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Mini Review

Octonians Cross Ratios and Spins Cross Procduct

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Abstract

In her research project MINT-Wigris the author developed models for the quantum range. She discovered that spin and rgb-gravitons which she defined as superposition of three color charges of quarks in a nucleon require measures whihc cannot be transformed into one another. For a spacial calculus, spin uses SU(2) with the three Pauli 2x2-matrices as xyz-space generators. They are for the physics 4-vectors of spacetime. Color charges require the doubling of them to octonians since rgb-gravitons require the uses of complex Moebius transformations, having as invarinats the six cross ratios for color charges. Color charges are in octonians an independent force. The last octonian coordinates is for the electromagnetic interaction, a Kaluza-Klein rolled U(1) circle as coordinate.

Keywords: Octonians; Rgb-Graviton; Spin; Color Charges; Moebius Transformations; Pauli Matrices

The geometrical difference between spin and rgb-graviton spaces and measures is that the spin rotations of a wheel in one of the uv-planes, uv = xy, xz,yz, generates as rotation xis the third dimension by zsung the real cross product which as normal vector to the uv-plane generates the xyz-space coordinates. For rgb-gravitons, the rotations are induced by gluon exchanges and permute the three quarks color charges in a nucleon. For permuting a reference triple 0,1,∞ as substitute of r,g,b the Moebius transformations MT 1/z, 1-z, z/(z-1) are suitable. The first one permutes 0,∞ and lets 1 fixed, the second permutes 0,1 and lets ∞ fixed, the third permutes 1,∞ an dlets 0 fixed. The other three MT for color charges use conjugation ins the form of inversion z as identity, 1/(1-z) as frequency, kinetic energy, (z-1)/z as rotational energy. Attributed to the other three cross ratios are the energies electrical charge 1/z, magentic force (1-z), heat z/(z-1). There are eight basic forces, not only four. Physics lists the four as electromagnetic interaction EMI, strong interaction SI, weak interaction WI, gravity GR.

GR has for matters mass a Higgs field which can attribute mass as real scalar to a system.This is only possible for 3-dimensional systems, not for the 2-dimensional case. Quarks are in this respect 3-dimensional in the xyz-space. Their barycenters generate a 2-dimensional triangle in a nucleon.

This is attributed to a rgb-graviton cross ratio as a perspective projection. As geometrical configuration a nucleon is drawn as tetrahedron (in chemistries it is the use of lattices decribing crystalic configuraions). The rgb-graviton spans the three space dimensions, for instance as x(r), y(g), z(b). It carries not length as weights of its three vectors, as spin does. It carries the neutral color charges of nucleons from quarks r,g,b charges. The asociated symmetries are for r the MT σ_1, the first Pauli matrix, for g $\alpha\sigma_1$, for b α as product $\alpha\sigma_1 \sigma_1$. Two reflections of the 2-dimensional quark triangle geneate a rotation α of the trinagle.

The measuring systems for spins quaternions (real cross product) and for rgb-gravitons octonians (complex cross ratios) cannot be transformed into one another.

S^2 models and fiber bundles

The sphere S^2 appears for the quaternionic case through the Hopf fiber bundle. It uses the threePauli matrices for projection xyzt-coordinates of spacetime into xyz-space. The fiber is a circle S^1. It can be attributed to the last octonian coordinate R as universal cover of U(1) for EMI where one revolution about the circle is for a time generated helix winding (photon) on a cylinder with 2 transversal section S^1 and axis z = t, z the third space coordinate t time. The Hopf map projects the unit sphere S^3 in spacetime down to the unit sphere S^2 in space. The north-south pole diameter of S^2 is stereographic projected down to 0 in a tangent plane at the south pole of S^2. In projective normed xy-coordinates the maps combine to $(x,y) \equiv z_2/z_1$ for $z_1 \not\equiv 0$ with $z_1 = 0$ taken as north pole of S^2 for the stereographic projection. In the Pauli matrix notation for a complex C^2 space, $z_1 = (ct,iz)$, $z_2 = x+iy$ where the order and scaling of z_1 coordinates is chosen for the C^2 matrix with first row $(z_1\ z_2)$ and second row $(-c(z_2)\ c(z_1))$.

