 = J_3 w_3$, and for Euler ,ϑ , angle exists ,
$\cos\vartheta = \frac{J_3 w_3}{B}$ = constant , and ϑ = constant and Euler equations (20) become ,

$$w_1 = \frac{d\varphi}{dt}\sin\vartheta\sin\psi , \qquad w_2 = \frac{d\varphi}{dt}\sin\vartheta\cos\psi \qquad \text{............ (23)}$$

$$w_3 = \frac{d\varphi}{dt}\cos\vartheta + \frac{d\psi}{dt}$$

From the first two exists $\frac{w_1}{w_2} = \tan\psi$ while from (22a) $\frac{w_1}{w_2} = \tan(\gamma w_3 t + b)$ so ,
$\psi = \gamma w_3 t + [b + k\pi] = \gamma w_3 t + \psi_0$, ψ_0= constant , and $\frac{d\psi}{dt} = \gamma w_3$,
Placing above in third equation of (23) then ,
$w_3 = \frac{d\varphi}{dt}\cos\vartheta + \gamma w_3$, or $w_3 = \frac{d\varphi}{dt}\frac{J_3 w_3}{B} + \gamma w_3$, therefore $\frac{d\varphi}{dt} = [1-\gamma]\frac{B}{J_3} = \frac{B}{J_1}$, and
since by definition of ,γ, then , $J_3 = [1-\gamma] J_1$ and $\varphi = \frac{B}{J_1} t + \varphi_o$ where φ_o is the integration constant , and the Position of the Solid is defined by Euler φ ,ϑ , ψ , angles as ,

$$\varphi = \frac{B}{J_1} t + \varphi_o$$

$$\vartheta = \text{constant} \qquad \text{............ (23a)}$$

$$\psi = \frac{J_1 - J_3}{J_1} w_3 t + \psi_0$$

2.4.1 ***Application to Material-Points*** [⊕↔⊖] of Figure.19 , and by considering Positive Constituent with angular velocity $\overline{w} = \overline{v}/r = \frac{\sigma}{2r}[1+\sqrt{5}]$ and an angle 45° from ,**x** , axis.
The Ellipsoid of angular velocity is perpendicular to the plane of motion . Moment of Inertia to ,**z**, axis is that of sphere equal to $J_3 = \frac{\pi r^4}{4}$ which is the same in all Principal axes , and
$J = J_1 = J_2 = J_3 = \frac{\pi r^4}{4}$, therefore (13) which is Angular-kinetic–energy ≡ Angular-velocity-Ellipsoid then becomes , $J_1 w_1^2 + J_2 w_2^2 + J_3 w_3^2 = 2L$, or →

$$w_1^2 + w_2^2 + w_3^2 = \frac{2L}{J} = \frac{8L}{\pi r^4} = B^2 = 3Jw^2 \text{ and from (10) then } \overline{B} = [r\,\sigma\,(1+\sqrt{5})] .$$

The value of constant momentum is $B^2 = 2L = 3Jw^2$, and is

$$B^2 = 3\frac{\pi r^4}{4}\left(\frac{\sigma}{2r}[1+\sqrt{5}]\right)^2 = \frac{3\pi r^2\sigma^2}{16}[6+2\sqrt{5}] = \frac{3\pi r^2\sigma^2}{8}[3+\sqrt{5}] .$$

For Planck`s length $r = 4{,}453.10^{-35}$, $r^2 = 19{,}629.10^{-70}$ and velocity $|\overline{v}| = \frac{\sigma}{r}[1+\sqrt{5}]$ becomes

$$|\overline{v}| = \frac{3{,}236 . \sigma}{4{,}453.10^{-35}} \text{ , or } \qquad |\overline{\mathbf{v}}| = \overrightarrow{\mathbf{0{,}7267.10^{35}}}.\ \boldsymbol{\sigma} \qquad \text{........(a)}$$

and for maximum velocity $c = 3.\,10^{8}$ m/s then $\boldsymbol{\sigma} = \frac{3.10^{8}}{0{,}7267.10^{35}} = 4{,}128.\,10^{-27}$ Kg/m²

and the value of the Angular-velocity is , $|w| = \frac{\sigma}{2r}[\,1+\sqrt{5}\,] =$
$\left(\frac{4{,}128.10^{-27}}{2.4.45310^{-35}}\right).\ 3{,}2360675 = 1{,}499\,.\,10^{8}$, or $|\mathbf{w}| = 1{,}5\,.\,10^{8}$ rad/sec

and the constant figure of the Torsional-Momentum becomes ,

$B^2 = \frac{3\pi r^2\sigma^2}{8}[3+\sqrt{5}]\ \frac{3\pi 19{,}825.10^{-70}\sigma^2}{8}[5{,}236] = 122{,}315.\sigma^2$, therefore , $\mathbf{B = 11{,}06\,.\,\sigma}$ ……..(b)
and for $\sigma = 4{,}128.\,10^{-27}$ Kg/m² then $\mathbf{B} = 11{,}06\,.\,4{,}128.\,10^{-27} = 4{,}566\,.\,10^{-26}$J = {Kgm²/s}

Constant plane ,E, is tangential to Ellipsoid at Spearhead point ,P, of $\overline{w}$ radii and Polar-line is parallel circle PT , Anti-Polar-line PS circle on plane , E , with circle that of vector - radii projection point of Momentum $\overline{B}$. Polar-cone POT is rolling on the Fix Anti-Polar-Cone POS with constant velocity and each common line-vector the Instaneous rotating axis .Since Angular-velocity-vector is constant then returns to initial position after the period of time $T = \left[\frac{2\pi J_1}{w_3(\ J_1 - J_2)}\right] = \left[\frac{2\pi}{w_3}\right]$.

and for $r = 4{,}453.10^{-35}$ then , period $T = \frac{2\pi}{w} = \frac{2\pi r}{v} = \frac{4\pi r}{\sigma\,(1+\sqrt{5})} \rightarrow$

$\mathbf{T} = \frac{4\pi.4{,}45310^{-35}}{\sigma\,(1+\sqrt{5})} = \frac{1{,}729}{\sigma}.10^{-34} = \left\{\frac{\mathbf{1{,}729}}{\boldsymbol{\sigma}}\right\}.\mathbf{10^{-34}}$ s , or $\mathbf{T} = \left[\frac{\mathbf{1{,}729}}{\mathbf{10^{34}\,.\,\sigma}}\right]$ s …….. (c)

and for $\sigma = 4{,}128.\,10^{-27}$ Kg/m² , then $\mathbf{T} = \frac{1{,}729}{10^{34}.4{,}12810^{-27}} = \frac{4{,}188}{10^{8}} = 4{,}188\,.\,10^{-8}$ s

and frequency $f = \frac{1}{T} = 5{,}7836.\,10^{35}\,.\,\sigma$ and $f = 2{,}388\,.10^{7}$ Hz respectively .

Above frequency corresponds to an Energy beam of light according to equation ,
Energy = h x f = $6{,}63.\,10^{-34}$ Js . $2{,}388\,.10^{7}$/s = $1{,}58\,.10^{-26}$ J , while for frequency of light $f = 6{,}70\,.10^{11}$ Hz , then Energy of photon in the beam = $6{,}63.10^{-34}.\ 6{,}70.10^{11} = 4{,}44.10^{-22}$ J .
i.e. Torsional-Momentum $B = 4{,}566\,.\,10^{-26}$ J , is 10^{5} times smaller .

In case of Rotation near the Symmetrical-Ellipsoid-axis , is that of *Nutation* , which happens to Earth`s rotating axis in case that doesn`t coincide with the Major-Geodic free axis .

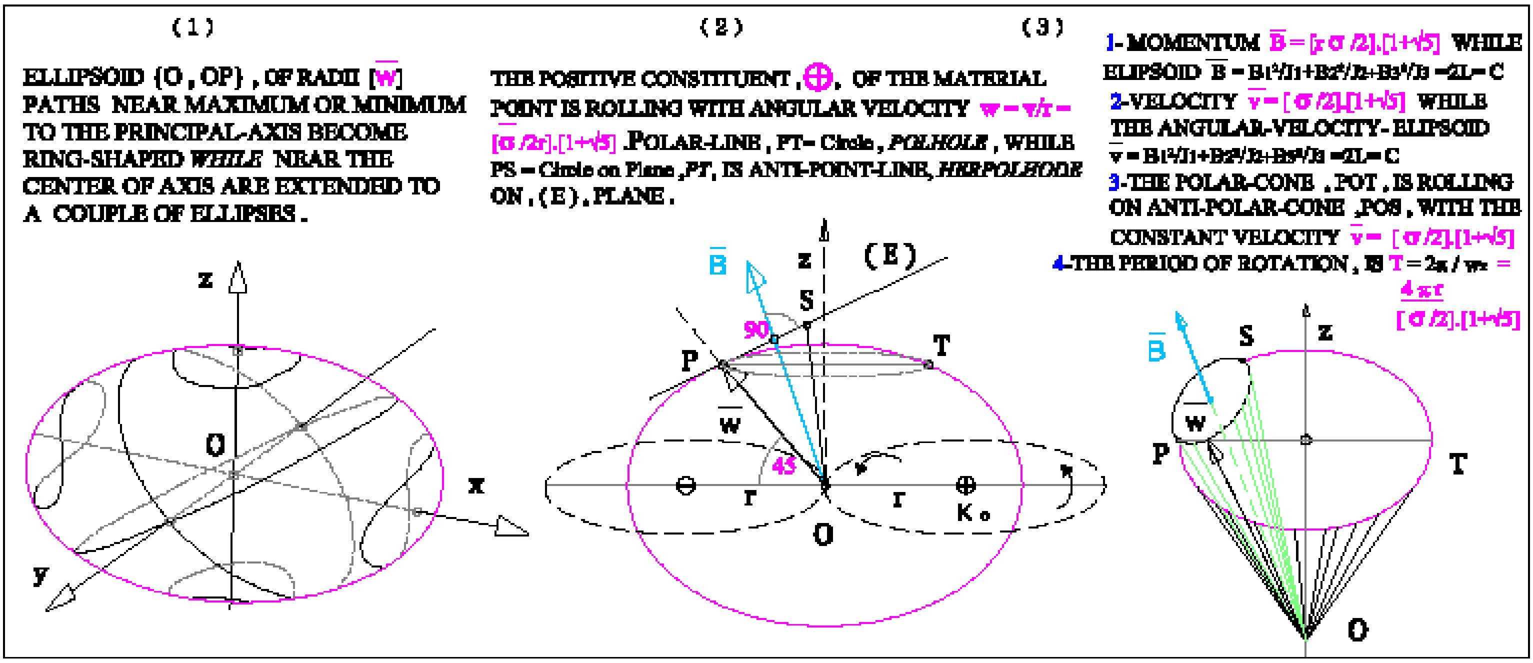


Figure.18.. In (1) , are shown Paths near maximum or minimum to Principal axis from where become-ring shaped or Small-circles , while near the center of axis extend to a couple of ellipses or Great circles . Rotating on small circles is created the $\pm\frac{1}{2}$ Spin ≡ $\overline{B}$

In (2) is shown Rotation with angular-velocity $\overline{w}$, 45° to the instaneous material axis OP ≡ [⊕↔⊖] of rotation where point P is the , *Nib* ,of Angular-velocity vector $\overline{w}$ and Sweeps-Out at OP slant height of the Central , POT-Cone , with $\overline{w} = \frac{v}{R}$.

In (3) are shown Polhode , *circle PT* , Herpolhode , *PS circle in plane E* . Polhode-Cone POT is rolling on the Fixed- Herpolhode-Cone POS , with the constant velocity $|\bar{v}| = \frac{\sigma}{r}[1+\sqrt{5}]$ dependent on Pressure ,σ, of the two material constituents .

3.. The Central Axial-Ellipsoid and the ⊕ constituent Rotating through constant point O .

Integrated Equations of motion become not from center of mass K_o , but from center O.
Since motion of ⊕ constituent becomes from Stress ,**σ**, only , the constant coordinate system is taken at O with , **z`** , axis perpendicular to Unit-vector $\mathbf{\bar{k}`}$ **,** on OK_o axis , the **x** axis . The x`, y` axis are perpendicular to $\vec{k`}$, vector and , x , y axis are perpendicular to $\overrightarrow{OK_o}$ direction.
Let be $\bar{s}_o$ the common axis of , x,y and , x`, y` planes such that coordinate system $\bar{k}`, \bar{k}, \bar{s}_o$ Is Right-handled . Vectors $\bar{s}_o$, $\bar{t}_o$ and x , y axis , are directed to Ellipsoid-equator of Angular velocity and thus , to both ,x , y axis , moment of inertia is the same as J_1 and J_2 to z .
For the definition of , ϑ , φ , ψ , related to time is proved that are needed three differential equations , the *first* , due to the intersection of , z , axis by $\overrightarrow{OK_o}$, where $M_s = 0$. Euler third equation (21) is then simplified to , $\frac{dw_3}{dt} = 0$ and $J_1 = J_2$ where is shown that projection of angular velocity w_3 on symmetrical axis ,z, is constant . Euler`s third equation of (20) becomes

$$(w_3 =) \frac{d\varphi}{dt}\cos\vartheta + \frac{d\psi}{dt} = \text{constant} \qquad \ldots\ldots\ldots\ldots\ldots(24)$$

A different ascertain was defined before for Moment , of the first integral which is zero on z` axis , therefore Momentum $\bar{B}\bar{k}`$ to this axis is constant . Momentum in the three directions $\bar{s}_o$, $\bar{t}_o$, $\bar{k}$, and to , O , axis is defined by equality , $\bar{B} = \bar{s}_o B_s + \bar{t}_o B_t + \bar{k} B_3$

$$B_s = J_1 . w_s , \quad B_t = J_1 . w_t , \quad B_3 = J_3 . w_3 \qquad \ldots\ldots\ldots\ldots(24a)$$

Where , B_s , B_t , B_3 and w_s , w_t , w_3 are the corresponding projections of Momentum and Angular-velocity to the three axis . From above issues ,

$\rightarrow \bar{B}\bar{k}` = \bar{s}_o\bar{k}` . J_1 w_s + \bar{t}_o\bar{k}` . J_1 w_t + \bar{k}\,\bar{k}` . J_3 . w_3$ and since ,

$\bar{s}_o\bar{k}` = 0$ , $\bar{t}_o\bar{k}` = 0$, $\bar{k}\,\bar{k}` = \cos\vartheta$ , then $\rightarrow \bar{B}\bar{k}` = J_1 w_1 \sin\vartheta + J_3 w_3 . \cos\vartheta$

From (19) issues $\bar{w} = \bar{k}`\frac{d\varphi}{dt} + \bar{s}_o\frac{d\vartheta}{dt} + \bar{k}\frac{d\psi}{dt}$ therefore ,

$$w_t = \bar{w}\bar{t}_o = \bar{k}`\bar{t}_o . \frac{d\varphi}{dt} + \bar{s}_o\bar{t}_o . \frac{d\vartheta}{dt} + \bar{k}\bar{t}_o . \frac{d\psi}{dt}$$ and since ,

$\bar{k}`\bar{t}_o = \sin\vartheta$, $\bar{s}_o\bar{t}_o = 0$, + $\bar{k}\bar{t}_o = 0$, therefore , $w_t = \frac{d\varphi}{dt}\sin\vartheta$ and above become,

$$(\bar{B}\,\bar{k}` =) \; J_1\frac{d\varphi}{dt}\sin^2\vartheta + J_3 w_3 \cos\vartheta = C_1 \quad \text{where } C_1 = \text{constant} \qquad \ldots\ldots\ldots\ldots(24b)$$

which is a differential equation of the first order .
Another one integral exist from velocity constancy , where then Mechanical energy remains unchanged and Dynamic energy is , V = Q(s) cos ϑ where (s) = OS , and from Kinetic-energy (L) to directions $\bar{s}_o$, $\bar{t}_o$, $\bar{k}$, on the three principal axis is ,

$$L = \frac{1}{2}(J_1 . w_s^2 + J_1 . w_t^2 + J_3 . w_3^2)$$ and using equation (19)

$$w_s = \bar{k}`\bar{s}_o . \frac{d\varphi}{dt} + \bar{s}_o\bar{s}_o . \frac{d\vartheta}{dt} + \bar{k}\bar{s}_o . \frac{d\psi}{dt}$$ and since also

$$\bar{k}`\bar{s}_o = 0 , \quad \bar{s}_o\bar{s}_o = 1 , \quad \bar{k}\bar{s}_o = 0 \rightarrow w_s = \frac{d\vartheta}{dt}$$ therefore ,

$$L + V = \frac{1}{2} J_1 \left[\left(\frac{d\vartheta}{dt}\right)^2 + \left(\frac{d\varphi}{dt}\right)^2 + \sin^2\vartheta \right] + \frac{1}{2} J_3 w_3^2 + Qs\cos\vartheta = C_2 \quad \ldots\ldots.(24c)$$

where C_2= constant , therefore the system of the three differential equations is ,

$$\dot{\varphi}\cos\vartheta + \dot{\psi} = w_3 ,$$

$$J_1\dot{\varphi}\sin^2\vartheta + J_3 w_3 \cos\vartheta = C_1 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(24d)$$

$$\tfrac{1}{2} J_1 (\dot{\vartheta}^2 + \dot{\varphi}^2) + \tfrac{1}{2} J_3 w_3 + Qs \cos\vartheta) = C_2 \text{ where , } w_3 , C_1 , C_2$$

Since Momentum-Ellipsoid **,** $\bar{B}$ **,** is perpendicular to **,** ***Angular -velocity-Ellipsoid*** **,** $\bar{w}$ **,**
no Work is produced and the Status is Neutral.

