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A Projective Decay Start For An Octonian World

Gudrun Kalmbach H.E.
MINT, PF 1533
D-86818 Bad Woerishofen, Germany
mint-01@maxi-dsl.de
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***Abstract*—The deuterons ecolution starts in this model with a dark matter location of dense 1-dimensional quarks,blown up from their lemniscate in a dark matter decay to 3-dimensional systems in a deuterons atomic kernel, containing six quarks.Their location is simplfied shwon 0-dimensional at the vertices of an octahedron. Instead of the strong interactions 8-dimensional matrices geometry, the octonians with another mutiplication for its coordinate units is used for describing the new model. For teaching purposes eight macsroscopic models are available. Projectivity occurs in many instances for blow up or down of dimensions, for dynamical orbits and maps.Essential are octonian measuring triples as shown in the Fano figure and the symmetry of Mobius transformations added to the symmetries of the standard model. This allows gravity to be included in the octonian extension of spacetime.**

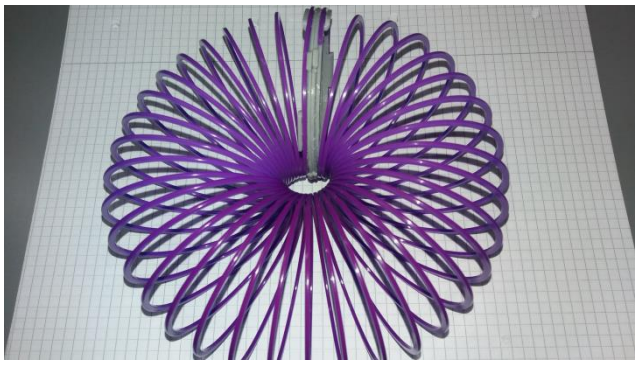
1. Introduction

A mathematical big bang model is presented how from dark matter or Higgs boson decays the octonian system for physics can be developed. The figures are from the Tool Bag MINT-Wigris [2] or videos and an overview is added at the end. The book [1] contains the theory and can be also read in the open access internet articles [9], [10] of the author. A new big bang model is described which starts with the decay of a Higgs mass (figure 1) which is a location of a dense set of quarks in a tiny volume and releases the quarks (first as 1-dimensional lemiscates or circles) by removing their join at infinity, the singularity of the Horn torus. Single quarks decay also.The particle scene is continued by the use of the strong interaction which confines with gluon exchanges three quarks in a nucleon. Its 2-dimensional triangle with quark edges has a rotor (6 roll mill in figure 4) for integrations (figures 3). The six energies as cross ratio invariants under Moebius transformations (G-compass in figure 4) are also used for the energy exchange of the deuteron with its environment (figure 2). The deuteron atomic kernel with a pair of nculeons and a weak isospin exchange between them is demonstrated in the Tool Bag by an octahedron with a 3-dimensional location inside a volume. The dihedrals and polynomials for roots of unity guide the evolution as well as projective duality. Gravity has its particles inside the octahedron and its mass representation in the decaying Higgs boson and the setting of barycenters. Minkowski metric rescalings and also the general relativvisitc factor as G matrix are included in the deuteron model. Length stretching/squeezing, observed for graviton waves is demonstrated by central projections, using the model deuteron (figure 4) where the shadow in the floor is longer or shorter according to the distance of deuteron to the floor. The addition of an octonian e7 coordinate extends the deuteron 6-dimensional energy space e1,.e6 such that atoms can live in this world. The octonians 8 dimensions have also a Gell-Mann SU(3) matrix presentation Octonians add through their multiplication table the seven GF measures (Fano memo figure 2) where space as spin SU(2) coordinates is only one and *rgb*-gravitons are another one from SU(3). The need of a vectorial projector e0 (see also [12]) is for localizations where an intial point is set and the length of the vector is a unit for the energy measure (meter, second, kg, Ampere, Volt, Kelvin, frequencies). It can also be reduced to setting a scalar at a point like mass at a barycenter. As force or speed vector it fixes a spacetime direction in which the energy acts.

2. Dihedrals and six energies

Start with the logarithmic function as inverse of the exponential function exp. Its use in physics is different from exp which describes wave functions. The real logarithm log(r) as function of a radius r shall carry a scalar for $f(r) = a \cdot \log(r)$ and its derivative $f'(r) = a/r$ is used in physics for potentials POT. It has a singular point when r approaches 0.

As space a projective P line as circle can be written in coordinates [x,y] where [1,0] is the (singular) point at infinity and [x,1] is a real line with the variable $x \varepsilon R$. A polynomial for the dihedral D1 [3] is setting x = 1 for the big bang decay point at infinity with the potential a/r for a Higgs boson, Higgs field or dark matter.



