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A Heisenberg c-Compass

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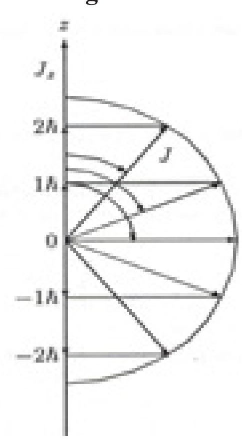
At the time of Heisenberg physics was bussy in developing nuclear power without extending their 4-vectors, describing space time in coordinates (x,y,z,t), t time, xyz for an orthogonal space coordinates triple. Heisberg did set without mentioning this already two more vectorial coordinates as (x,y,z,t,m,f) for his uncertaintenties (x,p=mv) position x momentum p in form of the quantum equation λp = h for wave length replacing x, h the Planck number; the mass m can be replaced by frequency f through the Einstein equation $mc^2 = hf$, c the speed of light as electromagnetic interactions waves EMI. Beside the above (x,p) equation he introduced a similar angle φ angular momentum equation φJ = h, J angular momentum and a third equation E = hf for energy. In this equation f = 1/Δt is used as an inverse time t interval for frequency. Angular frequency ω is related to this through ω = 2πf. Sometimes physics use intervals for differentials as in the f case. They can then be canceled like numerical quotients which is not the differentials use in mathematics. In physics it means that ptojective normings are allowed for this and df/dt for a functions in the variable t has then only the differential df left. The function f can dependent on another variable. You find this for instance in a computation for the planets orbits in the form dr/dt = (dr/dφ)(dφ/dt)
(r radius φ complex polar angle coordinate) or in (1) ∂ω/∂k = (∂ω/∂v)/(∂k/∂v) (k = 2πλ, λ wave length, v speed). Wave length occurs for wave packages in superposition of n waves and is measured as Δx = nλ. The measurments show then the uncertainties since the quantum operators for x and d/dx (or 1/Δx) are not commuting (PQ – QP ≠ 0 for many operators P,Q). The above equations include the Planck number h for this noncommuting. The six Heisenberg coordinates can be presented as energy carrying operators, not changing coordinate names. They belong to the strong nuclear interation SI and the Einstein energy plane is added as a complex cross product in z3 = (m,f) = z1 x z2 = (z,ict) x (x,iy) to spacetime coordinates. SI has eight field quantums and as geometry a toroidal product S^3xS5 of a 3- with a 5-dimensional unit sphere. This indicates that two more coordinates should be added as z4 = z1 xz2 xz3 . It is proposed that not the GellMann matrix multiplication for the SI gluons is used for zj but the octonian multiplication is used for an 8-dimensional vector space, doubling the weak interactions WI quaternions q for spacetime to
(q1 ,q2). It can be expected that the functional differentiation is giving a new uncertainty for the octonian coordinates z4 = (e0 , e7) (the above three z-coordinates belong to the other ej coordinates).

A c-compass is suggested for z4 . It has a vector needle e0 for setting units for energy measurements
(meter, kg, seconds etc.) on other coordinates. The linear e7 coordinate is Kaluza-Klein stereographic rolled to the 1-dimensional unit circle U(1) symmetry of the electromagnetic interaction EMI coordinate as circumference of the c-compass disk. The needle distributes on it the nth roots of unities when winding numbers Δt = n for instance of spin are counted about U(1). The number n is in this presentation for n energy carrying systems location distributed in equal dinstances on the nth Bohr shell of an atom. As angular frequency ω = 2π/n the coordinate is set equal to the spherical angle θ coordinate of the octonian e3 . The θ assoiated is measured towards the positive z-axis and sets a ray with the turning c-compass needle e0 .
Complex residuation contour integrates the winding number from 1/z.

