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Short Communication

Unification of Forces with Color Charges

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Abstract

How gravity GR can be unified with the three non-gravitational forces, strongSI, weak WI and electromagnetic EM is an unsolved problem. Gravitational waves have been observed by LIGO, but graviton particles are not found. Also general relativity gives a problem. A theory of quantum gravity is missing. Dark energy and dark matter could indicate the need for new physics for this.

Keywords: Gravity, Color Charge; Measuring GF Triples; Unit Spheres; Dark Matter; Dark Energy; Fiber Bundles

In several articles or books [1,3-5], for instance on the Planck era and spins, the author introduces a new basic color charge force. Octonions are used, their coordinates (and subspaces) are enumerated by indices 0,1,...,7. Spacetime dimensions 1234 have to be extended to eight octonions.

In case the projective subspace 126 is taken for rgb-gravitons [1] as composed system (observed as neutral color charge in nucleons), on the unit sphere S^2 antipods are identified for getting P^2. A nonorientable P^2 space has no unification symmetry like S^2. For a quantum gravity the six color charges cc are defined as the six cross ratios invariant under the complex Riemannian Moebius transformations of the sphere S^2. This fits for a unification MW of cc with EMI, SI, WI. The projective P^2 factorized GR not. A rgb-graviton spin-like base triple in nucleons act projected as xy(-z) 126 (right-hand screws) in space while in WI the Pauli spin base is xyz 123 (left-hand screws). The MW unification is demonstrated by running technical tools in the MINT-Wigris library toolbox (figure 1). GR is added as a derived force by using items from dark matter Dm and dark energy De such as the Schwarzschild radius Rs of Dm or the Minkowski cone of De.

Repeated from the references is: color charges cc are presented as six complex cross ratios, adding new coordinates for mass 5, for frequency 6, for the electromagnetic interaction EMI 7 and for the color charge force an octonion coordinate 0. A geometrical observation is that EMI, SI, WI have for their symmetries unit spheres U(1) as cirlce S^1, a SI topological product S^3xS^5 and the WI Hopf sphere S^3 in a 1-dimensional higher real space R^n. This is interpreted in the Planck era that the points of the spheres present rays coming from the origin Q in R^n.

Gravity GR gets its actions from different sources and is therefore not elementary. Many GR properties can be derived from the newly introduced cc space as complex Riemannian sphere S^2. This ray presentation through unit spheres is a unification of the cc force with EMI, SI, WI. For GR projectivity is added and its spacial points are presented as lines in a 1-dimensional higher real or complex space. Antipods on the S^n are identified.

An example is the authors rgb-graviton as superposition of three quark cc red-green-blue (figure 2 middle). Through a gluon exchange the b-quark entangles on a quark triangle circumference with a w-quark, w = r or w = g. In opposite direction at the circles points +1, -1 a rotational speed vector is added and exchanges the two quarks. The circle is projective covered by a 180 degree rotation for a projective 1-dimensional rgb-graviton P^1 space. It has spin 2. The cc sphere S^2 is also projective normed to P^2. This gives three r,g,b hemispheres presenting the area charge of the cc. They are centered in figure 2 at +x,+y and -z.

The real 5-dimensional projective P^5 view for gravity of the Kaluza-Klein theory [2] indicates that points are presented by lines through a center Q, identifying antipodes in the spheres. Projective unified in P^5 is EM with GR. The SI topological factor S^5 is a 1-point compactification of P^5. Its octonion subspace is 123456 for six color charges.

Figure 1: Toolbox, the tools work technically and replace detailed datas

Generating SI and WI means that two fiber bundles (section 1) are responsible for them while EMI has a circular rolled coordinate 7, an exponential helix line as universal cover for its energy on a circular cylinder. The WI Hopf S^3 map for leptons and a SI nucleon space generating S^5 map for nucleons and quarks are used. In section 2 the 3-dimensional measuring operator GF nuv extensions for energy n units in Dm, De are described. Projective dually set are for n octonion Pauli spin-like base triples nuv as listed in figure 2 right (Fano). Six energies can be listed in a table, factorizing the cross ratio symmetry permuting four elements S_4 by by its normal CPT Klein group Z_2xZ_2 to D_3, the quark triangle symmetry in a nucleon. The four factor classes contain an octonion coordinate, a color charge, a quantized measurable energy and a D_3 symmetry.