For the octonian case, the fiber bundle uses a topological S^5 factor of the SU(3) gluon bound geometry S^3 x S^5 with a 5-dimensional unit sphere added to the Hopf sphere. S^5 projects as fiber bundle with fiber S^1 down to a projective complex space CP^2 with a bounding sphere S^2. This is a nucleons and quarks space. If octonian coordinates are enumerated by indices 0,1,...,7 this space is 2356, not xyzt-space 1234. In a projection the S^2 is the surface of a heat generated volume of the nucleon in 1234. It serves for the energy exchange of the nucleon with its environment. For the EMI exchange not this sphere is used, but Bohr shells when electrons jump between main quantum number shells by emitting or absorbing spectral series.

In octonians the rgb-graviton discrete tetrahedron symmetry S_4 is factored by the CPT Klein subgroup to the quark triangle symmetry D_3. On Bohr shells for the nucleon are located not electrons but color charges. Their charge is located in a hemisphere which can be projective normed to a P^2 as a GR space. The Heisenberg uncertainties HU distribute the color charges on opposite x, y, or z directions. The factoring of S_4 means the to a color charge corresponds an octonian coordinate of the subspace 123456, an energy EM_{pot}, E(heat), E(rot), E_{magn}, E(kin) and E_{pot} for mass. The D_3 matrices are measuring with thier eigenvectors the energies in 1 Ampere (or spins length meter), 2 Kelvin (or spins lengths), 3 Joule (or spins length), 4 TESLA (or time seconds), 6 Hz for frequencies and 5 kg for mass. The octonian coordinate 7 is for EMI and 0 for the color charge force.

The S^2 geometries for the leptonis and nucleon case are different. In figure 1 at right the leptonic charge rotates on a latitude circle, the spin vector points on the north pole in +z direction for the eigenrotation. The rotations are clockwise cw or counterclockwise mpo. The EM charged leptons align their magentic momentum for a + charge parallel and for a – charge in opposite direction (gyromagnetic relation), for a neutral charge, the momentum direction is similarly and observed as helictiy. The hedgehog caps for the nucleons S^2 are shown in the left figure 1.

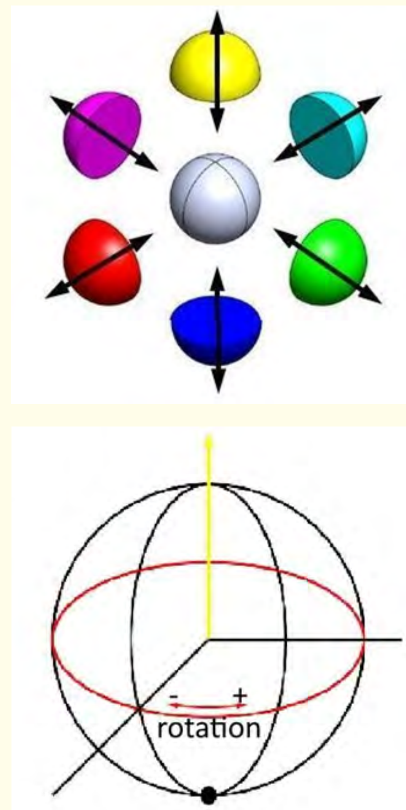

Figure 1

Figure 1 hedgehog S^2, leptons S^2, the spaces 2356 and 1456 are projected into spacetime 1234; in octonians 356, 145 are cross products; there are eight, rgb-gravitons from the first three SU(3) GellMann matrices and seven of the Fano memo octonians 123 (space 1), 145 (EM 4), 167 (EMI 7), 246 (heat 2), 257 (mass 5), 347 (rotation 3), 356 (frequency 6); 0 is for the color charge force [1-7].

Conclusion

There are different geometries and measures used for spin and rgb-gravitons. The use of octonians and complex cross ratios for color charges as force replace quaternions and real cross products.

Figure 2: The MINT-Wigris Tool Box in the Emmy Noether Memorial museum.

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