Figure 1

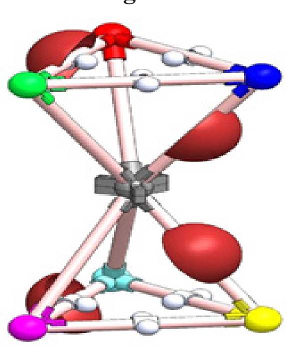


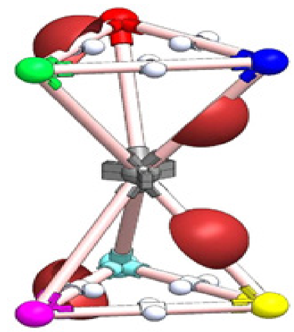
On the EMI symmetry U(1) the spherical computed exponential function exp(iθ) can be used as for the rolled Kaluza-Klein coordinate. The needle can also turn in the clockwise cw direction θ. For the orthogonal splitting of a base for the E plane z4 the angle θ = π/4 is used. Draw through two orthogonal positions of the needle in z-direction with base vector (1,0) and its orthogonal E vector (0,1) with angle θ = π/2 a segment of the unit circle U(1). At its midpoint P a vector ends in the θ = π/4 direction of length, addding to the P length 1 the new vectors length 1/√2. If P is orthogonal projected down to the z-axis its cosine value is ½. There are now three concentrical circles about B of discrete radii obtained in the proportions of the basic spin length ½:1/√2:1, discussed latr on. The c-compass needle gets a translation by (-1/√2,-1/√2) and the needle points like a radial θ-momentum force oriented acceleration towards B. The c-compass circle contains also in E the two orthogonal vector units of (1,0) for the horizontal $\theta = \pi$ line and (0,1) for the z-line. The new c-compass uncertainty proposed for them is obtained as follows.

One winding for a U(1) rotation is counted as a discrete time interval $T = \Delta t$ and the substitution
$\theta = \omega T$, written as $\theta = \omega t$ is for a wave description of the exponetntial function $\exp(i\theta) = \exp(i\omega t)$ of EMI waves. Then the constant speed c of EMI waves give the new uncertainty in form of the equation $c = v = \omega r = \theta fr$. The vector e0 can be called a vector momntum. The radius r can be measured in the needles direction, for instance on the z-line, setting $r = z$ as a real number measured in meters. Time is measured in seconds. An upper bound through c for speeds in the universe is obtained while the Heisenberg uncertainties give lower bounds. For noncommuting operators are available r with (1,0), f, t, z with (0,1), θ, ω. The t,f energy uncertainty is already used by Heisenberg for a lower bound, $\omega = d\varphi/dt$ also for angular momentum and θ belongs to this by substitution. The triple (r,t,z) is available for the mass rescaling

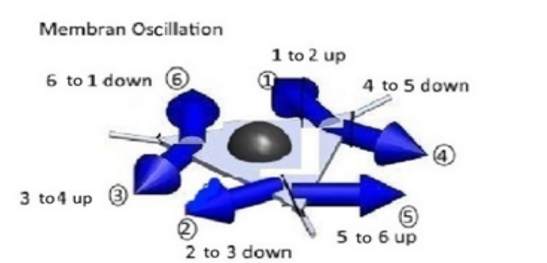
For matter waves in the universe the group speed $v<c$ occurs through their rescaled mass using special relativity in (1) as $v = \partial\omega/\partial k$ as group speed of a matter wave system. A new coordinate system is introduced in the plane E. This requires that the plane is extended to a projective plane P^2 by adding a z-line at infinity [r,ct,z=w]. The kinetic EMI speed as $c = r/t$ sets the scaling of time to ct in the triple. A vector with coordinates [r,ct,w] is associated by a correlation to a plane $ar + bct + ew = 0$, a,b,e real numbers. As projective transformation occurs a map which sets $w = 0$ and $\mathrm{sgn}(a) = 1$. For the two mpo, cw rotations on the U(1) circle the value of the third constant sgn(b) is +1 or -1. The measuring Minkowski light cone quardric occurs in P^2 as the points incident with their plane, $r^2 + c^2t^2 = 0$ which projective has no solution, but $r^2 - c^2t^2 = 0$ gives two intersecting lines in E as $r = ct$ and $r = ct$. If they are then rotated in a 3-dimensional environment of the E plane, the light cone as 2-dimensional surface is obtained. Since the E plane has also as parts the (r,θ)-coordinates it is assumed that the third complex polar spherical coordinate φ contributes through space coordinates (x,y) to the extension of radius as measure for the Euclidean space in $r^2 = x^2 + y^2 + z^2$ as distance. The Minkowski metric in form of $ds^2 = dr^2 - c^2dt^2 = dx^2 + dy^2 + dz^2 - c^2dt^2$ arises through this. central hoirzontal triangle projections at left: a triangle, at right a hexagon with a 180 degree turn between the upper and lower triangle.