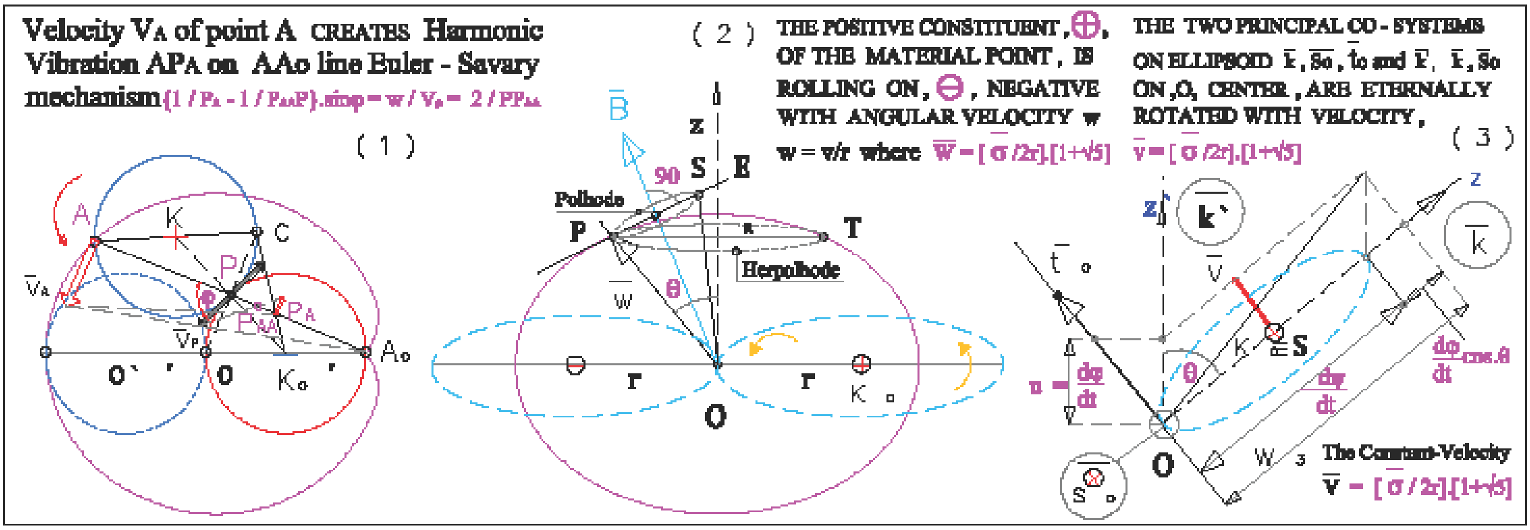


Figure.19. In (**1**) ***Material point AP*** , {the two circles $\ominus \equiv K_o, K_oP$ – $\oplus \equiv K$, KP } of the Space point A (+) and Anti-point P(-) is rotating through point A_o , which is the center of Common circle and form material angle $\vartheta = \vartheta_A.t = (\frac{v_A}{\sqrt{c^2-r^2}}).t$, CREATE the Cardioid Envelope curves generated by the above Vibrating -Velocity-Energy-Geometry-Segment , A P_A , on , AA_o , rotating line.

In (**2**) is shown Angular-velocity-vector $\bar{w}$ Ellipsoid , and $\bar{B}$ Momentum-Ellipsoid both Due to the Opposite-Stresses , ±σ , which create the constant velocity $|\bar{v}| = \frac{\sigma}{2r}[1+\sqrt{5}]$ of the K_o Rotating-Center of mass of the ⊕ constituent .

In (**3**) are shown the two Coordinate -Systems on Principal axis , the one of the ,⊕, Central-Momentum-Ellipsoid about the Fixed center ,**O** , {the $\bar{s}_o$, $\bar{t}_o$, $\bar{k}$, System } of the POT Cone and the other one of the same ,⊕, rotated constituent , around the Instaneous axis of rotation , **z** , of POS-Cone and about center ,**O**, {the $\bar{s}_o$, $\bar{k}$` , $\bar{k}$, System } .

According to Poinsot , *on Symmetrical-Ellipsoid around an axis* , the equidistance tangential Planes are symmetrically placed around this axis and the Polar-curves are Parallel-circles and are sketsing on the solid as the Polar-surface- regular-cone , ***the Porhode*** , around the symmetrical axis , and on the constant system a regular-cone also , ***the Herpolhode*** , around the constant vector $\bar{B}$.

3.1. The Vector-equation of motion .

The vector equation of Rotational-axis-motion is defined by analyzing $\bar{w}$ to $\bar{k}$ direction of Ellipsoid-Inertial-axis , and another one perpendicular to $\bar{k}$, and then

$$\bar{w} = \bar{\imath} w_1 + \bar{\jmath} w_2 + \bar{k} w_3 = \{ \bar{k} [\bar{w} \ \bar{k}] \} + \bar{k}\,\bar{w} \quad \text{and since } [\bar{w} \ \bar{k}] = \frac{d\bar{k}}{dt} \quad \text{then ,}$$

$$\bar{w} = [\bar{k} \frac{d\bar{k}}{dt}] + \bar{k} w_3 \qquad \ldots\ldots\ldots\ldots\ldots (25a)$$

Analyzing Momentum-vector $\bar{B}$ as above to $\bar{k}$ direction then exists ,

$$\bar{B} = (\bar{\imath}\, w_1 + \bar{\jmath}\, w_2)\, J_1 + \bar{k} w_3\, J_3 \quad = \quad [\ \bar{k}\ \frac{d\bar{k}}{dt}\ ] .\ J_1 + \bar{k} w_3 .\ J_3 \qquad \text{............. (25b)}$$

Moment of external forces Q , to ,O , is equal to → [$\bar{s}\,\bar{Q}$] = - sQ [$\bar{k}\,\bar{k}$`] and Momentum becomes

$$J_1\ \{\ \bar{k}\ \frac{d^2\bar{k}}{dt^2}\ \}\ +\ J_3 w_3\ \frac{d\bar{k}}{dt}\ +\ sQ\,[\ \bar{k}\,\bar{k}`\ ] = 0 \qquad \text{.................. (25)}$$

Angular velocity w_3 was shown constant .

Equation (25) defines Unit-vector , $\bar{k}$, of Ellipsoid-rotating-axis , related to time and after the solution , equations (25a) and (25b) define Angular velocity , $\bar{w}$, and Angular-momentum-vector $\bar{B}$ respectively . It is proved [page 62] that $\bar{B}$ vector is that what we call Spin of particles .

3.2. The Intrinsic rotation , Precession , and Nutation .

General :

Since Earth is as Sphere , names of longitude and latitude , *which are angles* , are referred to a Right Ascension and Declination in a spherical Polar coordinate system . What is seen from Earth , is the celestial equator on which the Ecliptic , *the apparent path of the Sun through the year* , where the Sun moves into Northern hemisphere and which is called the ,*Vernal equinox*, and the analogous motion of the Sun to Southern-hemisphere and called the , *Equinox* .

Sun`s apparent motion is not completely regular and also, both celestial-equator and Ecliptic , are moving with respect to the stars . By far , Precession of the equinoxes is the largest effect , where Earth`s rotation axis sweeps out a cone centered on the Ecliptic pole , completing one revolution in about 26000 years and is called the , *luni-solar precession* . The cause of the motion is the torque exerted on the distorted equatorial bulge of the spinning Earth by the Sun and the Moon.

At the equinoxes equatorial bulge and torque shrink to zero and it is the smaller-faster effect and is called Nutation . Note that Precession and Nutation are simply different frequency components of the same Physical effect .

The orbit of the Earth-Moon system is not fixed in orientation because of the attraction of the Planets , and this slow secular rotation of the Ecliptic about a slowly moving diameter , is the Planetary Precession .

From Classical Mechanics :

The Angular-Kinetic-Energy $\bar{B}$, *Angular momentum vector* , is conserved , so $\frac{d\bar{B}}{dt} = 0$ and since may be expressed in terms of the moment of Inertia Tensor , J , and the Angular velocity vector , $\bar{w}$, so then according to (21a-21b) the ellipsoid of Angular velocity vector is $J_1 w_1{}^2 + J_2 w_2{}^2 + J_3 w_3{}^2 = 2L$ where Kinetic-Energy $L = \frac{\bar{w}^2 J_n}{2}$, and , w , is on the surface of the Inertial Ellipsoid. The tangent Plane-normal at $\bar{w}$, is $\nabla \frac{\bar{w}\, J_n}{2} = \nabla \frac{1}{2} [\ J_1 w_1{}^2 + J_2 w_2{}^2 + J_3 w_3{}^2\ ] = [\ J_1 w_1 + J_2 w_2 + J_3 w_3\ ] = \bar{B}$ i.e. the attitude of the Tangent-Plane is constant and at a distance $\frac{\overline{w.B}}{|\bar{B}\,|} = \frac{2\bar{L}}{|\bar{B}\,|}$ which is also constant ,

or from $\bar{B} . \bar{w} = L = \frac{1}{2} J_1 w_1{}^2 + \frac{1}{2} J_2 w_2{}^2 + \frac{1}{2} J_3 w_3{}^2$, where w_1 , w_2 , w_3, are the components of vector $\bar{w}$, along the Principal axes , and J_1 , J_2 , J_3 , are the Principal-moments of Inertia **.** (Fig.18)

Thus , the conservation of Kinetic-Energy ,L, imposes a constraint on the three-dimensional Angular velocity vector , $\bar{w}$, and an Ellipsoid in the Principal axis frame , *the Inertia Ellipsoid* , J .

The Ellipsoid axes values are the half of the Principal-moments of Inertia , and the Path traced-out on this Ellipsoid by the Angular velocity vector , $\overline{w}$, is called , *Polhode* .

From above , the Tangent-Plane is Fixed and so , The Energy - Ellipsoid rolls without slipping on this Constant Plane . On Fixed-Constant-Plane is traced the Herpolhode path , while on the Energy-Ellipsoid is traced the Polhode path . i.e. On any Angular-velocity-vector , $\overline{w}$ ***,*** *produced from velocity due to the* , main Stress , σ , and which represents the Energy from Chaos , ***corresponds an Angular-momentum-vector ,*** $\overline{B}$ ***,*** which represents the Energy-monad , ***to the common point O, of rotation . Vector ,*** $\overline{B}$ ***, is perpendicular to the Tangential to ,*** $\overline{w}$ ***, nib Angular-velocity-Ellipsoid , while ,*** $\overline{w}$ ***, is perpendicular to the Tangential to ,*** $\overline{B}$ ***, nib Energy-Momentum-Ellipsoid .*** Figure.14. This Energy-Ellipsoid is what is called , ***Spin*** .

According to Euler`s equations (20) , in the Principal axis frame , Angular-momentum-vector (which is rotating in the absolute space) is not conserved even in the absence of applied torques , but varies as in (20). However , in the absence of applied torques , (4a) , magnitude , $\overline{B}$, of the Angular momentum $B^2 = B_1^2 + B_2^2 + B_3^2$ and Kinetic Energy , L , are both conserved and as in (13a) for Angular-velocity-momentum-Ellipsoid $L = \frac{B_1^2}{2J_1} + \frac{B_2^2}{2J_2} + \frac{B_3^2}{2J_3}$, where B_1 , B_2 , B_3 are the components of the Angular-momentum-vector along the Principal axes , and the J_1 , J_2 , J_3 are the Principal moments of Inertia . These conservation laws are equivalent to two constraints to the three dimensional Angular-momentum-vector , $\overline{L}$, The Kinetic energy constrains of , L to lie on an Ellipsoid , whereas the angular momentum constraint , constrains ,L , to lie on a Sphere . These two surfaces intersect in taco-shaped curves that define the possible solutions for , L . This is a construction method based on Angular-momentum-vector , $\overline{L}$, rather than that of Poinsot`s which is based on Angular-velocity-vector , $\overline{w}$,

In case of an Axisymmetric Rotating Body , with Angular-velocity ,w, ***the moment of Inertia , J , about two of the Principal axis ,*** x - y ***, are equal , then The Angular – velocity - vector ,*** $\overline{\mathbf{w}}$ ***,*** describes the Ellipsoid of Angular Velocity and its nib describes a Cone of which Plane-Base is Fixed ***, and Simultaneously ,* The *Angular-Momentum*** , $\overline{B}$, describes the Ellipsoid of *Angular-Momentum and its nib describes* a Cone also of which Plane-Base is also Fixed **.**

The Nib of Angular – velocity - vector , $\overline{\mathbf{w}}$ ***, describes on the Tangential-Plane of the Angular-Momentum-Ellipsoid ,*** *the Herpolhode* ***, while , The Nib of Angular-Momentum describes on the Tangential-Plane of the Angular-Velocity-Ellipsoid ,*** *the Polhode* **.**

The Fixed-Tangential-Planes of , $\overline{w}$ *, and ,* $\overline{B}$ ***, are alternately Perpendicular to ,*** $\overline{B}$ ***, and ,*** $\overline{w}$ ***, central axes of rotation and thus form the Material-Point-energy-monad .***

Vector , $\overline{B}$ ***, is perpendicular to the Tangential to ,*** $\overline{w}$ ***, nib Angular –velocity -Ellipsoid ,***

while , $\overline{w}$ ***, is perpendicular to the Tangential to ,*** $\overline{B}$ ***, nib Energy-Momentum-Ellipsoid.***

All above happen in Material-Point , where the , ⊕ ***, constituent is Eternally self-rolling on the ,*** ⊖ ***, constituent ,*** with Angular-Velocity , **w ,** becoming from constant constituents Glue-Bond Pressure , **σ** , ***in Infinite Spherical traces , either at Great-circles or Small-circles , or any other close Spherical-curve , and by applying all laws of Mechanics into this Energy-Chaos , is thus created the First-Discrete-Energy-monad which is the Material - Point , and from this all the other Energy and material monads .*** (q . e .d)

Equations (24)-(25) , show immediately if the motion is Possible , and under which circumstances.
To examine the Possibility for Ellipsoid-Symmetrical-axis ,OS , to perform rotation as Regular-Cone around the vertical axis $\bar{k}`$, **i.e**. if it is possible , under the presupposition , ***ϑ = constant*** , to solve above referred equations of motion . Because w_3 = constant , from (24d)

Second-equation implies $\frac{d\varphi}{dt}$ = constant , while First-equation implies $\frac{d\psi}{dt}$ = constant

Meaning that , according to equation (19) , $\bar{w} = \bar{k}` \frac{d\varphi}{dt} + \bar{k} \frac{d\psi}{dt}$ ………… (26a)

and which is considered as the rotation of Material-point around the Ellipsoid-Symmetrical-axis ,OS , with constant Angular-velocity $u = \frac{d\psi}{dt}$, and simultaneously rotated through the vertical $\bar{k}`$ axis with the same constant angular velocity $\frac{d\varphi}{dt} = u$ . Since Angular-velocity-vector $\overline{w}$, is constant then its algebraic-figure is also constant and lies in , $\bar{k}\ \bar{k}`$, Plane .