Two fiber bundles for WI and SI

The Hopf map defines for WI a fiber bundle with fiber S^1 and maps S^3 onto S^2. Projected is time to a constant, the xyz-space for S^2 is generated by the three Pauli matrices, metrically applied to 1234 coordinates (z_1 = z +ict, z_2 = x+iy), c speed of EMI waves. The three Pauli matrices corrsepond to three weak bosons W^+, W^- and Z^o. The Heegard decompositions of S^3 show the linked two parts (figure 2 left) with leptonic decay particles. The S^2 projection is interpreted as lepton geometry: a spin vector is attached at the north pole together with either an aligned magnetic vector or a momentum (for neutral leptons). The EM charge is rotating on a latitude circle C, Jumping with its potential between descrete C. For negative EM charge the momentum orientation is opposite to spin, for positive both show in the same direction. Helicity of neutral leptons show the same entanglement of spin and momentum. At the south pole of S^2 Higgs can set a mass as charge of the lepton. The 3-dimensional spin and GF extension of a basic circle adds its energy measuring GF quantization for leptons in 4-dimensional spacetime.

For SI the author defined a similar S^5 fiber bundle with fiber S^1 and a map onto a complex projective 2-dimensional CP^2 space with boundary S^2. The octonion subspace is 2356. In projection, 23 are the z_2 = (+x,+y) coordinates as cc red r and green g members of the rgb-graviton and 6 is (-z)-coordinate directed as vector (figure 2 middle). Entangled are the vectors with three quarks which can be rotated and exchange in pairs gluons for their confinement in a nucleon. Identifying for the projective rgb-graviton antipods on S^2, means that it has spin 2, a 180 degree rotation about an axis keeps it identical, the anticolors c(u), u = r,g,b, are not present. As the projective P^2 normed S^2 mentioned in the abstract for the cc, in coordinates [t,v,w] for 126 the norming of u can be [r,1,0] [1,g,0], [1,0,b] for the cc lines, closed to circles by [1,0,0], [0,1,0], [0,0,1].

A measuring Gleason operators 257 GF octonion 3-dimensional base triple allows six mass values for the fermionic quark series. It allows also for the fermionic series six mass values. An inner dynamics (figure 3) as D_3 quark triangle symmetry presenation generates barycentrical coordinates for a nucleon and sets at their intersection with Higgs a huge mass for the nucleon. The nucleon wave package can move with a relativistic speed v and special relativistic rescaled mass m with momentum p = mv on its world line in spacetime. As in the leptons (with spin case), the 5-dimensional GF extensions of a basic S^2 or P^2 adds its energy measuring GF quantization for quarks, gluons, rgb-graviton and the nucleon in a 6-dimensional color charges energy space. Observed is that 3-dimensional quarks have 1-dimensional lemniscates as retracts having two poles while the leptonic circle has one pole.

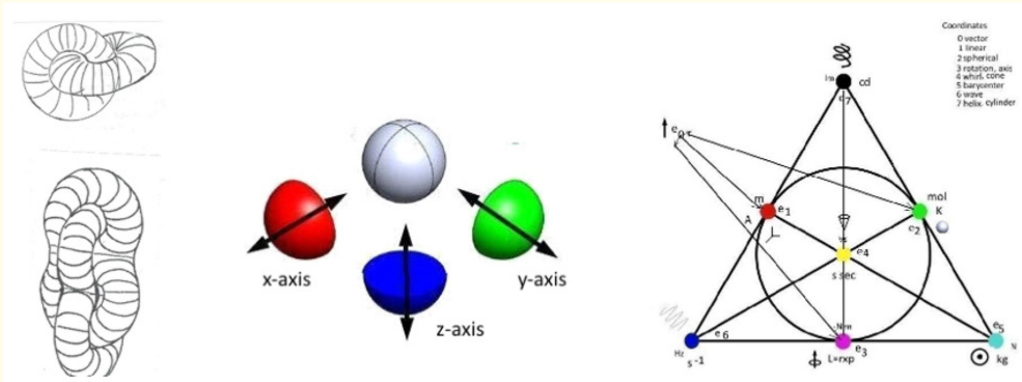

Figure 2: Linked leptons, linked quarks left, rgb-graviton middle, Fano GF right.

Figure 3: Inner nucleon dynamics.