Figure 2





strong SI spherical coordinates (r,φ,θ) are used at left, weak Euclidean xyz-space coordinates are used at right for a dinucleons proton-neutron location in a deuteron atomic kernel; the upper nucleon is rotated by an angle of 180 degrees against the lower nucleon
In projections the new octonian EMI bound situation is described through two positions of the energy and coordinate vectors of two nucleon tetrahedrons in deuteron‘s atomic kernel, which is important for fusion. Two protons release a weak boson W+ form one u-quark for a neutron, proton dinucleon in deuteron and an associated rotation makes the spherical SI position changing to the Euclidean WI position. The two coordinate systems are in special relativistic movement where for the SI location (left in figure 2) barycentrical coordinates of the triangle for gravity GR are generated through a SI rotor. In the right figure the Heisenberg uncertainties show collinear coordinates for the x,p vectors on the x-line from red as r (not radius) at +x to turquoise as t, p at x, similarly on the y-line are located collinear vectors for the complex polar angle φ green g on +y and the angular momentum magenta m (not mass) on -y. The third pair is for time yelow y on +z and blue b for kinetic frequency on -z. That this pairing arises through rays having the center of the figure as initial point is shown in the left figure; when rotated back from the right rigure the two rays generate a plane, the former Euclidean x,y, or z lines are not available and replaced by vertical segments joining the two color charges involved. The three planes are for reflections of the tetrahedron which interchange color charges by a gluon exchange of the strong interaction between two points not on the plane. If the planes reflections are drawn as 180 degree rotations the mpo or cw orientation exchanges the color charges through the six gluons x and the conjugate of y, $x \neq y$, for instance in the upper triangle for the force vectors cr = t, cg = m, b. The strong rotor proposed for this is a representation of the quark triangle symmetry D3 . The color charge cr is kept fixed and rotates cw the triangles plane, exchanging the cg,b vectors, the color charge cg is kept fixed in its new position and rotates mpo the triangles plane, exchanging the cr,b vectors. The exchange repeats three times where b is always moved. The location of the six blue states is shown in **figure 3.**



Momentum fixes the quarks vertex upper tetrahedron location in space, in figure 4 is shown a model for the proposed SI rotors discrete dynamics. A single barycenterical triangle-axis from the three in 120 degrees location are used for the cw or mpo rotations where the other two axes at that time are drawn to make the rotation possible. In the quantum measurement language for experiments, their location is not determined since it is not existing, only one fixed rotation axis from possible three locations is used in the Copenhagen quantum measure interpretation.

The model in figure 4 illustrates the use of Gleason operators N for quantum measurements. They generate measures through orthogonal spin like frame GF triples x = (u,v,w) as coordinates for a unit sphere S^2 in space. Each vector u, v or w has a positive real weight attached as measure and N, GF have as weight the sum of these three weights. For a Euclidean <x,x> measure the N renorming is <Nx,x>. The GF triples occur through the Pauli spin matrix multiplication as real cross product w = uxv. Extend the xy-coordinates base as (1 0), (0 1) to three dimensions (1 0 0), (0 1 0), take them as second and third row of a 3x3-matrix and as first row take (i j k) for the spin quaternions. The determinant of this matrix gives the cross product vector (0 0 1) for the z-axis of space.