Because $[\ \bar{k}\ \bar{k}`\ ] = -\ \bar{s}_o\ \sin\vartheta$, and $\frac{d\bar{k}}{dt} = [\ \bar{w}\ \ \bar{k}\ ]$ and from (26a)

$$\frac{d\bar{k}}{dt} = \bar{s}_o \sin\vartheta\ ,\ \{\ \bar{k}\ \frac{d\bar{k}}{dt^2}\ \} = [\ \bar{k}\ \bar{s}_o . u . \sin\vartheta\ ] = \bar{t}_o . u . \sin\vartheta \qquad \text{and}$$

$$\frac{d}{dt}\ [\ \bar{k}\ \frac{d\bar{k}}{dt}\ ] = [\ \bar{k}\ \frac{d^2\bar{k}}{dt^2}\ ] = \frac{d\bar{t}_o}{dt} . u . \sin\vartheta \qquad \text{and because}$$

$\frac{d\bar{t}_o}{dt}$ = the nib of velocity-vector $\bar{t}_o = -\ \bar{s}_o . u . \cos\vartheta$ then , $[\ \bar{k}\ \frac{d^2\bar{k}}{dt^2}\ ] = -\ \bar{s}_o . u^2 . \sin\vartheta . \cos\vartheta$

Introducing above in (25) and , division by $\sin\vartheta$, and when $0 < \vartheta > 0$, and , $\pi < \vartheta > \pi$, then becomes relation $J_1 . u^2 \cos\vartheta - J_3\, w_3 . u + s . Q = 0$ ……………. (26)

which is the Necessary-Proposition , *Precession* , for the motion of the Material-Point [⊖↻↺⊕].
Second degree Equation (26) gives real roots for velocity , **u** , only for negative $\cos\vartheta$, i.e. the center of mass , S , is below rotational point O. If $\cos\vartheta > 0$ then $w_3{}^2 >= \frac{4 J_1 sQ . \cos\vartheta .}{J_s{}^2}$ … (27)

and by solving (27) then Angular-velocity $u = |\bar{w}| = \frac{d\varphi}{dt} = \frac{J_3 . w_3}{2 J_1 . \cos\vartheta} \pm \sqrt[2]{-\frac{sQ}{J_1 . \cos\vartheta} + (\frac{J_3 . w_3}{2 J_1 . \cos\vartheta})^2}$ … (27a)

Since equation (27a) , is of 2nd degree and has two solutions ,a, and ,b.

a.. Algebraic-magnitude-figure w_3 is such that , the within square root is zero or near zero .
From figure this happens when figure w_3 coincides with that of Angular velocity vector , $|\bar{w}|$, and from $\frac{d\psi}{dt}$, where then its direction coincides with the Ellipsoid-Symmetrical-axis ,OS. The second term being in square is strengthening J_1 moment of inertia directing the axis to J_3 direction.
Material point occupies a large moment of Inertia by rotating about the Ellipsoid-Symmetrical-axis through constant point O, on Ellipsoid-axis , of the truncated Cone , i.e.

The Inner-Rotation of Material-point , happens through the algebraic and constant Angular-velocity-vector , $|\bar{w}|$, ***{ on the Ellipsoid-Symmetrical-axis } , where the Surface of the Truncated-Polar-Cone is Rolling ,*** sweeps out ***, on the Unmovable-Polhode-Cone with a very large figure ,*** *the absolute value* ***, of Angular velocity vector ,*** $|\bar{\mathbf{w}}|$ **.**

In Material-point where External forces are equal to zero (Q=0) , the above equation becomes ,

Angular-velocity-figure , $u = |\bar{w}| = \frac{d\varphi}{dt} = \frac{J_3 . w_3}{2 J_1 . \cos\vartheta} \pm \sqrt[2]{(\frac{J_3 . w_3}{2 J_1 . \cos\vartheta})^2} = \frac{J_3 . w_3}{2 J_1 . \cos\vartheta} + \frac{J_3 . w_3}{2 J_1 . \cos\vartheta} = \frac{J_3 . w_3}{J_1 . \cos\vartheta}$ and when

$J_1 = J_3$ then , u = $\frac{w_3}{\cos\vartheta}$ = w_3. sec ϑ , meaning that the constancy of ,u, becomes from Geometry of the rotating energy only as this happens to the constancy of velocity , **c** , in cave , **r** .
This is the analogous which happens to Lorentz factor **γ** ≡ ***sec.φ , and then*** u = w_3. sec ϑ = γ. w_3

b.. Algebraic-magnitude-figure ,u, is equal to w_3 and $\frac{d\psi}{dt}$ and to ,w, also .
In this case , the direction of the Angular-velocity-vector $\bar{\mathbf{w}}$ is diverging the $\bar{\mathbf{k}}$ axis of the Central-Truncated-Ellipsoid and Angular-velocity ,**u**, occupies , low and high values.
This Phenomenon happens in Astronomy where Equator-points , i.e. on Celestial-Sphere traces of sections ($\bar{s_o}$) of the Planes of ecliptic ($\bar{k}$`) and Ecuador ($\bar{k}$) , are slowly moving on Zodiac circle with an approximate Period of 21000 years .
Due to Earth-Geoid , Precession of Equator-points is proved to become from rotation of the Earth Polar-axis perpendicular to Ecliptic and thus not producing Work .

c.. The algebraic figure within the square root is zero or near zero .
In case ,⊕ , constituent is rolling on great circles on ⊖ constituent then , all moments of Inertia of Material point are equal and $J_1 = J_2 = J_3$ and angular velocities of mass center are also equal therefore $w_1 = w_2 = w_3$ and sec ϑ = 1 / cos ϑ , therefore (27a) becomes ,

$$\text{Angular-velocity } \mathbf{u} = \frac{d\varphi}{dt} = \frac{J_3 . w_3}{2\,J_1.\cos\vartheta} = \frac{w}{2\cos\vartheta} = \frac{w}{2}(\sec\vartheta) = \frac{w}{2\sqrt{1-(\frac{v}{c})^2}} = \frac{w.c}{2\sqrt{c^2-v^2}} =$$

$$\frac{wr.c}{2\sqrt{c^2r^2-2\sigma^2.[3+\sqrt{5}]}} = \frac{v.c}{4\sqrt{c^2r^2-2\sigma^2.[3+\sqrt{5}]}} = \left[\frac{\mathbf{c.\sigma}}{\mathbf{4r}}\right].\frac{[\mathbf{1+\sqrt{5}}]}{\sqrt{\mathbf{c^2r^2-2\sigma^2.[3+\sqrt{5}]}}} = \mathbf{u} \qquad \text{.........(c)}$$

Equation (c) , defines the Angular-velocity-figure ,**u,** related to constant velocity ,**c ,** and Stress , **σ** .

i.e. Constant Angular-velocity-value ,u ***, is such because of the two constants ,*** **c** ***, and Glue-Bond ,*** **σ ,** *or ,* ***The Energy of opposite ,*** ⊖ , ⊕ , ***from Chaos*** { r ≡ 0 } , ***is transformed as Discrete - Monad*** | ⊖ ⊕ | ***in the Self -Rotated Material-Point*** {| ⊖ ↔⊕ |} , ***due to the Glue-Bond Stress ,*** **σ .** [58]

d.. The Eternal Precession .

Torque , T , is the Twisting - Force that tends to cause rotation **{** T = Q.r sin ψ where Q is the force and ,ψ, the angle between radius ,r, and force Q **}** and the Angular-momentum-vector , L = J .w .

Material - point is a System which has an Inner – Rotation - constrained *, Due to the velocity vector ,* $\bar{v} = \frac{d\psi}{dt}$ *becoming from Stress ,* ***σ*** *, which is the Force-applied on lever - arm , r* ***, in space , on where External Forces and Moments are not existing*** *.*

The inner forces of this system , are the two equilibrium Centripetal and Centrifugal Forces due to the Eternal ***,*** ± σ ***, Stresses of Opposites*** *.*

Equation (26) is the Necessary-Proposition , *Precession* , for the motion of the Material-Point In case that is not holding then Precession near the axis of Ellipsoid is continuously existing .

Considering the Material-Point rotating with a great speed $\frac{d\psi}{dt}$, around a fix point O, and near the symmetrical axis of the Central Ellipsoid , and lying on this axis also then , because of the great velocity exists a great Angular velocity and therefore a strong Rotational-Momentum , so that change is very small as , $d\bar{B} = \bar{M}dt$ = [s $\bar{Q}$] dt = - s Q [$\bar{k}$ $\bar{k}$`] dt , and for a short of time it is very small to real Momentum , as (|B|>>|s Q|) . The same also happens to Kinetic energy for a small displacement on ⊖, constituent . In figure.17-1 and F.18-3 , the ⊕ constituent executes different rings near maxima or minima. Around the fixed Vector of Momentum , $\bar{B}$,is moving the

Angular-velocity-vector , and Inertial Ellipsoid is Rolling on Poinsot`s constant Plane , following a Circular Polar curve and , the animated rolling on the fixed Central-Pole-Cone , drawing the symmetrical axis , Oz ,to Precession . Because Vectors , $\overline{\mathbf{B}}$ and $\overline{\mathbf{w}}$**,** are very near each other and both to $\overline{\mathbf{k}}$ axis , Polar curves are very narrow rings as in figure , the Animated on the Ellipsoid of that of Angular-velocity while the Un-movable on Poinsot`s Plane and around Vector , $\overline{B}$ . During motion , Momentum , $\overline{B}$ ,is altered because of the different moment of Inertia due to the Area of the traced-curve and so is added , **-** sQ [ $\overline{k}\,\overline{k}$`]dt , perpendicular to $\overline{\mathbf{k}}$ symmetrical axis and thus to the mean-Position of Vectors , $\overline{\mathbf{B}}$, and $\overline{k}$` axis .

The above is happening because of the equivalence of Kinetic-Energy and the Rotating-Energy , as

$L = (1/2).\ \Sigma m_i.\overline{v}_i^2 = (1/2).[\Sigma m_i].\overline{v}_S^2 = (1/2).\ \Sigma m_i.[\overline{w}.\ \overline{r}_i]^2 = (1/2).(\Sigma m_i.\overline{r}_i^2).\overline{w}^2 = \frac{1}{2} J_a w^2$, i.e.

Rotational Kinetic Energy $L = \frac{1}{2} J_a w^2 = (1/2).[\Sigma m_i].\overline{v}_S^2 = L =$ *Kinetic Energy , is dependent on the moment of Inertia which is related to the Area of the curve* , so Rotational-Momentum-vector $\overline{\mathbf{B}}$, is slowly rotated on Central axis with angular velocity , **u** , which is $\frac{d\overline{B}}{dt} = -\,sQ\,[\,\overline{k}\,\overline{k}`]$. Integrating (Angular velocity , u =) becomes $\rightarrow \frac{s\,Q}{B} = \frac{s\,Q}{J_3 w}$ and the Period of rotation $T = \frac{2\pi}{u} = \frac{2\pi\ J_3.w}{s\,Q}$.

Since also frequency $f = 1 / T$, then $f = \frac{s\,Q}{2\pi.J_2.w}$ which denotes the frequency monad .

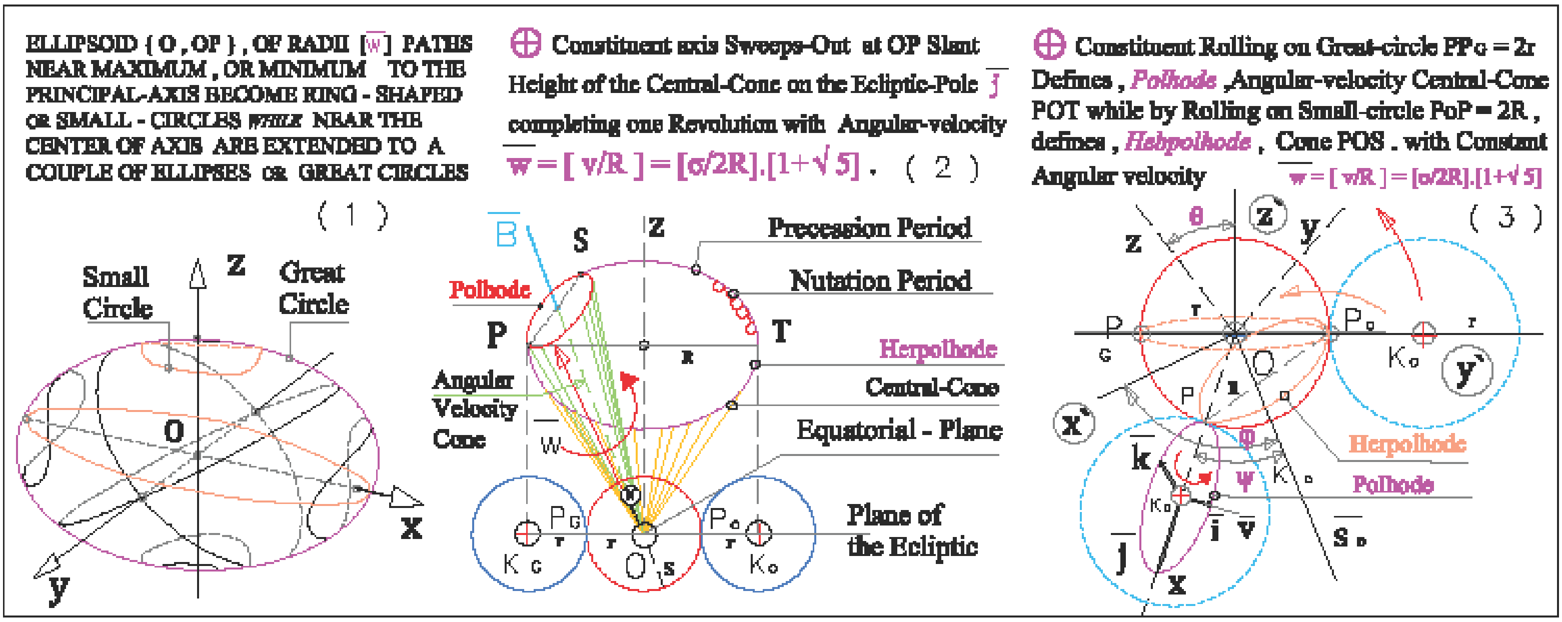


Figure.20. In (1) , are shown different Paths near maximum or minimum Principal axis from where become-ring shaped or Small-circles while near the center of axis extend to a couple of ellipses or Great-circles .For a constant Angular-velocity ,**w**, and by changing torsional momentum ,**B**, only then Infinite curves are possible for the motion .

In (2) , ⊕ constituent is rolling on Great-circle $P_G P_o$ = 2r Sweeps-out , at OP slant height of the Central-Cone of Angular velocity on the Ecliptic-Pole , O $\overline{j}$, with angular velocity , $w = \frac{v}{r}$. Angular-velocity-Ellipsoid describes Central-Cone POT with , *Herpolhode* , on Fixed Base-circle PT while Momentum-Ellipsoid describes Cone POS with , *Polhode* , on Fixed Base-circle PS. The tangential-Plane of Angular-velocity-Ellipsoid at , P, is perpendicular to Angular-momentum-Ellipsoid axis $\overline{B}$, while the tangential-Plane of

$\overline{\text{B}}$ vector is perpendicular to Angular-velocity-Ellipsoid $\overline{\text{w}}$ vector .

In (3) , ⊕ constituent is rolling on Small-circle $PP_o = 2R$, Sweeps-out , at OP slant height of the Central-Cone of Angular velocity , *Polhode* , on the Ecliptic-Pole, $\overline{\jmath}$, with the angular velocity , $w = \frac{v}{r} < \frac{v}{R}$ such that , the Rotational-momentum $\overline{B}$ becomes ,

$$\overline{B} = \overline{\jmath}\, J_2 \,.\, \frac{v}{R} = \frac{\pi r^4}{4} . \frac{\sigma}{2r} [1+\sqrt{5}\,] = \frac{\pi r^3 \sigma}{8} [1+\sqrt{5}\,] .$$

Because vertical force ,Q, cannot be zero and Angular velocity , $u = \frac{s\,Q}{B} = \frac{s\,Q}{J_3 w}$ = constant and Period of rotation , $T = \frac{2\pi\ J_3 . w}{sQ}$ changes , and this from , J_3 , by the area of the New Great- circle (πR^2) instead of Initial (πr^2), becomes $Q = \frac{u\overline{B}}{s}$

3.3. ***Application to Material-Points*** [⊕↔⊖] , [⊕ ↻↺ ⊖] of Figure.19.