Gleason operator GF measures for energies, projective duality and inversions

Further octonion GF base triples (figure 2 right) are 123 for WI spin, 167 for EMI, 145 for EM, 246 for heat (for magnetic force and time is the coordinate 4), 347 for rotation and $z_1 = r + ict$ or $r - ict$ Minkowski cone lines on 34 closed at infinity 7 by two points for a lemniscate, 356 for the nucleon dynamics. The stretching/squeezing of graviton waves observed for spacetime coordinates by LIGO is in the nucleon repeated (figure 4 right) as spiralic quark triangle area changes in proportion of the three basic spin values ½:1:2.

Beside 126 this requiers a second SI GF with the dual cc as 345. A third new GF can be 037 for the cc force as projective plane and a G-compass where a radial vector in a disk bounded by S^1 sets on sixth' roots bounded segments the six cc in the Heisenberg uncertainties relation (figure 4 left).

The former rotation 347 has its lemniscate not only for a Minkowki cone coundary but also for 1-dimensional quark retracts inside a dark matter Q location. Lissajous figures for two orthogonal hitting frequencies arise for integer proportions like 1:2, for leptons the circle retract has proportion 1:1. Projective duality in a P^5 allows the retracts to become 3-dimensional: An inverted 1-dimensional radius r' inside dark matter is then metrically $r^2 = x^2 + y^2 + z^2$; inversion is on the Schwarzsschild radius Rs of Q by $r'r = Rs^2$ (Figure 5).

A 1-dimensional circle becomes a solid torus, for leptons and a lemniscate becomes a solid brezel for quarls with two poles for its mass and EM charge foci (Figure 6).

For mass systems Q in the universe their Rs allows a potential cusp catastrophe with three potential levels (Figure 7) setting the two cosmic speeds as thresholds between the orbits of another mass system P, free fall of P, rotational ellipse or rosette orbit of P about Q and no GR entanglement for escape of P (parabola, hyperbola orbits).

Rs in $\sin^2 \beta = Rs/r$ arises as quotient for the $\cos \beta$ Schwarzschild metric norming of Minkowski metric projective in [r,r-Rs,w] as [r/(r-Rs),1,0] or [1,(r-Rs)/r,0]; the cc cross ratio polynomials z/(z-1),

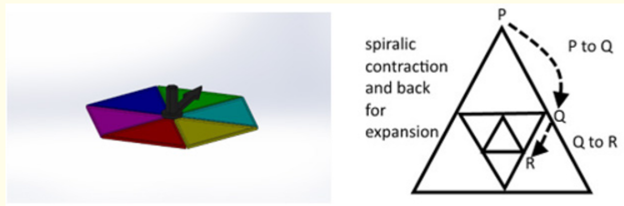

Figure 4: G-compass, quark triangles at right.

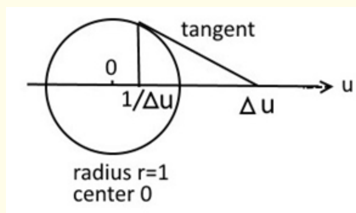

Figure 5: Mathematical inversion at a circle.

Figure 6: Torus, quark brezel.

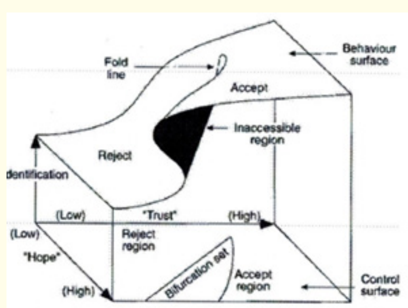

Figure 7: Cusp catastrophe.

(z-1)/z are properly scaled; perspective transformations can be listed for this too.

As projective plane 347 [r,t,w] for dark energy the parts at infinity give three kinds of speeds when the coordinates are permuted; for instance [v = r/t,1,0] kinetic speed, [1,v_{rel},0] relativistic speed, [1,0,v_H] Hubble speed for the expanding universe.

Conclusion

The former listing shows that adding a cc force on the octonion coordinate 0 with an associated G-compass for color charges and complex cross ratios provides the unification of a derived GR force with the rgb-graviton spin-like GF base triple 126. Dark matter and dark energy adds further GR properties. Radius inversion from dark matter generates in the universe the gravitational potential with two cosmic speeds thresholds. A cusp catastrophe has for them three protential levels.