In octonian coordinates and also in GellMann 3x3-matrix notation for the SU(3) symmetry of the strong interaction there are many such triples for GF measurements. The GF descritptions are found in the added references. Pauli spin space (x,y,z) is one from seven octonian triples, measuring length in meter. An SI rotor triple is for cr,cg,b. From the SU(3) symmetry a triple for an rgb-graviton whirl with tip Q is obtained. It can be used for generating in projection from the strong interactions SU(3) geometry the tetrahedron figure for nucleons having a quark triangle as base and Q as tip of the tetrahedron. When Q carries as coordinate the complex variable z and the three quarks get extended complex numbers 0,1,∞ attached, tne D3 symmetry of the quark triangle is obtained as the invariant cross ratios of these four values. They carry six octonian coordinaes (e1 = x,e2 = y, e3 = z, e4 = t, e5 = m, e6 = f) for spacetime coordinates (x,y,z,t) and for an Einstein projective mass-frequency plane for mass m and frequency f with the mc^2 = hf line.

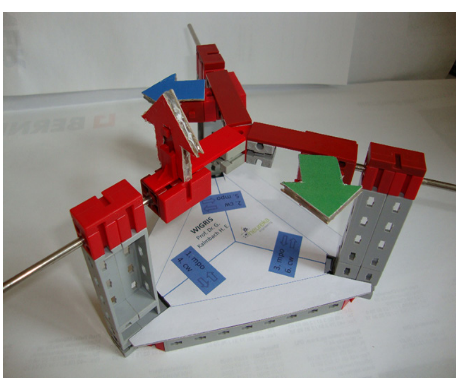


Figure 4 the SI rotor

A pulsation is added by GR which can be a change of the deuteron radius or of its projection from the figure 1 tetrahedrons in a horizontal plane below the spherical model. In the second case the distance between the ball in space the octonian space (e2 ,e3 ,e5 ,e6) onto a (x,y)-plane is changing according to the three radii in proportion ½:1/√2;1 due to gravity giving a stretching of squeezing of length. In the surway figure below for the eight models in the MINT-Wigris Tool bag the model deuteron shows this. The stick on which the ball hange is changed in height proportions as above or in basic spin proportions ½:1.2.

Repeated is: The c-compass needle is an octonian e0 coordinate and U(1) is a rolled Kaluza-Klein coordinate which is stereographic projected down to the octonian e7 coordinate. The model is more general available for dihedral symmetries, having as poles nth roots of unity for the needles discrete locations. The c-compass has one or two poles in its E plane. As symmetries arise the cyclic group Z2 with an identiy and the conjugation operator C of physics. For two poles the symmetry is the Klein group Z2xZ2where the parity P and time reversal T operator are added as new group elements. The noncommutative version of the spin quaternionic symmetry is due to the real cross product. If the spacetime coordinates are written in form of two complex vectors u = (x,y) v = (z,ict) then the complex cross product adds the Einstein plane w = (m,f) as w = uxv. Another complex cross product is then for p = (e0 ,e7) as p = uxvxw and a complex 4-dimensional space is obtained, extending the 4-dimensional real space. For the octonian multiplication can be used the doubling of quaternionic coordinates according to the Cayley-Dickson construction. The doubling of complex coordinates to quaternions is due to the real cross product.

Figure 5

Figure 5 a G-compass for color charges where the needle uses the 6th roots of unity for its six discrete possible states; in turns from one to the next of the 6th roots it is giving to the area in between when traversed a color charge; the location is similar to an electrical charge stored on a condensor plate; in single segments the two rays are identified and the six color charge conic whirls are a replacement of the magnetic field quantum whirls; gluons are superpositions of 2 or 6 color charge whirls

As described above, the Heisenberg uncertainties are for the real or complex pairing of (e1 ,e5),
(e2 ,e3), (e4 ,e6) coordinates, using the Planck number for the equations involved while the c-compass pairing (e0 ,e7) is using for its equation the constant speed of light. The Minkowski rescaling of nucleons mass gives the optical computed group speed with which a nucleon or deuteron as dinucleon or atomic kernels mostly composed by dinucleons (where the common center Q is replaced by an exciton keeping them in distance together) move on world lines in their environment. From the handbook of [7] is repeated:

The octonians provide a vector space and vector multiplication for revising quantum mechanical symmetries, the energy systems geometries, adding projections and projectivity to the older spacetime quantum vector space with the affine Minkowski metric. New measuring devices like the GF help to include the Copenhagen quantum interpretation of measurements and dihedrals are added for the nth roots of unity as poles arising from the units measuring radial e0 vector plus angle θ which describe also radial surfaces as boundaries of mass carrying energy systems in spacetime.
In an evolution of energies, the e0 vector as force POT bifurcates (and drives as motor) into two potentials for the gravity force E(pot) and the electromagnetic force EM(pot). E(pot) bifurcates into E(kin), E(rot as kinetic and rotational force energy and EM(pot) bifurcates into E(magn), E(heat) as magentic field strength and temeprature as energy. From the last four energies the 8 gluons bifurcate in pairs. After that in the evolution a heat chaos can occur.

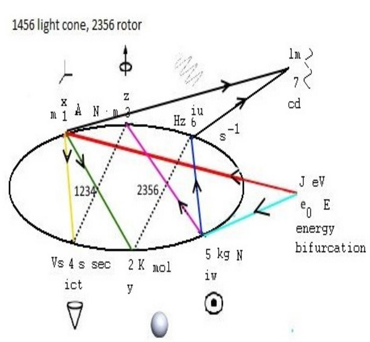


Figure 6 energy bifurcation with geometrical logos and measures added for energy presentations.

In figure 6 a Pascal figure is shown for the energy evolution where e0 acts as input vector for energies and e7 is for the EMI output of electrons in an atoms shell. The three 4-dimensional octonian subspaces for spacetime are listed by the octonian indices of coordinates as 1234, for the SI rotor of figure 3 as 2356 and for EMI as 1456. In the Pascal figure they occur as three points for intersecting lines 14+23,, 23+56 and 14+56. In [12] a similar subspace decomposition is obtained for a unified POT as EM(pot)+E(pot) 5-dimensional real projective space. Used is in this approach a projector which maps the POT field space R5 onto three 4-dimensional EM(pot) space, E(pot) and a scalar field space. It is an open research question how this can be seen for fields using the octonians from this article.

Beside its complex residual integration to the manyvalued log(z) function there are three kinds of inversions, due to the complex Moebius transformation 1/z. A radius inversion occurs at the Schwarzschld radius Rs of a mass system in fomr of r‘r = Rs. For instance quarks radius r>Rs is inverted to a radius r‘<Rs inside a Horn torus for dark matter or a black hole. A second inversion is for speeds of matter in the universe v<c in v‘v = c^2 to dark energy speeds in a pinched torus v‘>c. EMI, light with photons is at the speed v = c and Higgs bosons can have a radius r = Rs which also sets with Rs the gravitational constant for mass. The third inversion is for a periodic time interval Δt in Δt·f = 1 with f = 1/Δt in a circular orbital movement. The Planck constant is set for energy as E = hf. Using frequency, there are two kinds of speed, for 6 kinetic, linear as v = ds/dt and for 3 angular, rotational ω = dφ/dt = 2πf. In a scaling with the heat measuring unit Kelvin as Boltzmann constant k, phonons for 2 have associated a sound temperature-energy quantum T = h/k, setting Δt =1.

Sound whirls expand in the universes spacetime as Mach cones. If the cones rays are extended to lines and the double cone is closed at projective infinity by a circle, this geometry for dark whirls has inside a helix winding with f = n nodes on latitude circles of radius rn . The radius is proportional to $f^2 = n^2$, the rotating vectors energy has the kinetic energy En proportional to speed squared v = Δs/Δt = ds/n. When the radius changes with n, the energy difference is absorbed or emitted as scaled b·($1/n1^2 - 1/n2^2$) EMI frequency. For scalings is used the angular momentum J (spin) value h/4π and the formulas J = rxp, p = mv momentum, a wave length λ = h/p where λ has to fit with n nodes on the circles circumference 2πr. Kinetic energy times radius are constant. The nodes for a given n are taken as nth roots of unity on a unit circle for a dihedrals poles as solutions of the complex polynomial zn -1 = 0. As geometry for this multivalued function n complex planes are cut at the negative half x-axis, glued as usual together for the solutions in adjacent pairs where the last open half axis is glued to the first one in a cycle. The figure for an infinite gluing belongs to the mulitvalued (arguments of) log(z) function as inverse of the exponential function exp(z).