Since the constituents of Material Point are without mass , and this because there is not any reaction to the inter motion , the Rotational Momentum becomes from Angular-velocity ,w, and so equation of *Rotational Kinetic Energy* $L = \frac{1}{2} J_a w^2$, is related to moment of Inertia J_a , *therefore* any change to the Great-circle-area of Ellipsoid , changes Kinetic-Energy , ***so*** , On ⊕, constituent Inertia J_a becomes from the Inertia of Area , of the Surface traced on the Great circle of the ⊖ constituent and is $J_3 = J_r = \frac{\pi r^4}{4}$ for circle-radius , r , and of Area = π.r² , while on Small-circle of radius R is $J_3 = J_R = \frac{\pi . R^4}{4}$ and of Area = π.R² .

The change in moment of Inertia is $J_D = \frac{\pi}{2} (r^4 - R^4)$ and becomes of the different trace of motion .

The ⊕, constituent is rolling on ⊖ constituent with the constant velocity $\overline{v} = \frac{\sigma}{2} [\ 1+\sqrt{5}\ ]$ because of the Constant Stress ,σ. Circular motion happens with parallel circles perpendicular to ,z , axis .

Case a.. ⊕, constituent is ***Not-Rolling around ,z, axis .***

The Algebraic-figure of Momentum to center of mass is $J_2 . w_2$, where J_2 is the moment of Inertia to vertical axis y , and w_2 is the Angular-velocity-meter and equal to $\frac{v}{R}$, where R is the Curve-Radius of Curvature .

The direction of the Momentum is on , y , axis and that of Angular-velocity-vector is $\overline{\imath}\, w_2$ and issues ,

$\overline{B} = \overline{\imath}\ J_2\, w_2 = \overline{\imath}\ J_2 \,.\, \frac{v}{R}$

Because the first derivative of Momentum is zero therefore magnitudes , v , R , J_2 are unaltered and so is not needed any other force to act on , z , axis , *except that of Centripetal* , to follow curve.

Case b.. ⊕, constituent ***Is-Rolling around ,z, axis on Small-circles*** .

Because of the constant Stress , σ , and Angular velocity w_2 , Momentum $\overline{B}$ is containing another term on $\overline{k}$ axis , $\overline{k}\, J_3\, w_3$ with much greater Algebraic-figure , and this because during rolling on semicircle, another curve R < r on ⊖ constituent executes greater number of turns about its axis , x and $J_3 = \frac{\pi R^4}{4} < \frac{\pi r^4}{4}$ and the difference moment of Inertia is $J_D = \frac{\pi}{2} (r^4 - R^4)$.

Angular velocity w_3 becomes greater to w_2 as it is , $J_R > J_2$. The first derivative of this term under the restriction w_2= constant becomes $\frac{d\overline{B}}{dt} = J_3\, w_3 \frac{d\overline{k}}{dt}$, where $\frac{d\overline{k}}{dt} = \overline{\imath}\ w_2 = \overline{\imath}\ \frac{v}{r}$, so for the continuity of motion is needed a couple of forces at the end points of axis such that moment is

$\overline{M} = \overline{\imath}\ J_D\, w_3 w_2 = \overline{\imath}\ J_D\, w_3 \,.\, \frac{v}{r}$. Reactions are created at the ends of , z , axis and for 2R distance then Reaction is $F = \frac{J_D\, w_3 w_2}{2R} = \frac{J_D\, w_3\, v}{2R^2} = \frac{J_D\, v^2}{2R^2\, r} = \frac{\pi(r^4 - R^4)\,\sigma^2 (3+\sqrt{5})}{2R^2 r . r^2} = \frac{\pi\sigma^2 (r^4 - R^4).(3+\sqrt{5})}{2 R^2 r^3}$,

which is the Gyrostatic reaction of motion .

The vertical force Q = $\frac{u\bar{B}}{s} = \frac{u\bar{B}}{R} = \frac{\frac{\sigma}{r}[1+\sqrt{5}]\cdot \pi r^3\sigma}{R\quad 8}[1+\sqrt{5}\,] = \frac{[\,\pi\,\sigma^2\,(3+\sqrt{5})\,]}{8\,.\,R}$ and for rotation the needed moment is , M = Q.$(r^2\text{-}R^2)$ = $\frac{[\,\pi\,\sigma^2\,(r^2-R^2)\,(3+\sqrt{5})\,]}{8}$ with Reactions on perpendicular to , y , axis .

For Planck`s length and ratio k = $\frac{R}{r}$ = 0,5 , the above become in Algebraic figures ,

$$F = \frac{\pi\sigma^2(\,r^4-R^4).(3+\sqrt{5})}{2\,R^2\,r^3} = \frac{\pi\sigma^2(\,1-k^4).(3+\sqrt{5})}{2\,k^2\,r} = \frac{\pi.17{,}04.10^{-54}.0{,}75\,.5{,}236.}{2.0{,}25\,.4{,}453.10^{-35}} = 9{,}442\,.\,10^{-18}\ \text{N}$$

$$Q = \frac{[\,\pi\,\sigma^2\,(3+\sqrt{5})\,]}{8\,.\,R} = \frac{[\,\pi\,\sigma^2\,(3+\sqrt{5})\,]}{8\,.\,k\,r} = \frac{\pi.17{,}04.10^{-54}}{8.0{,}5\,.4{,}453.10^{-35}} = 3\,{,}000\,.\,10^{-19}\ \text{N}$$

$$M = \frac{[\,\pi\,\sigma^2\,(r^2-R^2)\,(3+\sqrt{5})\,]}{8} = \frac{[\,\pi\,\sigma^2 r^2(1-k^2)\,(3+\sqrt{5})\,]}{8} = \frac{\pi.17{,}04.10^{-54}0{,}75.19{,}829.10^{-70}5{,}236.}{8} = 1{,}327.10^{-121}\ \text{KN.m}$$

Remarks :

Forces , F , Q , applied on lever-arms , r , and , R , *which are both in the* , Material-point-System , are differing on the Moment of Inertia J_r and J_R values , of the sketching circles of rotation .

Synopsis 3 :

The Material-point *is the discrete continuity **Content*** ≡ |{⊕+⊖}|= ***The Quantum*** through mould of Space –Anti-space in itself , *which is the material dipole in inner monad Structure and is Identical with the Electromagnetic cycloidal field of Energy monads .This is* ,the Energy-distance ≡ **The Form** , *and consists the deep concept of Material-geometry* , ***i.e.***

Material-Point becomes as , DISCRETE - FORM , from Euclidean-Point which is the CHAOS , by its Eternally – Moving-Content → the in Mode Content of existence , which is the Energy-Quanta in Mechanics. In Article is clarified the* How *, the* When *and the* Why *CHAOS becomes DISCRETE and thus Joining Euclidean - Geometry – Mechanics – Physics in One Unity and with the same Universal Laws , from Zero ≡ Non-existence ≡ Chaos , to Discrete , Microcosms to Macrocosms .

In Primary*-material-point* , ***Form*** (distance = r) ***and Content***, [⊕ ℧℧ ⊖] , *is constant while in all others issues the law of transformation of **Quantity into Quality** , and this is extended from the smaller particle to the largest phenomena , i.e. in all levels of the Energy-space universe .*

Form (distance = r) ,**of *Material point* AB** ,{ *the two Spherical constituents* ,[⊖≡ K_o,K_oB]–[⊕≡K,KB]} *of Space point* , A (⊕) *and Anti-point* , B (⊖) ***and created on STPL Mould*** , *by the rotating velocity vector* v_A = w.r , ***is thus forming*** *the material angle* , $\vartheta = \vartheta_A . t = (\frac{v_A}{\sqrt{c^2-r^2}})\,.\,t$, *which in turn* { **r** and **ϑ** } *create the Envelope of Harmonic-Vibration-curves on this , r , ϑ rotating STPL - line .* In [58] ,

Quantity into Quality *transformation can be seen in many levels as , the velocity* v_A *of any point* A , *in Primary-Dipole* AB *which creates Infinite Free Harmonic Vibrations on* AB *monads , following Euler-Savary mechanism where Rolling motion is transformed to Vibration curves , and on different waves which properties is determined by the number of oscillations per second , i.e.*

*The **frequency related to vibrations** is the quantitative change giving rise to different kinds of the wave-signals . Increasing the rate of vibrations turns the colours from Red indicating low frequency, to Orange -Yellow , to Violet , to the invisible Ultra-violet and* , X-rays , *and to gamma rays . Reversing the process at the lower end , we go from infrared and heat rays to radio-waves , as in* [39]. *Also the changing of Temperature offers no resistance to electric-currents , and for Helium which is the only substance which cannot be frozen because is in Primary-Form and exists the Critical – Energy Quantity* CEQ *as before .*

Instead , a particle`s intrinsic Angular-momentum is just another property that it has , like charge or mass , which is the structure of space itself .

The difference between Organic and Inorganic Chemistry is only relative ,
i.e. the different collection of atoms and the DNA structure. [54-55]

The elementary particles which make up the atoms interact constantly by passing into each other while at every moment are both themselves and something else (are a different entity which in turn determines the behavior of its component parts) while the Union of atoms into molecules follows chemical formulas, the atoms themselves had remained unchanged with only a purely quantitative relationship , in contradiction to Molecule which cannot be reduced to its component parts without losing its identity . The Principle of the < Whole being equal to the parts > issues for all compositions either in Form or in Content or for both , as happens to the square root of a number which can be either positive or negative .

It was referred that the Zero equality in Content , $(P_A + P_B)=0$ *is the Critical-Energy-Quantity* {CEQ} *for any transition in Quality , is a kind of Catalyst which is not changing the composition of Primary Segment ,* the unity of opposites *and also the Work ≡ Energy ≡ Heat ≡ Pressure ≡ velocity ≡ motion involved in all levels , and generally on Material-Points , in Material-Geometry . Beyond a certain Critical-Energy-Quantity the Bonds ≡ Content are broken and then a qualitative leap occurs .*

AS , Zero(0) *is the Border-line between all Positive* (+) *and Negative magnitudes* (-) *and stands in a relation of infinity to every other number and represents a real magnitude , THUS* {CEQ} *which is zero in Material-point , is identified with that Zero of Euclidean-geometry.*

Quality *in a particle is ± Spin dependent on its direction , giving the Outer Electromagnetic-Wave of moving and the Inner Electromagnetic-Field of monads . This Inner unity of opposite* [⊕↔⊖] ≡ 0 *is , in nature , the velocity ≡ motor-force of all motion , starts to recover → gathering strength as Spin which in turn to Outer-Spin and to the Electromagnetic - Wave .* [40]

All above occur either by Rolling of Space A ≡ (⊕) *on Anti-space* B ≡ (⊖) sphere , joint by ,σ, Stress , *on STPL Mould ,* or *by Rolling of Space* A ≡ (⊕) *on Anti-space* B ≡ (⊖) Evolute-Cycloid , *joint by the* ,$\bar{v}$, energy , *on STPL Mould-length which is the* → Isochronous curvature radius *from the Cycloid , Evolute-cycloid Rolling points* . All above in Energy-Space Universe is a Slit for Future-Technologies .

From math theory of Elasticity , the Total Work on free edges where there is no shear becomes from Principal stresses only and the Work is $W = \frac{\sigma^2}{2E} + \frac{\tau^2}{2G}$, where the analogous Energy in monads
$W = \frac{1}{2}[\varepsilon E^2+\mu H^2]$ is spread as the First Harmonic and equal to outer Spin $\bar{S} = E / w = 2\pi r.c$.
Equation of Planck`s Energy E = h.f = (h/λ).c is equal to the Isochromatic pattern fringe-order in monad as →
$\sigma 1 - \sigma 2 = (a/d).N = (a/d)nf1 = (8\pi r^2/3).n.f1$. where , n = the order of isochromatic , *a number* , and f1= the frequency of Fundamental-Harmonic .
This is the why colors exist in fringe-order and are of wave form.
Since total Energy in cave $(wr)^2$ is dependent on frequency only , and stored in the Fundamental and the first Six Harmonics , so the summations bands of these Seven Isochromatic Quantized interference fringe-order-patterns , is total energy , E , in the same cave $(wr)^2$ as ,

$$E = \text{Spin} , \quad w = \bar{S}.w = (h/2\pi).2\pi f = [\frac{8\pi r^2 f1}{3}].[\frac{n(n+1)}{2}] = [\frac{4\pi r^2 f1}{3}]. n.(n+1) \qquad \text{.........(a)}$$

When stress (σ1-σ2) go up then , n = order fringe defining Energy goes up also ,and the colors cycle through a more or less repeating pattern and the Intensity of the colors diminishes .Since phase φ = kx-wt = Spatial and Time Oscillation dependence , For n = 1 , Energy in the First Harmonic is , E =2πr.c = $[\frac{4\pi r^2}{3}]$.f1.[1] , and for n = 2 , Energy in the First and Second Isochromatic Harmonic is , E = $[\frac{4\pi r^2}{3}]$.f1.[3] in threes, and , φ , is trisected with Energy-Bunched variation f2 , i.e.
Energy stored in a homogeneous resonance , is spread in the First of Seven-Harmonics beginning from the (first) Fundamental and after the filling with frequency ,f1 , follows the Second - Harmonic with frequency , 2.f1 , and so on .

In this *way the Energy-Space monads are generated from the frequency in caves , or slits. This is the how Spin is ½ or 1 .*

In Second-Harmonic energy as frequency is doubled and this because of sufficient keeping homogeneously in Spatial dependence , Quantity kx =(2π/λ).x , which is in threes , meaning that , → ***Dipole–energy is Spatially-trisected*** in Space - Quantity Quanta the Spin=h/2π as the angle φ , of phase φ=kx-wt=(2π/λ).x , ***and Bisected*** by the Energy-Quantity Quanta as this happens in an RLC circuit . [49] .

4.. *The Intrinsic and Ordinary Rotation of monads* :

a.. Momentum and Spin , in Material-Point .

In Material-point , the two magnitudes of the Energy ellipsoids , are those of ,

Angular-velocity - Ellipsoid $\overline{\mathbf{w}}$ → $J_1 w_1^2 + J_2 w_2^2 + J_3 w_3^2 = 2L = C$ ……... (13) →

Angular - Momentum-Ellipsoid $\overline{\mathbf{B}}$ → $\frac{1}{J_1} B_1^2 + \frac{1}{J_2} B_2^2 + \frac{1}{J_3} B_3^2 = 2L = C$ …..... (13a)

and for Constant Kinetic-Energy ,L, of ⊕ sphere then exists $\overline{B}\overline{w} = 2L$. and Equation (9)

→ $J_x w_1^2 + J_y w_2^2 + J_z w_3^2 - 2(J_{yz} w_2 w_3 + J_{zx} w_3 w_1 + J_{xy} w_1 w_2) = C$ ...……. (9)

Defines angular velocity , $\overline{w}\,(w_1,w_2,w_3)$ in all directions of constant , $\overline{B}\overline{w}$, *Therefore issues and for the Constant Kinetic-Energy* ,L, of ⊕ sphere $\{\overline{B}\overline{w} = 2L\}$ and defines the same Ellipsoid .

From the relation of Kinetic energy $L = (\frac{B}{2})\, w = (\frac{B}{2}).2\pi.f = \pi.Bf$, and from $E = h.f = h.(w/2\pi) = w.\frac{h}{2\pi} =$ w.[Spin] then → **Spin =** $\frac{\mathbf{h}}{\mathbf{2\pi}}$ **,** and from $\overline{B}\overline{w} = 2L$=Energy $= h.f = w.\frac{h}{2\pi}$, or → $\overline{\mathbf{B}} = \frac{\mathbf{h}}{\mathbf{2\pi}}$ **, then ,**

The Momentum-Energy-Ellipsoid $\overline{\mathbf{B}} = \frac{\mathbf{h}}{\mathbf{2\pi}}$ **= Spin of monads .** and also from (9) ,

Every radius of Inertial-Ellipsoid acquires meter , the angular velocity which ⊕ sphere must be rotated , so that kinetic energy remains constant and equal to → $\equiv \frac{\mathbf{1}}{\mathbf{2}}$ **C** ***and Because of above property Inertial-Ellipsoid coincides to Angular – Velocity - Ellipsoid.***

The two Ellipsoids that of , *Angular-velocity-Ellipsoid* , and that of , *Momentum ≡ Energy - Ellipsoid* are Interchangeable , meaning that ***Energy* ≡ *Momentum from Chaos* ≡ *monad*** , sweeps out a cone centered on the *Ecliptic-pole of Angular-velocity Ellipsoid as* , **The Spin ,** in this tiny Energy-ellipsoid . The Two magnitudes , of *Angular-velocity-Ellipsoid* , and of *Angular-Momentum ≡ Energy - Ellipsoid* , in the absence of Principal axis are both conserved , *i.e. Energy and mass are* interchangeable .

b.. The Value of Energy-quanta in Material-Point .