From older articles of the quthor is added: For the former mentioned escape of a system P from a central system Q no common barycenter is set for P,Q, but the Lorentz transformations and reltivistic measure rescalings arise for them. For free fall the momentum vector of P is aligned with the centrifugal force, for rotations between the thresholds an angular momentum L = rxp is generated as cross product on the octonion coordinate 3, setting a radius r between quarks. The momentum for a nucleon arises for a quark wavepackage by renorming relativistic with speed v the nucleon mass m and using v for defining nucleons momentum p = mv with which it moves on its world line. The use of color charges in nucleons is extended by magenta 3. Turquoise 5 is added for Higgs ssetting at a barycenter B of the nucleon its new mass using 257. The location of B is determinded by the inner nucleon dynamics which sets by rotation three barycentrical coordinates in the nucleon triangle (Figure 3). For an inner entropy (heat) inside the nucleon boundary the 246 GF is set. Figure 2 is extended to the hedgehog (Figure 8) including six projective cc caps for the S^2 Bohr shells. Their energy vectors can turn up/down on a Moebius strip for the energy exchange of the nucleon with its environement. The Heisenberg uncertainties show up on the coordinate lines x for 15, y for 23 and z for 46. As GR the thresholds for the change are given by catastrophes and their potentials. Adding the EM charges of quarks means that their magnetic momenta 145 are aligned for a nucleon momentum at the north pole of S^2. As normal to S^2 it carries for 4 also the nucleon spin with the 123 GF. The EM positron charge rotates on a latitude circle of S^2. By WI and its Hopf map the three Pauli matrices set the xyz coordinates, time t is normed. The complex spacetime Hopf coordinates are $z_2 = x + iy$, $z_1 = z + ict$. The nucleon is projected in it. Its space arises from the S^5 fiber bundle as 2356, including 356 for the nucleons inner dynamics. 347 is used for the angular momentum L. Beside the six hedgehog cc for a nucleon all octonion GF are acting, except 167 EMI which arises later in the universes evolution when atoms are formed.

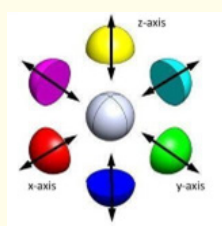

Figure 8: Hedgehog.

After a big bang in the Planck era in different dimensions the mentioned unit spheres set ray presentations for symmetries: start with points where charge values can be set, S^0 sets dipoles, intervals with two endpoints oder two up/down directed vectors on a line, S^1 is for fibers and EMI (atoms), S^2 for cross ratio cc as force, S^3 for the Hopf WI, EM, S^5 as factor of the SI topology for nucleons. Energies measuring 3-dimensional GF quantizations extend lower dimensional geometrical retracts like a leptonic circle or a cc S^2, P^2. Projective spaces and arguments arise for the derived GR by norming spheres antipods with line presentations of points. The Copenhagen measuring interpretation is presented for energies through the GF of Gleason operators. The energy coordinates are set as 1 EM charge (GF 123), 2 heat (GF 246), 3 rotation (GF 347), 4 magnetism (GF 145), 5 mass (GF 257). 6 frequency (GF 356), EMI is on 7 (GF 167), the cc force on 0 where a GF 037 can be used. For the dual graviton the strong GF 345 is used. SI adds to the seven octonion GF three GF 126, 345, 037. The cross ratio 4-tuple z with three reference points has symmetry S_4 which factors through its normal CPT Klein subgroup $Z_2 x Z_2$ to the quark triangle symmetry D_3. The factor classes each contain an octonion coordinate, a cc, a quantized measurable energy and a D_3 symmetry. The six D_3 symmetries replace in this nucleon model the WI/spin three Pauli matrices.

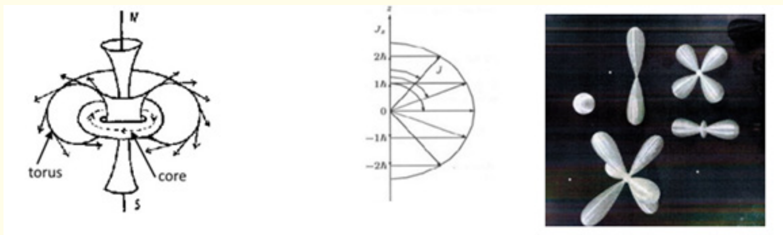

Figure 9: Inverse Hopf map, nth roots, electrons probability locations on atoms Bohr shells.

The Hopf geometry allows for atoms several electrons located on spheres, (deformed) clubs or tori, using nth roots for distances. Chemistry and the periodic system is generated. Experiments for the other figures are replaced by tools in the tool box.

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