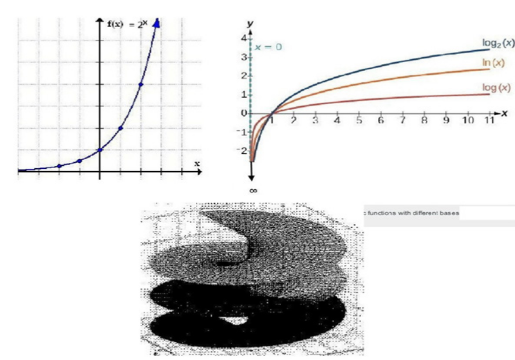
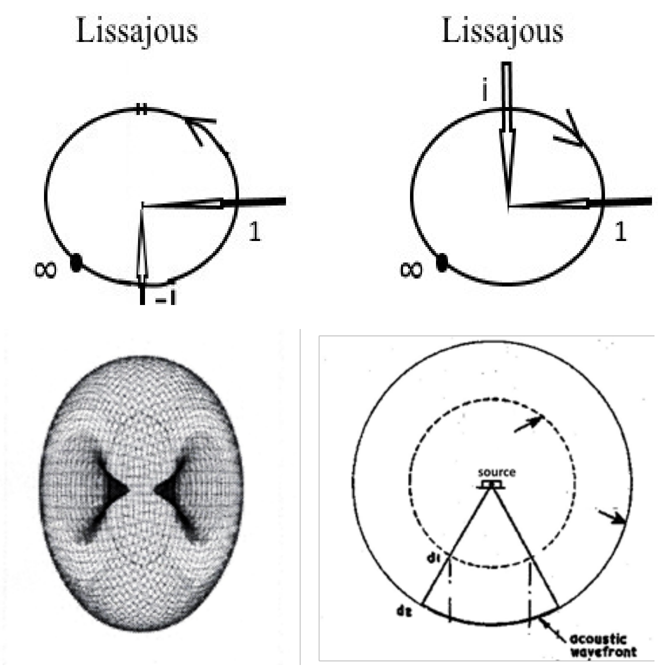
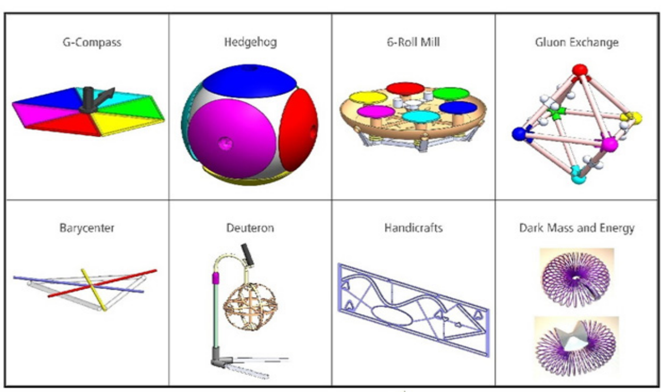


Figure exp and log functions, infinitely many planes connected along the negative half of the x-axes for presenting the log functions values uniquely

Other figures related to the discussion before are for instance Lissajous figures when frequencies with different integer proportions hit and generate nodes for their new energy orbits, a pointed torus for dark whirls, spin root distributions or whirls in a usual projected flat cross cut. Some examples are shown. Lissajous 1-dimensional figures like the U(1) circle or quark lemniscates are obtained by two orthogonal hitting frequencies as new energy location. The pinched whirl torus for dark whicle has no cylindrical part for frequencies expanind in time as helix on a cylinders surface, at right a Mach cone flat drawn figure for whirls.





8 models in the MINT-Wigris Tool bag

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