A Standing Wave or ***Stationary Wave ,*** is a wave having parts remaining in constant position [49]. Equation of Gravity , *which is the minimum and less attractive Force in a Standing wave , equal to* ∇i = 2(wr)² *on* ***dispersion*** **→[|+($\overline{\mathbf{w}}$.r)²|↔|-($\overline{\mathbf{w}}$.r)²|=|λ|] cycloidal cave** ← and *which cave is the material energy length consisted of* ***the material end points*** **|(wr)²|** *and are the two* ± |(wr)²| *dipole , restrained by the above Electromagnetic field* , E , P , *and becoming from the binding force* , |2(wr)²| are as follows ,
In a cave of length ,*l*, where vibrations are of two fixed nodes , *one pair* at each end , and since also c = f.λ then exist for ,

First Harmonic	f 1 →	*l* = λ/2 = c / (2.f)	and	**f 1**	=	c / (2*l*)	=	**f 1**
Second Harmonic	f 2 →	*l* = λ = 2c / (2 .f)	and	**f 2**	=	c / (*l*)	=	**2 .f 1**
Third Harmonic.	f 3 →	*l* = 3λ/2 = 3c / (2.f)	and	**f 3**	=	c / (*l*)	=	**3.f 1**
Fourth Harmonic.	f 4 →	*l* = 4λ/2 = 4c / (2.f)	and	**f 4**	=	c / (*l*)	=	**4.f 1**

When the applied force **E** =hf= **w**.(h/2π) = w .**Spin** then **Spin** = $\frac{\mathbf{E}}{\mathbf{w}}$ = [±$\overline{v}$.s²] /w = (r.s²) on cave ,r, and are created the **Fermions** with **Spin = [** $\frac{\mathbf{E}}{\mathbf{w}}$ **] = (r .s²) →** $\frac{\mathbf{1}}{\mathbf{2}}$

When the applied force **E** = h.f = **w**.(h/2π) = [∇i = 2(wr)² = 2.$\overline{v}$s²] on cave then **Spin** = $\frac{\mathbf{E}}{\mathbf{w}}$ = [2.$\overline{v}$.s²] / w = 2.(r.s²) and are created **Bosons** with **Spin = [** $\frac{\mathbf{E}}{\mathbf{w}}$ **]= 2.(r.s²) → 2.(** $\frac{\mathbf{1}}{\mathbf{2}}$ **) = 1** ***which is double the before.*** i.e. ***Energy*** as velocity vector $\overline{v}$ or **E** =[±$\overline{v}$], applied on the material energy dipole points [± s²] *as the Dipole Quantity* |$\overline{v}$|² =|$\overline{w}$x$\overline{r}$|² = |$\overline{w}$.r|² = s² , separately creates the massive Particles , ***Fermions*** , while *the* velocity vector $\bar{v}$, applied on the ***Double Quantity*** **Energy** vector breakages $\nabla i = 2(wr)^2 = 2.s^2 = 2[\pm\bar{v}]^2 =$ **2E** and since v = (w.r) , $2v.s^2 = 2|\bar{v}|s^2 = 2.|\bar{w}x\bar{r}|^3 = 2v.|\bar{w}.r|^2 = 2s^2$ creates the Energy Particles , ***the Bosons*** , by doubling its frequency [f 2 = 2.f 1] in the same cave . Fig.21.

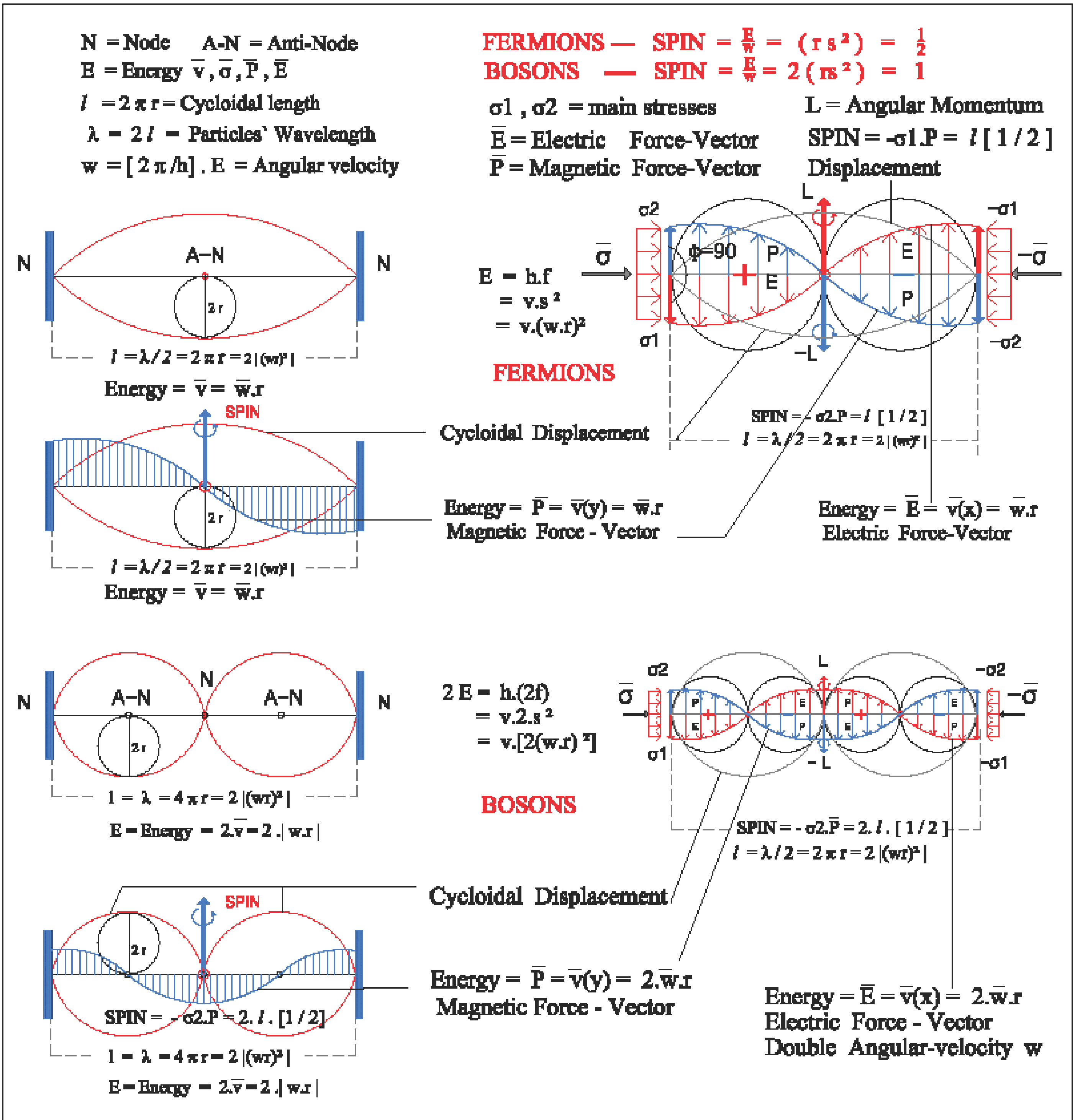


Figure.21. The Energy $\bar{B} = \frac{h}{2\pi}$ = Spin = $\frac{h.f_1}{\bar{w}}$ = as velocity , v = (wr) in cave , *l* , is the Spin ½ ,

while Doubled $\bar{B} = \frac{h}{2\pi}$ = Spin = 2 = $\frac{h.f}{\bar{w}}$ = 2. $\bar{B}$, in the same cave , *l* , then → f = 2. f_1

i.e. In the same cave , *l* , Energy is quantized as $\mathbf{\frac{1}{2}}$ / 2 .$\frac{1}{2}$ =**1** / 3 .$\frac{1}{2}$ =**1,5** / 4 .$\frac{1}{2}$ =**2** ,… n $\frac{1}{2}$

and so on , depending on the number , n , of Wave-notes in cave , *l* .

Question : *How and Where* Energy $\bar{B} = \frac{h}{2\pi}$ = Spin *is becoming Halve and in a changing Direction* .

4.1. *The Intrinsic Angular Momentum and Spin .*

The both rest , Gravity Field and Dark-matter are consisted of the same material points jointed by the *inward* E,P fields , *which two* , consist Gravity`s and Dark-matter`s rest material dipole. From Planck`s energy equation E=h.f=(h/λ).c and Isochromatic pattern , σ1-σ2 = (a/d).N=(a/d).n.f1 where the Isochromatic fringe *Quantized* order $n.f_1 = (wr)^2$, is varying from the First–Harmonic Energy-Bunched variation $f_1 \to \lambda/2$ to Second $f_2 \to \lambda$ for doubled Energy and to $n.f_1$. [40] The Standing waves in caves , $l = \lambda/2 \to \lambda$, and the Intrinsic Angular momentum of Particles for ,

[1] *The applied force on* NN *cave is* **E** =h . f= **w**.(h/2π)= w . SPIN → **Spin=** $\frac{E}{w}$ = $[\pm\bar{v}.s^2]/w = (r.s^2)$

[2] For E = $\pm\bar{v}$ then → **Spin** = $\frac{E}{w}$ = $[\pm \bar{v}.s^2] / w$ = **(± r . s²)** → **± Fermions** ***with spin*** $\frac{1}{2}$

[3] For E = $[\nabla i=2(wr)^2 = 2.\bar{v}s^2]$=**2.(r.s²)** then → **Spin** =$\frac{E}{w}$= $[2.\bar{v}.s^2]/w$= **2.(r.s²)** → **Bosons** ***of spin*** **1**

i.e. Double energy [2.(r.s²)] on a constant cave creates **2** crests and doubling the frequency (h) **,** with Spin 1 . **N-times energy [N.(r.s²)]** on a constant cave creates **N** crests N-times the frequency **(h)** with **Spin N/2** .

Since Energy **[$\bar{E}$x$\bar{H}$]** = Pressure = Spin **S = ρ.c.w. [εE²+μH²] / 2 = 2rc. sin.2φ** then
Energy / sin2φ = **[εE²+μH²] / sin2φ =** 2rc/ ρw = 4r² / ρ = constant , only on Cycloidal motion.

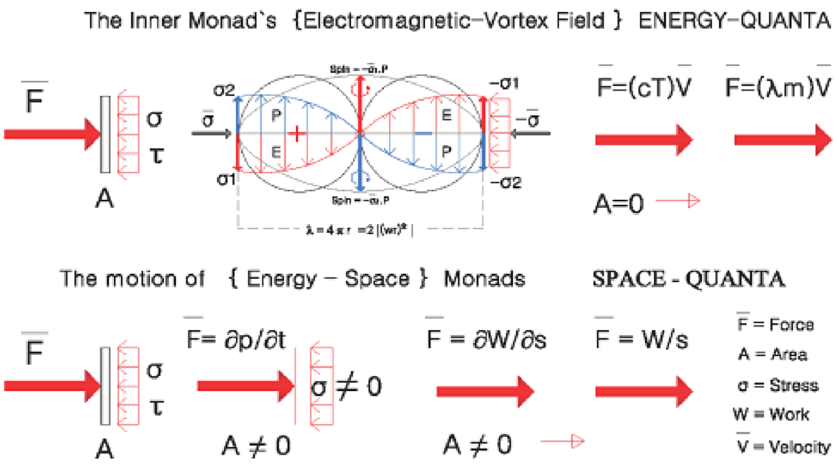


Figure .22.
Transformation of principal Stresses into Force-velocity. Inversing the Spin becomes the Quantization of Work as Discrete Velocity Force (The Kinetic Energy) =The Electromagnetic field [E , P] = momentum = (p) = Force *For Area* A=0 then Force is Transformed as Velocity $\bar{v}$ and as Stationary - Kinetic Energy of monads .

Remarks :

In Fig.21 Spin $\bar{B}$ = $\frac{h}{2\pi}$ = h .($\frac{f_1}{w}$) in cave`s length , $l = \frac{\lambda}{2}$, for wavelength , λ , and Double

Spin $\bar{B}$ = $\frac{h}{2\pi}$ = h.($\frac{2.f_1}{w}$) in cave`s length , $l = \frac{\lambda}{4}$, for wavelength , λ , and when this in

Conversely . i.e. → If a Force (as frequency f_1) in a cave of length ,*l*, is ***Coerced*** to enter another cave of a smaller length , then is separated into two Half-lengths , $\frac{l}{2}, \frac{l}{2}$, with $l = \frac{\lambda}{4}$

and Spin $\bar{\mathbf{B}}$ = h.($\frac{f_1}{2w}$) = h.($\frac{f_1}{4\pi f_1}$) = $\frac{\mathbf{h}}{\mathbf{4\pi}}$ = ***One halve of the Initial Spin*** $\frac{h}{2\pi}$.

In Fig.2 In (**1**) The Glue-Bond pair of opposites [⊖ ⊕] in the ***Straight Direction of Great circles ,*** creates rotation on circle of radius , r , with velocity $v = w.r = \frac{2\pi}{T}.r = 2\pi r.\ f = [\frac{\sigma}{2}].(1+\sqrt{5})$,

where frequency $f = \frac{(1+\sqrt{5}\,]).\ \sigma}{4\pi r}$, Period $T = \frac{4\pi r}{\sigma(1+\sqrt{5})}$ and ±σ , are the two equal and opposite Centripetal ,F_p , Centrifugal ,F_f forces and Angular velocity $|w| = \frac{\sigma}{2r}[\,1+\sqrt{5}\,]$.

Energy is → $E = h.f = \frac{(1+\sqrt{5}]).\sigma h}{4\pi r}$ and exists as Stationary Wave *in **Zero** Wave-node , of cave* $l = \lambda/2$ and of wavelength , λ . If the same Energy is ***Obliged to enter a smaller cave*** then this cave is the length of the Stationary wave for wavelength , $\lambda = l$, which is separated into ***Two Half-lengths*** $\frac{l}{2}, \frac{l}{2}$, with *One-Wave-node* . Thus Energy is Split into the two lobes.

The Momentum-Energy-Ellipsoid $\bar{\mathbf{B}} = \frac{\mathbf{h}}{\mathbf{2\pi}} = \mathbf{SPIN}^{\mathbf{SD-G}}$ is of , ***Straight Direction in Great circles.***

In (**1**) The Glue-Bond pair of opposites [⊖ ⊕] in the , ↺ , ***Left Direction in Small circles*** , creates rotation on circle of radius , R , with velocity $v = w.2r = \frac{2\pi}{T}.r = 4\pi r.\ f = [\frac{\sigma}{2}].(1+\sqrt{5})$, where frequency $f = \frac{(1+\sqrt{5}]).\ \sigma}{8\pi r}$, Period $T = \frac{8\pi r}{\sigma(1+\sqrt{5})}$ and ± σ are the two equal and opposite Centripetal , F_p , Centrifugal , F_f , forces .
The Angular momentum $\bar{w}$ is Anti-Clockwise , that is to say Negative [-] ≡ [↺].

The Obliged Energy $E = h.f = \frac{(1+\sqrt{5}]).\sigma h}{4\pi r}$ of the , ⊕ , constituent to rotate in a circle of radius R < r , is Split into two lobes following the ***Stationary-Wave-Nodes Principle*** .

Energy is → $E = h.f = \frac{(1+\sqrt{5}]).\sigma h}{8\pi r}$ *in **One** Wave-node , and*

Momentum-Energy-Ellipsoid $\bar{\mathbf{B}} = \frac{\mathbf{h}}{\mathbf{4\pi}} = -\mathbf{SPIN}^{\mathbf{LD-S}} = \frac{1}{2}\mathbf{SPIN}^{\mathbf{SD-G}}$ is for **Left *Direction- Small circles.***

In (**1**) The Glue-Bond pair of opposites [⊖ ⊕] in the , ↻, ***Right Direction in Small circles*** creates rotation on circle of radius , R , with velocity $v = w.2r = \frac{2\pi}{T}.r = 4\pi r.\ f = [\frac{\sigma}{2}].(1+\sqrt{5})$, where frequency $f = \frac{(1+\sqrt{5}]).\ \sigma}{8\pi r}$, Period $T = \frac{8\pi r}{\sigma(1+\sqrt{5})}$ and ± σ are the two equal and opposite Centripetal ,F_p , Centrifugal , F_f , forces .
The Angular momentum $\bar{w}$ is Clockwise , that is to say Positive [+]≡ [↻].

The Obliged Energy $E = h.f = \frac{(1+\sqrt{5}]).\sigma h}{4\pi r}$ of the , ⊕ , constituent to rotate in a circle of radius R < r , is Split into two lobes following the ***Stationary-Wave-Nodes Principle*** .

Energy is → $E = h.f = \frac{(1+\sqrt{5}]).\sigma h}{8\pi r}$ *in **One** Wave-node , and*

Momentum-Energy-Ellipsoid $\bar{\mathbf{B}} = \frac{\mathbf{h}}{\mathbf{4\pi}} = +\mathbf{SPIN}^{\mathbf{RD-S}} = \frac{1}{2}\mathbf{SPIN}^{\mathbf{SD-G}}$is of **Right *Direction-Small circles.***

This is **The How** (by following the Stationary-Wave-Nodes Principle) and
The Where (In the first Energy Stationary-monad of Material-Geometry cave) .
The How , this Practically can be succeeded , is left to Laboratory Nuclear Physicists .

For Zero Static - Moment $\bar{M} = 0$, the Energy-monad is supported through center of mass and is ,

$$\begin{aligned} J_1 \frac{dw_1}{dt} - (J_2 - J_3).w_2 w_3 &= M_1 = 0 \\ J_2 \frac{dw_2}{dt} - (J_3 - J_1).w_3 w_1 &= M_2 = 0 \qquad \text{……….. (21a)} \\ J_3 \frac{dw_3}{dt} - (J_1 - J_2).w_1 w_2 &= M_3 = 0 \end{aligned}$$

and for rotation through Principal axis of Inertial-Ellipsoid [for ,z, axis $w_1 = w_2 = 0$] then w_1 =constant (= 0) w_2 =constant (= 0) w_3= constant . ***i.e. the rotation is continued through this axis with constant angular velocity*** $\bar{w} = \frac{\bar{v}}{r} = \frac{\sigma}{2r}[1+\sqrt{5}]$ ***and of that of the material-point*** , of radius , r , ***and of the three Free-axis*** .

4.2. ***The Wave nature of Monad*** $\overline{\mathbf{AB}}$ **.** Following Analysis in [33] then ,

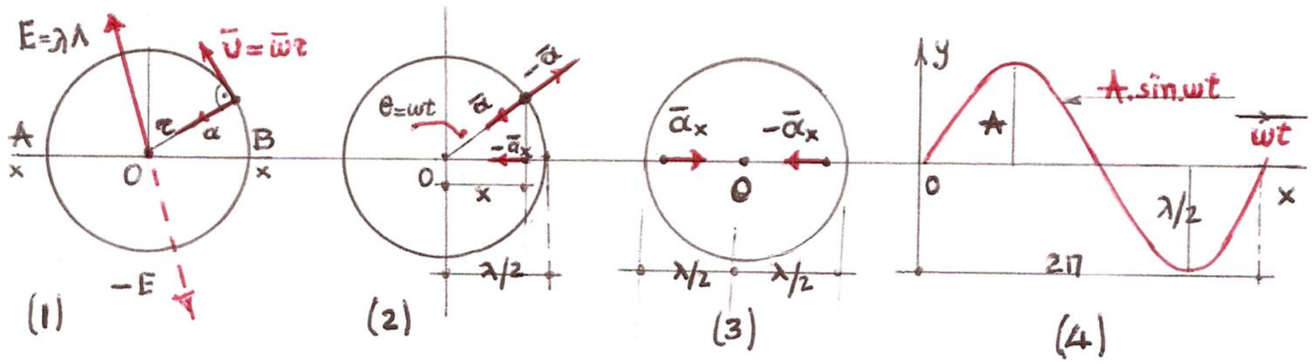


Figure.23. In (1) , are shown *Velocity* , $|\bar{v}| = w.2r = \frac{2\pi}{T}.r = 4\pi r.\ f = [\frac{\sigma}{2}].(1+\sqrt{5})$, *Angular velocity* $|\bar{w}| = \frac{\sigma}{2r}[1+\sqrt{5}]$ and *Frequency* , $f = \frac{(1+\sqrt{5}]).\sigma}{4\pi r}$ in cave , r .

In (2) , are shown Centripetal , ā , and Centrifugal ,− ā , acceleration in cave , r .

In (3) , are shown the *Projections* on AB axis of Centripetal , $\bar{a}_x$, and Centrifugal ,$-\bar{a}_x$ acceleration in cave , r = λ .

In (4) , is shown the *Sinusoidal - motion* of the Centripetal , $\bar{a}_x$ and Centrifugal ,$-\bar{a}_x$ acceleration in cave , r = λ/2 .

Monad $|\overline{\mathbf{AB}}|$ = r = λ/2 is the ENTITY ≡ Space , and [**A , B –** $\overline{\mathbf{P}}_{\mathbf{A}}$, $\overline{\mathbf{P}}_{\mathbf{B}}$**]** is the CONTENT ≡ Energy which is the LAW , so Entities are embodied with the Laws . Entity is quaternion ∇i = **[** s +v̄ ∇i] , with *Real* part |AB| = The length r = s = λ/2 between points A , B and *Imaginary* part the equal and opposite forces $\overline{P}_A$, $\overline{P}_B$ such that $\overline{P}_A + \overline{P}_B = 0$. [18] . In Primary-Neutral - Space [PNS] , [23] The Dipole | Ā ↻↺ B̄ | = [λ , Λ] in [PNS] are composed of the two elements λ , Λ which are created from points A , B only , where *Real* part |AB| = λ /2 = wavelength (*dipoles*) and from the embodied Work B̄w̄ = 2L , *where the Imaginary part* B̄ = (r.dP) = r̄xp̄ = I.w = [λ.p] = λ . Λ = k2 = $\overline{\mathbf{B}} = \frac{\mathbf{h}}{\mathbf{2\pi}}$, the momentum **Λ** = **B̄** and the Forces **dP =** $\overline{P}_B - \overline{P}_A$ are the stationary sources (*the excitation sources*) of the Space -Energy field . [22-25] .

The moving charges is velocity , v̄ , *created from the eternally rotated main stresses* , ± σ , forming the *dipole momentum vector* , ± Λ̄ , *when is mapped on the perpendicular to Λ plane as* → v̄ E || dP and v̄ B ⊥ dP) . Since (dP ⊥ ± Λ̄) the work occurring from momentum p̄ is p̄ = mv̄ = Λ acting on force **dP** . dP̄ is zero , so ***momentum*** **Λ̄ = mv̄** ***only , is exerting the velocity vector*** v̄ , ***to the dipole*** **, λ /2 ,** with the generalized mass **m** (*the reaction to the change of velocity* v̄) which creates the component forces , F_E || dP. v̄ and F_B ⊥ dP**x** v̄ . Dipole momentum { Ω = (λ . Λ) = Spin } is the rotating total Energy on dipole $\overline{\mathbf{AB}}$ and mapped on the perpendicular to Λ plane as , *velocity* v̄ , *mass* **m** , *on radius* , **r** , *to* AB/2 = **λ/2** From F.1 velocity v̄ is created from the Centrifugal force $\mathbf{F_f}$ = - σ and from the equal and opposite to it Centripetal force $\mathbf{F_p}$ = + σ with acceleration ā , and the *meter* of **x ,** component equal to **a**.sinθ = **a**.(x/A) = (a/A).x . The equation of motion then becomes m.(d²x/dt²) = - (a/A). x with the general solution , **x** = C_1 sinθ + C_2 cosθ = C_1 sin.**wt** + C_2 cos.**wt** , *where* **w**² = (a/Am) **,** C_1, C_2 constants and for θ = 0 then **v** = $\mathbf{v_o}$= w.r = w. λ / 2 = (**w**λ) / 2 and $\mathbf{x_o}$ = A = **λ/2 ,** where A = The amplitude of oscillation and when , x = 0 then A = λ / 2 . Above equations define the wave nature of inner motion of monads .

Considering motion from time $t = 0$ where motion passes through O , (x = 0) with velocity

$\mathbf{v_o}$// Ox , *then Displacement* $\mathbf{x} = \mathbf{v_o} . \sin \mathbf{w}t = A . \sin [\sqrt{(a/Am).\mathbf{t}} + \pi/2]$,

Velocity $\dot{\mathbf{x}} = dx/dt = \mathbf{v_o} .\mathbf{w}. \sin (\mathbf{w}t + \pi/2) = A. \sqrt{(a/Am)} . \sin [\sqrt{(a/Am).\mathbf{t}} + \pi/2]$ .... (3.1)

Acceleration $\ddot{\mathbf{x}} = d^2x/dt^2 = - \mathbf{v_o} .\mathbf{w}^2. \sin (\mathbf{w}t + \pi) = (a/m). \sin [\sqrt{(a/Am).\mathbf{t}} + \pi] = - (a/Am) . \mathbf{x} =$

$- (2a/\lambda m). \mathbf{x}$, or $\ddot{\mathbf{x}} =- (2a/\lambda m). \mathbf{x}$ i.e. The amplitude of oscillation ($\mathbf{x}_{maximum}$) is equal to the constant $\mathbf{v_o} / \mathbf{w}$ while the period **T** of a complete oscillation , to the constant $2\pi /w$ is as , $w = 2\pi /T = 2\pi f = \sqrt{(a/Am)}$ where f = frequency and solving for , a , then

$$\mathbf{a} = (2\pi / T)^2. (Am) = \mathbf{w}^2.(Am) = \mathbf{w}^2.(\lambda m) / 2 , \quad .... (3.2)$$

And for the material point where , $m = \frac{2E}{a_a} = [\frac{\bar{B}.\bar{w}}{\bar{B}x\bar{w}}] . J$, then $\mathbf{a} = \mathbf{w}^2. [\frac{\bar{B}.\bar{w}}{\bar{B}x\bar{w}}]. \frac{\pi r4}{2}$ .... (3.3)

i.e. Monads $|\overline{\mathbf{AB}}|$ ***are Waves*** or , ***of Wave nature*** .

A.. *The Binomial nature of Monad* $\overline{AB}$.

According to the Binomial **theorem** it is possible to expand on the power , **d ,** or $1/d \equiv {}^{\mathbf{d}}\sqrt{}$ of monad AB = $(s + \bar{v} \nabla i)^{\mathbf{d}}$ into a sum involving terms of the form as $({}^{d}{}_{k}).(\mathbf{s})^{d - k} . (\bar{v} \nabla i)^{\mathbf{k}}$ (*binomial formula*) and each $({}^{d}{}_{k})$ is a specific positive integer known as *binomial coefficient* . On Monad AB with power d = 1 → ∞ are created infinite Spaces and infinite Anti-Spaces (monads) ***on and in the same monad .*** i.e Spaces , Anti-Spaces and Sub -Spaces *on and in the same monad* are differing , *on the binomial coefficient* , *the successive decrease of powers on* **s** *and increase of power on* (∇i) which are also the infinite monads in monads . Since also Sub-Spaces are of ***wave nature*** then infinite Spaces and infinite Anti -Spaces differ only in angular velocity $\bar{\mathbf{w}}$, the velocity $\bar{\mathbf{v}}$, and the wavelength , **λ** . [27] , [29] . ***The Spaces - Sub-Spaces of monad* AB *are*** ,

$AB = (s + \bar{v} \nabla i)^{\mathbf{d}} = ({}^{d}{}_{0}).(\mathbf{s})^{\mathbf{d}}.(\bar{v}\nabla i)^{\mathbf{0}} + ({}^{d}{}_{1}).(\mathbf{s})^{\mathbf{d - 1}}.(\bar{v}\nabla i)^{\mathbf{1}} +....({}^{d}{}_{k}).(\mathbf{s})^{\mathbf{d - k}}.(\bar{v}\nabla i)^{\mathbf{k}} +({}^{d}{}_{d-1}).(s)^{\mathbf{1}}.(\bar{v}\nabla i)^{\mathbf{w -1}}+({}^{d}{}_{d})$,

$\mathbf{(s+\bar{v}\nabla i)^{1/d}}=({}^{d}{}_{0}).\mathbf{(s)^{1/d}}.(\bar{v}\nabla i)^{\mathbf{0}}+({}^{1/d}{}_{1}).\mathbf{(s)^{1/d-1}}.(\bar{v}\nabla i)^{\mathbf{1}} +...({}^{1/d}{}_{k}).\mathbf{(s)^{1/d-k}}.(\bar{v}\nabla i)^{\mathbf{k}}+({}^{1/d}{}_{1/d-1}).(s)^{\mathbf{1}}.(\bar{v}\nabla i)^{\mathbf{1/d-1}}+({}^{d}{}_{d})$

i.e ***Spaces or Sub-Spaces of any monad*** , AB *maybe* , ***Scalar or Imaginary or both parts*** . [14]

QUESTION ??

Why Rotational Energy as Spin = $\bar{\mathbf{B}} \equiv \Lambda$ is *Elastically* damped in monad $\lambda_P = 10^{-35}$ m , as mass, m , velocity $\bar{\mathbf{v}}$, angular velocity $\bar{\mathbf{w}}$, and finally as a Constant - Frequency , f , which is dissipated in the fundamental particles (*Fermions and Bosons*) by altering the two variables , velocity $\bar{\mathbf{v}}$, and wavelength , λ , only ??

Since monad (AB) = ***quaternion*** = **z** , and the ,**d** , Spaces and , $\mathbf{1/d = d^{-1}}$ Sub - spaces are monads in ,**d**, power and , $\mathbf{d^{-1}}$, root which represent the *Regular - Circumscribed* and the *Regular - Inscribed* Polygons in monad , AB , then quaternion $z^{\mathbf{d}} = \bar{\mathbf{z}} = s + \bar{v} = s + \bar{\mathbf{v}}.i = \mathbf{s} + [v_1+v_2+v_3]\mathbf{.}\nabla i = s +\bar{v} \nabla i$, where , **s ,** is the Scalar part and $\bar{\mathbf{v}} = [v_1+v_2+v_3]$, the Imaginary part of it , equal to $\bar{\mathbf{v}} \nabla i$, [25] and ,

$\rightarrow \mathbf{z}^{\mathbf{d}} = (s + \bar{\mathbf{v}} \nabla i)^{\mathbf{d}} = [z_o.(\cos.\varphi+ i.\sin.\varphi)]^{\mathbf{d}} = |z_o|^{\mathbf{d}}. \{\cos(d\varphi) + \boldsymbol{\varepsilon}.\sin(d\varphi)\} = |z_o|^{\mathbf{d}}. e^{i(d\varphi)}$

where ,

$\rightarrow |z_o| = \sqrt{s^2 + v^2{}_1 + v^2{}_2 + v^2{}_3}$, $\boldsymbol{\varepsilon} = [v_1.i + v_2.j + v_3.k] / [\sqrt{v^2{}_1 + v^2{}_2 + v^2{}_3}]$, $\cos.\varphi = s /|z_o|$

and

$\rightarrow \mathbf{z}^{1/\mathbf{d}} = \mathbf{(s+\bar{v} \nabla i)}^{1/\mathbf{d}} = |z_o|^{-\mathbf{d}}. [\cos.(\varphi+2k\pi)/w + i.\sin.(\varphi+2k\pi)/w] = |z_o|^{-\mathbf{d}}. e^{i(\varphi+2k\pi)/d}$ i.e.

In Planck\`s length , ***the Rotational Energy*** $\bar{\mathbf{B}}$ **= Spin ,** or

E = Λ = $\bar{\mathbf{B}}$ = (m$\bar{v}$). $\lambda_P/2$ = (m.wλ_P/2). $\lambda_P/2$ = (mw). $\lambda_P^2/4$ = (m.2πf).²/4 = f (mπ. $\lambda_P^2/2$) .
Total Energy **2L** ≡ $\bar{\mathbf{B}}\bar{\mathbf{w}}$ = h . f = Λ.$\lambda_P/2$ = (m$\bar{v}$ $\lambda_P^2/4$ = (m.w.$\lambda_P^2/4$). λ_P= (mw). $\lambda^3{}_P/4$ = (m.2πf). $\lambda^3{}_P/4$
= f (mπ. $\lambda^3{}_P/4$) , or , **2L** ≡ $\bar{B}\bar{w}$ = $\bar{B}\frac{v}{r}$ = (r.m.v) $\frac{v}{r}$ = mv² , which agrees with total energy of cave $\lambda_P/2$.

From equation of Work = Energy E = P.d$\bar{s}$ = P. $\bar{v}$.dT = P. $\bar{v}$.(2π/w) = P. $\bar{v}$.(2π/2π.λ) = P. $\bar{v}$/ λ = hf = h(**$\bar{v}$/L**) , i.e.
during diffraction , **d$\bar{s}$** , frequency , **f** , doesn't change and only the velocity , **$\bar{v}$** , and wavelength , **λ ,** changes ← the direction → Diffraction , **d$\bar{s}$** , maybe on any Quantized Space monad (*quaternion*)
as this is in Planck Length L_p ***but how ?***

Work is embodied in the three regions L_{up} , L_p , L_{ap} as the ***Rotating Energy Λ*** on dipole $\overline{AB}$ = d$\bar{s}_{Lup}$, d$\bar{s}_{Lp}$, d$\bar{s}_{Lap}$, in the Configuration of co variants , **Λ** , **d$\bar{s}$** , with the constant

C = 4.Λd$\bar{s}$/(πwλ²) , *which exists simultaneously as the Equation of → Quaternion* = Space . d$\bar{s}$ = $\bar{z}$ = [s ± $\bar{v}$.∇i] = [s ± $\bar{v}$.i] = Work = Total Energy = ET = [Λ∇ +Λ x∇] = $\sqrt{[m.\,v^2{}_E E]^2}$ + [Λ.v.**B** + Λx v.**B**]² = $\sqrt{[m.\,v.\,E^2]^2}$ + T ² = $\sqrt{[m.\,v.\,E^2]^2}$ + |$\sqrt{p_1\,.\,v.\,B_1}$|²+|$\sqrt{p_2\,.\,v.\,B_2}$|²+|$\sqrt{p_3\,.\,v.\,B_3}$|² = $(\bar{z}_o)^{\mathbf{d}}$ = (λ , Λ.∇I)$^{\mathbf{d}}$ = | $\bar{z}_o$|$^{\mathbf{d}}$. $e^{v-d\vartheta}$= | $\bar{z}_o$|$^{\mathbf{d}}$. **e**^ **{** [$\bar{Λ}$ ∇i /√ Λ’$\bar{Λ}$]. [Arc Cos (**d**|λ/2|.|√$\bar{z}$`$_o$. $\bar{z}_o$|] **}** **i.e.**

Nature has not any < meter > ***to measure quantized quantities (of Space and Energy) except these of Geometry constants , one of which is number , π , (Archimedes number , π) , so the quantization of Points*** (as λ) ***follows Geometry constant*** (π) ***and for Energy*** $\mathbf{W_d}$ ***, which is the quantized Energy of the Quantity dissipated per cycle*** [*and this because monads follow sinusoidal oscillation on wavelength = monads as the* **d**.th *power and the* **n**.th *root of this monad where* **w.n = 1** *as above* ***on and in the same monad***] ***and which energy is*** $\mathbf{W_d}$ as

$\mathbf{W_d}$ **= (mw) $\lambda_P^2/4$ = (2mπf). $\lambda_P^2/4$ = (mπ. $\lambda_P^2/2$).f = C.f . i.e**

From above monads **(s+$\bar{v}$ ∇i)** $^{1/\mathbf{d}}$ = | z_o| $^{-\mathbf{d}}$. $e^{i(\varphi+2k\pi)/d}$, where cos.φ = s / |z_o| , and for Rotated energy case, where , **s** = 0 , and also for , cos.φ = 0, exists for angle φ = π /2 , quaternion **(s+$\bar{v}$ ∇i)**$^{1/\mathbf{d}}$

as dimension power $e^{i.\left(\frac{\pi}{2}+2k\pi\right).1}$= $e^{-i.\left(\frac{5\pi}{2}\right).b}$= $e^{-i.\left(\frac{\pi}{2}+2k\pi\right).b}$= $\mathbf{e}^{\mathbf{i\,.\,(-\,5\pi/2)\,.10}}$ where is as [26] ,

L_p = $\mathbf{e}^{\mathbf{i\,.\,(-\,5\pi/2)\,.10}}$ is the basic Geometrical interpretation of the < ***Planck - scale - meter*** > based on the

two ***Geometry constants*** **e , π** where **k = 1** , and ***base*** **b = 10** , and this from logarithm properties with different bases on the same base **e** , as $e^{\mathbf{d}}$ = (b $^{\log_b(e)}$)$^{\mathbf{d}}$ = $b^{\mathbf{d}.\log_b(e)}$ and $^{\mathbf{d}}$√e = e $^{1/\mathbf{d}}$ = e $^{-\mathbf{d}}$ = $x^{1/\mathbf{d}.\log_b(e)}$ *which are monads in monads* , ***and is therefore of Wave motion*** *with the angular velocity*
w = 4$\mathbf{W_d}$ / (π. $\mathbf{C_o}$. λ²) , i.e.

Space and Energy is quantized and measured on the two Constant and Natural numbers , e , π where for base the natural logarithm , e , ***and exponent the decimal base*** , b = 10 , ***then exists →***

Planck's Length **Lp =** $e^{-i.\left(\frac{\pi}{2}+2k\pi\right).b}$= $\mathbf{e}^{\mathbf{i\,.\,(-\,5\pi/2)\,.10}}$ = $\mathbf{e}^{\mathbf{i\,.\,(-5\pi/2)\,.10}}$ = $e^{-(78,5398)}$ = **8,906 . 10 $^{-35}$** m , **or**

For base e = 2,71828 and base b = 10 then $e^{-78,2879}$ = 1 .10^{-34} m
For base e = 2,71828 and base b = 10 then $e^{-78,5398}$ = 1 .10^{-34} = **8,906 .** 10^{-35} **m**
For base e = 2,71828 and base b = 10 then $e^{-80,5905}$ = 1 .10^{-35} m
Since cave is a versor then *Planck's Length* [**8,906** .10^{-35}] is divided by π.$\sqrt{3}$ and is =1,616199.10^{-35}m

L_p = $e^{i.\left(\frac{\pi}{2}+2k\pi\right).b}$ = $e^{-i.\left(5\frac{\pi}{2}\right).b}$ = $e^{i.\left(-5\frac{\pi}{2}\right).10}$ = $e^{-.(78,5398).}$ = **8,906**.10^{-35} m = {$\sqrt{3}$.π. **1,616199**.10^{-35} m }.

which is the Answer to the above question .

B.. *The Geometrical explanation of the Binomial Monad* $\overline{AB}$. [31]

According to the Binomial theorem and for , w = 4 , *which may be any monad* , then monad is composited as ,

$$(s + \bar{\mathbf{v}}\,\nabla i)^{\mathbf{4}} = s^4 + 4.s^3 . (\bar{\mathbf{v}}\,\nabla i)^1 + 6.s^2 .(\bar{\mathbf{v}}\,\nabla i)^2 + 4.s^{\cdot} .(\bar{\mathbf{v}}\,\nabla i)^3 + (\bar{\mathbf{v}}\,\nabla i)^4 \quad \text{i.e.}$$

s^4 = The pure Massive part of monad which is the regular Tetrahedron in Space forming the *Massive - Matter* .

$(\bar{\mathbf{v}}\,\nabla i)^{\mathbf{4}}$ = The pure Energy part of monad which is the regular Tetrahedron in Space forming the *Energy – Quanta* .

$4.s^3 . (\bar{\mathbf{v}}\,\nabla i)^1$ = The mixed massive Trihedral (cube) with *Positive or Negative* linear - energy part forming *Fermions and Bosons* .

$6.s^2 . (\bar{\mathbf{v}}\,\nabla i)^2$ = The mixed massive regular Plane (square) with *Positive or Negative* energy part in Plane *forming the Antimatter* .

$4.s^{\cdot} . (\bar{\mathbf{v}}\,\nabla i)^3$ = The mixed massive regular Linear (on straight line) with *Positive or Negative* energy Cube part in Space *forming Energy - fields* .

A more extend explanation in [14 - 29 - 31] .

Summary :

a).. From definition **Spin** $\equiv \frac{\mathbf{E}}{\mathbf{w}} = \frac{h}{2\pi}$ = The Total Energy , E , in Particles .

From Mechanics , Physics the Total energy $\mathbf{2L} \equiv \overline{\mathbf{B}}\overline{\mathbf{w}}$ = h . f , and $\overline{B} = \frac{h.f}{w} = \frac{h}{2\pi}$, where ,

$\overline{B}$ = The Angular –Momentum – Ellipsoid .

$\overline{w}$ = The Angular –Velocity – Ellipsoid .

meaning that → Spin = $\frac{h}{2\pi}$ is identical with the Angular –Momentum –Ellipsoid $\overline{B} = \frac{h}{2\pi}$ of the Material Point .

b).. The Rolling of the [⊕] constituent , on the *Great-Circles* of the [⊖] constituent in the Material-Point , creates the + *or* – Bosons with ***Angular-Momentum-Vector*** $\overline{B}$ = Spin = $\frac{h}{2\pi} = 1$

c).. The Rolling of the [⊕] constituent , on the *Anticlockwise Small-Circles* of the [⊖] constituent in the Material-Point , creates the–Fermions with ***Angular-Momentum-Vector*** $\overline{B}$ = Spin= $\frac{h}{4\pi} = -\frac{1}{2}$

d).. The Rolling of the [⊕] constituent , on the *Clockwise Small-Circles* of the [⊖] constituent in the Material-Point , creates the +Fermions with ***Angular-Momentum-Vector*** $\overline{B}$ = Spin= $\frac{h}{4\pi} = +\frac{1}{2}$

e).. Material-Point is a monad with Pure Massive part , a *Regular - Polyhedron* in Space and with Pure Energy part , the *Work in the Regular - Polyhedron* in Space and with mixed massive Polyhedron with linear – Plane and Cube Energy parts .

4.3. *Spin , and the Magnetic - moment.*

Magnetic Dipole - moment ($\bar{\mu}$) , *or the Torque on a current loop* , is a ***vector - quantity*** arising from the rotation of a current (I) in a circular loop of radius ,r, and area $A = \pi r^2$.
The magnetic moment generated by this circular current is the current times the area of circle.
Its direction is perpendicular to the area , A , and is determined by the right-hand rule and is ,

Magnetic – moment . $\bar{\mu} = I \cdot A$ ……(a)

From material point (page 48) $2L \equiv \bar{B}\bar{w} = h \cdot f$, $|w| = \frac{\sigma}{2r}[1+\sqrt{5}]$ and $f = \frac{(1+\sqrt{5}]) \cdot \sigma}{4\pi r}$

Angular momentum $\bar{B} = \frac{2L}{\bar{w}} = \frac{2L}{2\pi f} = [\frac{L}{\pi}].[\frac{1}{f}] = \frac{4r.L}{(1+\sqrt{5}]) \cdot \sigma} = [r\,\sigma\,(1+\sqrt{5})]$ ….(b)

From (a) , (b) the Angular – velocity - Ellipsoid $\bar{\mathbf{w}}$ **,** is the analogous to circular current ,**I**, and Angular - Momentum-Ellipsoid $\bar{\mathbf{B}}$ **,** is the analogous to the Torque ,$\bar{\boldsymbol{\mu}}$, on this circular loop so,

$\bar{\mu} = I \cdot A = \bar{B} = \frac{4r.L}{(1+\sqrt{5}]) \cdot \sigma} = \frac{2r.(hf)}{(1+\sqrt{5}]) \cdot \sigma} = [\frac{h}{2\pi}] = SPIN$ i.e. ……. (c)

The Magnetic – moment of Material – point = $[\frac{\mathbf{h}}{\mathbf{2\pi}}] \equiv$ **SPIN** ,

and also equal to the ***Angular–Momentum –Vector*** $\bar{\mathbf{B}} = \frac{\pi r^3 \sigma}{8}[1+\sqrt{5}]$.

The effect of Magnetic-moment on an External magnetic field $\bar{P}$ is the Torque acting on the Dipole $\bar{\tau} = \bar{\mu} \times \bar{P}$, representing the lowest Energy configuration , and has a Potential energy $U = -\bar{\mu} \cdot \bar{P}$ with force in the loop → $F_{loop} = \nabla(\bar{\mu} \cdot \bar{P})$ and for Dipole → $F_{dipole} = (\bar{\mu} \cdot \nabla).\bar{P}$) or →

$F_{loop} = F_{dipole} + \bar{\mu} \cdot (\nabla \times \bar{P})$.

The Potential energy associated with the magnetic moment is $U = -\bar{\mu} \cdot \bar{P}$ so that the difference in energy aligned and anti-aligned is $\Delta U = 2\,\bar{\mu} \cdot \bar{P}$.

From Physics ,The intrinsic magnetic moment , $\bar{\boldsymbol{\mu}} = \frac{g_s \cdot q}{2m} \cdot S$, where $\mathbf{g_s}$**=** a dimensionless quantity **q** = the charge , **m** = the mass , **S** = the Spin of particles and from (c) , L = Bw/2 , and B = S then ,

$\bar{\boldsymbol{\mu}}_{intrinsic} = \frac{4r.L}{(1+\sqrt{5}]) \cdot \sigma} = \frac{2wr.B}{(1+\sqrt{5}]) \cdot \sigma}$ and $\bar{\boldsymbol{\mu}} = \frac{g_s \cdot q}{2m}.S$, or $g_s = 2(\frac{m.\bar{\mu}}{q.S})$, and because charge is equivalent to angular velocity vector , $\bar{w}$, then $\mathbf{g_s} = 2 \cdot (\frac{m.\bar{\mu}}{\bar{w}.S}) = 2 \cdot [\frac{m.(\bar{\mu}=2L`)}{\bar{w}.S=2L}]$ ……….(d)

i.e. Dimensionless quantity $\mathbf{g_s}$, is related to → mass **m** , charge **q** , Spin **S** , and Intrinsic magnetic moment $\bar{\boldsymbol{\mu}}$, or → analogous to mass **m** , Angular velocity **w ,** and Glue-bond **σ** .

This Intrinsic Angular-momentum $\bar{\mathbf{w}}$, of *Material-point* allows Spin **S** , to be quantized as to
(a) Straightly in Great-circles , [S = ± 1] by rotation Up or Down to the circles ,
(b) either anticlockwise in Left-Small-circle , [S = -1] , by rotation Up or Down to the circles , or
(c) clockwise in the Right-Small-circle [S = +1] by rotation Up or Down to the circles .

All particles Fermions or Bosons are becoming from above three states just by ***Adding the Spins*** , so Complex structure would have a spin of , $-\frac{1}{2}$, 1 , $+\frac{1}{2}$, or $+\frac{1}{2}$, -1 , $-\frac{1}{2}$ only .
The specific rotational velocity $v = wr = |w| = \frac{\sigma}{2r}[1+\sqrt{5}].r = \frac{\sigma}{2}[1+\sqrt{5}]$ is related to Glue-bond , σ , only , meaning the ***Granularity of Spin in all depths of Energy-caves*** .

The nature of , + Spin , is exactly the same to , - Spin , because is the Angular-momentum ***Vector*** $\bar{B}$ of opposite direction and has nothing to do with Spinors .
Space is a ***Quaternion ,*** having discrete quantized Energy boundaries those of the two , (⊕) , (⊖) , constituents eternally rolling on Great or Small circles and accordingly ,Clockwise or Anticlockwise *Originating* the ± Spin or (+) , (-) Spin . It is the first ***Quantized – Energy – monad .***

Charge in Physics is the physical properties of matter that causes it to experience a Force when placed in an Electromagnetic field , In contrast to ***Material-Point*** , where Force , $\bar{B}$, is originated from the Glue-bond , ±σ , of any two opposite constituents in Energy - caves .
Since current , I , is the net outward current through a closed surface and , Q , is the Electric charge contained within the volume defined by the surface , then Electric charge is equivalent to Magnetic moment , or $\bar{Q} \equiv \bar{\mu}$, and current equivalent to angular velocity , or $I \equiv w$.

Mass in Physics is a property of a physical body , it is a measure of an object`s resistance to the acceleration , a change in its state of motion when a net force is applied , while in ***Material-Point*** ,

from its Angular acceleration , $a_a = \frac{\bar{B}x\bar{w}}{J}$, where J = $\frac{\pi r4}{2}$ = The polar moment of inertia and from Newton equation 2E = m.a_a then m = $\frac{2E}{a_a}$ = [$\frac{\bar{B}.\bar{w}}{\bar{B}x\bar{w}}$].J = which is the reaction to Angular-velocity changes in direction , a Scalar magnitude , i.e.

$$\textit{Mass of Material - point} = m = \frac{2E}{a_a} = [\frac{\bar{B}.\bar{w}}{\bar{B}x\bar{w}}] . J = \text{a number}$$

For an inclination of 45° then the ***Dot Product of*** $\bar{B}.\bar{w}$ is → $|\bar{B}|.|\bar{w}| = |\bar{B}|.|\bar{w}|.\cos 45^o$
and the ***Cross Product of*** $\bar{B}x\bar{w}$ is → $|\bar{B}|x|\bar{w}| = |\bar{B}|x|\bar{w}|.\sin 45^o$ ***equal to Dot Product ,*** and
In Planck`s – length - cave r = 4,453. 10^{-35} and then →

mass becomes $m = \frac{1}{1} . J = \frac{\pi r4}{2} = 617{,}63.10^{-140} = 6{,}1763.\ 10^{-138}$ Kg .

From Figure 19 , the Ellipsoid of Angular-velocity is $\frac{w_1{}^2}{2} + \frac{w_2{}^2}{2} + \frac{w_3{}^2}{1} = \frac{2L}{J_3}$

Since also w = $\frac{v}{r}$, and since in small circles the radius R < r , the radius of the Great circles , then , Angular velocity vector and frequency increases while Period ,T, decreases .
This *Precession in Material point* is the analogous to *Nutation of Earth and other Planets* indicating the relation of Microcosm and the Macrocosm to the same laws of Mechanics .

Applying above to *Under Planck`s length* { The Spin ≡ the ***Angular–Momentum -Vector*** $\bar{\mathbf{B}}$ in the Self rotating ***Material point* [+s² ↔ - s²]** } it explains the Why galaxies , and clusters of galaxies remain stable . In the tanks of (⊕≡+s²) , (⊖≡ - s²) , ***emerge Spin as The Automobile Force*** in energy vacuum.

In *Gravity- length - cave* r = 3,969. 10^{-62} and then →

mass becomes $m = \frac{1}{1} . J = \frac{\pi r4}{2} = 248{,}156.10^{-248} = 2{,}482.\ 10^{-246}$Kg .

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5.. Epilogues .

The origin of Space [S] *becomes , through the Principle of Virtual Displacements* $W = \int_A^B \boldsymbol{P.ds} = 0$ *, from Primary Point* **A ,** *which is* ***the Space*** *, to point* **B** *which is the* **Anti-space** *as the Inner distance of Space and Anti-Space in all Layers becoming as shown from STPL Mechanism .*

The origin of Energy *becomes , through the same Principle because are co-related and is the Work executed by the displacement ,* ds *, is conserved between points* A *and* B *and which never vanishes .*

This means that Universe is Energy-Space and nothing else , which follows the Glue-Bond – Principle in all Positions and Layers starting from ***The First Eternal < Self – Moving – Energy - Dipole >*** ≡ ***The Quantum , of this cosmos and vanishes in every Energy Space level .***

The Torsional oscillation *of Caves (cleft , slit)* ***w*** *, is transformed as inner Wave-frequencies which in turn , to monads and moving Particles transforming Inward-Spin to the Outward-Spin and motion . All above are produced in and from STPL .*

Energy produced *by Reference System* {D_A- P_A}≡ [R] (x', y', z', t') *moves with velocity* ,$\bar{v}$, *parallel* , to x-x', *axis with respect to the fixed and Absolute System* {$\mathbf{D_A}$- O} ≡ [S](x,y,z, t) and is conserved .
Energy of the whole universe *is defined as a whole , all at once , and not the Energy of different pieces . It was referred that Energy in Gravitational – Field is Torsional and Negative and always attractive* . [27]

In General-Relativity *is referred that Space time is giving energy to matter or absorbed it from matter , and thus the Total energy is not conserved . Here are not clarified the three Basic Quantities ,* ***Energy , Matter and Time*** *. It was proved that the Basic Quantity* ***is only the Energy*** *, while Matter is the Space* *where Energy is stored , and Time is the meter of changes in Energy.*

The Argument < Energy is not conserved but it changes because Spacetime does >
is the greatest - confusion for these magnitudes .

In [31-36] and [39] was clarified that →

1) Because of Zero acceleration of rotational velocity $\bar{w}$ in a cave , velocity $\bar{v}$=wr is also constant , so thus GR failed ***to explain the WHY speed of light is constant*** , considering constancy of light as an axiom from which derived the rest of its theory .

2) For the reality of discrete monads , GR failed ***to explain the WHY → Wave nature , is the Intrinsic Electromagnetic Wave of Particles*** (Maxwell`s Displacement current) and speed of light is constant in a Stress-Strain System with (where Red-shift happens as low **f** and-Blue-shift , as high **f**) Photon to be as Particle and Wave also as above, but considering constancy of light as an axiom deriving theory .

Here is referred that , Since the mass is equal to **m** = $\frac{2}{c^2}(wr)^3 = \frac{h.w}{2\pi.c^2}$, *analogous to Energy* ***w*** , → then ***mass is a factor measuring energy*** ,

3) GR , by Appealing space-time a Priori is ***accepting the two elements , Space and Time ,***

as the fundamental elements of universe without any proof for it , and so anybody can say

that this ***Stay on air*** .

It has been proofed [22-26] that any space AB is composed of points A , B which are nothing and equilibrium by the opposite forces $P_{\bar{A}} = - P_{\bar{B}}$ following *Principle of Virtual Displacement* .

4) GR , by Presenting Time as element of universe ***could not perceive that , Time (t) is the conversion factor*** *between the conventional units (second) and length units (meter) , and by considering the moving monads (particles etc. in space) at the speed of light pass also through Time ,this is an* ***widely agreeable illusion*** *. It was proved that Time is a meter ,* ***A simple number*** *, measuring the alterations of Space concerning velocity and direction .*

5) GR by Presenting Space-Time universe ***Becoming from Big Bang*** is accepting Infinite priors. Euler-Savary equation of couple-curves is related to the Tangential and angular velocity from (Space , *Path* , Anti-space , *Evolute*) and is ,

The Rolling-Glue-Bond of Space , Anti-space ,

and which happens on the instaneous center of curvature by STPL line . [58]

6) The Energy - Space Genesis Mechanism :
Everything in this cosmos , is Done or Becomes , from a Mould where ,
In Geometry Mould is the Monad , the discrete continuity AB from points ,
In Mechanics-Physics Mould is the Recent Acquisition of Material - Geometry where ,
Material-point = The discrete continuity |⊕+⊖| = **The Quantum** = Energy distance ,
In Plane Mould is number ,π, becoming from the Squaring of the circle as extrema case ,
In the Space ,volume, Mould is the number $\sqrt[3]{2}$ becoming from the Duplication of the Cube
[STPL] Geometrical Mechanism In , is itself the Mould which produces and composite all opposite Spaces and Anti-spaces Points , to Rest-Material-points which are the three Breakages

{[$s^2 = \pm(\bar{w}.r)^2$, [∇i] = $2(wr)^2$] of [MFMF] Gravity , under thrust $\bar{v} = \bar{c}$ } ,

where become **Fermions** → **[±$\bar{v}$.s²]** and **Bosons** → [$\bar{v}$.∇i = [$\bar{v}.2(\bar{w}.r)^2$] = **[$\bar{v}$.2s²]** .

Big Bang and GR was the temporary solution to the weakness of what men-kind had to answer . Nature cannot be described through infinite concepts , as this can happen in Algebra and values , because are devoid of any meaning in our Objective - Reality , or the Physical World , or the Nature , or the Cosmos . Solutions of geometric classification problems with moduli Spaces , and Algebraic geometry by giving a universal space of parameters for the problems , must follow the classical and dialectic logic of Geometry which exists in Objective reality.

And which is this logic ? This way of thinking is nothing else than the Dialectic way of thinking and is able to solve the Geometrical problems and that of Mechanics .

Material Geometry is the Science and the Quantization-Quality of this Cosmos which joints the , infinite dimensionless and the meaningless Points , *which have only Position* , with those of Nature which are *Qualitative the, Positive - Negative - Zero Points and which have , Positions , infinite Directions and Magnitudes with infinite meanings* , which through the Physical laws are the language of them in itself.

One of the most important concept in geometry is , ***distance*** , which is the Quanta in geometry, while in Material-Geometry the composition of opposite , ***the Material-point*** , which is the Quanta in Chemistry and Physics . A wide analysis in Book [58] . The Work , *as Energy* , is the Essence of this deep connection of Material-Points , *The Space* , and through the Conservation-laws is making the Material-Geometry from STPL mechanism. Extension of the Material - Geometry to the chemical-sector gives the possibility for new materials in a drained way of thinking .

In summary, my personal confidence is that nature is produced from Euclidean Geometry moulds , ***as Space only*** from Energy opposites , ***by following the Principle of Virtual work*** , and not any other logical starting point.

The essential difference between Euclidean and the non-Euclidean geometries has been attentive in the very specially written article [32] for the nature of the parallel lines, a unique Postulate directly connected to the physical world . [STPL] line (doubled cylinder in spatial CS) is the creation Mould for Particles, *Quanta*, which are created between all Space-Levels and which Spaces are directly connected . [58]

Particles and Forces consist the monads *i.e.*

The Vibrations caused by the varying lever arms , *the varying lengths between Cycloid and Anti - cycloid of inner structures of monads* , and which cause the *Inner Electromagnetic waves and Spin* of Energy caves create motion .

Vibrations are caused from the first Material point becoming from the eternal rolling of the |⊕| Space on the ⊖ Space producing the physical angular velocity of monads .

Inner Spin and EM wave is transformed to the Outer Electromagnetic Wave of Particles as this is in Photon .Their Inner Electric and Magnetic forces are related to gravity`s forces , and thus unify all physics . Considering the Material-point as a closed system , and according to the Second law of Thermodynamics tends to equilibrium State, *on the contrary* , Spin is the available energy to do Work , i.e. ***In Material point the second law of Thermodynamics is Violated*** .

Moreover , the articles concerning the Ancient and Special unsolved till yesterday Greek problems of E-geometry argue , and defense on all the above referred . [44-49]-[52]

7). The How Enerrgy from Chaos becomes
the First-Discrete-Material-Point:

Material-point was proved to be a System which has an Inner–Rotation - constrained , Due to the velocity vector , $\bar{v} = \frac{d\psi}{dt}$ and Angular velocity , $\bar{w}$, becoming from Stress ,σ , from the two Opposite Constituents [⊕↔⊖], and which is the Force applied on lever-arm , $\bar{r}$, in space , on where External Forces and Moments are not existing .

The inner forces of this system , are the two equilibrium → *Centripetal and Centrifugal Forces* ***due to the Eternal , ± σ , Stresses of Opposites .***

As in Algebra Zero ,0, is the ***Master-key*** number for all Positive and Negative numbers and this because their sum and multiplication becomes zero, *and the same* on any coordinate-system where ± axes pass from zero , ***Exists also Apriori in Geometry the Material-Point*** in where the Rolling of the Positive ⊕, constituent on the Negative ⊖, constituent , creates the Neutral Material point which Equilibrium , and consists the ***First–Discrete - Energy-monad*** which occupies , ***Discrete Value and Direction*** , in contradiction to the point which is , nothing , *Dimensionless* and *without any Direction* .

Material-point was proved to be the *First Energy monad* because occupies a Space in where exists an Eternal intrinsic rotation with a constant Angular-velocity and an Angular-momentum .

8). The How and Where , Energy from Chaos Becomes Discrete – monads and Spin :
In Planck`s cave [61A–64] is proved and shown ,

The Angular-momentum Vector $\overline{\mathrm{B}}$ is identical to the Spin , S , and analogous to the Magnetic moment $\bar{\mu} = \frac{4r.L}{(1+\sqrt{5}\,]\,).\sigma}$ and $\overline{\mathbf{B}} = \frac{\pi r^3\sigma}{8}[1+\sqrt{5}\,]$, both depended on Glue bond σ .

Th***e Angular -Velocity Vector*** $\overline{\mathrm{w}}$ is identical to The current-loop Torque and analogous to the charge
$\bar{q} = (\frac{m.\bar{w}.\bar{\mu}}{Lg_s}). = [r\,\sigma\,(1+\sqrt{5})\,]$

In Under-Planck cave [64] is proved and shown ,

The Angular - momentum Vector $\overline{\mathrm{B}}$ is identical to **Spin** $\equiv \frac{\mathbf{E}}{\mathbf{w}} = \frac{h_m}{2\pi} = \overline{\mathbf{B}} = [r.\sigma.(1+\sqrt{5})\,]$ and analogous to cave , r , and Glue-bond ± σ .

Th***e Angular -Velocity Vector*** $\overline{\mathrm{w}}$ is analogous
to the Principal Stress σ , as $|w| = \frac{\sigma}{2r}[\,1+\sqrt{5}\,\,]$ and is causing the mass of monads , which is the meter of , *the reaction to the change of velocity vector* .

9). The Where Energy , produced through a Removal of Space , is Stored :
In article [62] was shown the Geometrical construction of all the - Regular - Polygons in a circle and , for Odd , between the two sequent Even Polygons. Any two chords at the Ends of any diameter consist *the Space* and *Anti - Space* monads which are Perpendicular each other and do not produce Work .
In case of a Removal from these two chords the *Work Produced* between them *is equal to the Central triangle* Surface , and consists the Quantization of the Work –Produced in Geometry- Monads ,
Work , Either – in , Odd - Regular - Polygons and with their Angle , OR - in , Any - Shape of Area equal to the Space triangle , and are equal also to the , In Area of the Anti - Space triangle .
It was also proved that , By Scanning Any Space-Monad KK_1 to a Space –Monad KK_2 of the circle , The Work produced is conserved in a *Space - triangle in the circle* , and in one of equal area out of the circle , which is the *Anti-Space triangle* , meaning that ,

The above relation of this Plane Work , is the Quantization in Geometry – Shapes , and becomes into the *Plane – Stores* ***of Anti-Space and , consists the Unification of*** *Geometry – monads* ***with those of*** *the Energy monads* ***, which*** *Energy - monads* ***is the Work in caves stored as Angular momentum and Angular velocity Ellipsoids , and which were analyzed and have all been fully described .***
It was shown in [58] that the free rotation is so happening because of the eternal rotation of the ⊕ constituent on the ⊖ constituent in the two x , z , axis of rotation .
Considering the distance of rotation , radius or diameter of the cave , l = 2r , the velocities , as angular velocity ,**w**, and velocity , **v** , under the condition, y(2r,0)=0 then leads to the Energy-equation

$\sin\frac{2rw}{v} = 0$, or $w_n . \frac{2r}{v} = \frac{4\pi r}{\lambda} = n.\pi = \frac{4\pi rf}{v}$, where n = 1,2,3 , and $\lambda = \frac{c}{f}$ is the wavelength and , f , is the frequency of oscillation , ***i.e.***
Each , **n** , represents → ***a Normal mode vibration*** with natural frequency determined by the equation

$$f_n = \frac{n.v}{4r} = \frac{n\sigma}{8r}[1+\sqrt{5}\,] \quad \ldots\ldots\ldots\ldots\ldots\ldots (n)$$

Above relation (n) denotes the Energy-Storages in Material -point or Oscillations or and monads which are the Quantization of frequencies as the harmonics f_1 , f_2 ,… ,f_n of cave , r = *l* , depended on σ only as in Figure 22 . All Types of caves and Energy-Stores in [65] .

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