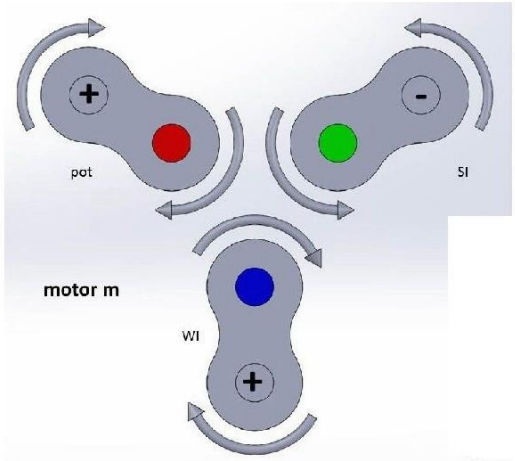


Figure 1 dark matter with a singular point in the center of a Horn torus, three quarks in a nucleon

For the dihedral D2 the polynomial $x^2 = 1$ sets two points for the two electrical and gravity potentials aj/r, j=1,2, of quarks. They arise as decay products from the D1 case. Projective duality [4] allows in a 4-dimensional projective space P^4 to replace the 1-dimensional space of D2 by a 2-dimensional dual space with coordinates (x,y) and quadric $x^2+y^2 = 1$. As new energy is added E(rot) as rotational energy where for 3 nucleon quarks as vertices of D3 the quadric describes a circular orbit. This projective duality is in 6 dimensions. Comparing the orbit situation with macroscopic systems, kinetic energy E(kin) is set equal to E(pot) where the last potential arises from a nucleons barycenter and its mass scalar, and E(kin) is for the speed of the rotating quark. Barycentrical coordinates (figure 4) are generated and *rgb*-gravitons in nucleons present their neutral color charge.

For the next extension to D4, the 2-dimensions of the nucleon triangle is extended for E(heat) energy to a volume V inside a quadric $x^2+y^2+z^2 = 1$. Inner entropy in the volume adds for the particles inside a pressure on the surface. In the model MINT-Wigris there is for a deuteron atomic kernel, containing two nucleons, a weak interaction decay with an isospin exchange where a u-quark decays into a d-quark by releasing a weak W+ boson and its partner d-quark absorbes the W+ energy and becomes a u-quark. The three coordinates x,y,z of space for D4 are generated. The projective duality allows in 8 dimensions the D4 space as dual to the D3 space. The case of atoms is 7-dimensional when light can be emitted and electrons can be stored on Bohr shells about an atomic kernel. In octonian coordinates, the first e0 coordinate is projective normed to 1, the atom

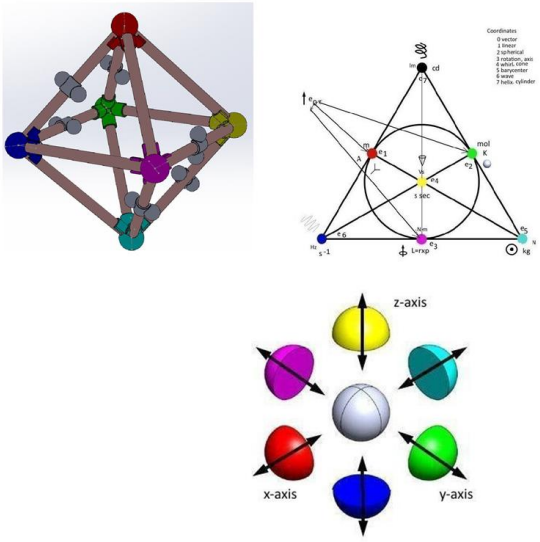


Figure 2 left upper deuteron atomic kernel demonstrated as octahedron (symmetry of order 48 with the orientation preserving subgroup S^4 of order 24),

Fano memo for the octonian GF as 7 lines (upper right), lower left hedgehog with six color charge hemisphere caps and input output vectors for the energy exchange of deuteron with its environment

Coordinates are e1,..,e6 and the light e7 octonian coordinates is rolled to a Kaluza-Klein circle U(1) as symmetry of the electromagnetic interaction (template in figure 4). The affine D4 space with 4567coordinates (deleting e and writing only indices) is for Gleason frames GF to be generated from the xyz 123 Gleason frame of D3. The Fano memo for the seven octonian GF is obtained (figure Fano memo). In other articles of the author further measures or scalings of coordinate units are mentioned, the GF are for integrations. The reader is referred to the special relativistic rescaling of mass for getting a common group speed for systems like a nucleon, deuteron or atom. It belongs to D4. The *rgb*-graviton action in nucleons D3 can be interpreted as a general relativistic renorming of Minkowski metric by using a Schwarzschild radius of the nucleon. The D2 of quarks sets a linear radius or x-coordinate measure. There are unit vectors necessary. From the octonians, the e0 coordinate is used as a vector which can set these units for the other coordinates. It acts also as an input output vector for the energy exchange in the hedgehog model for deuteron. Units are for the energies EM(pot), the electrical potentials charges as six'th roots of unity on a G-compass, for the six color charges, for heat, kinetic, magnetic and rotational energy, frequencies, mass, The newly mentioned magnetic energy can be located on the e4 octonian coordinate.

This world can be described by an octonian system where many matrix presentations, multivalued functions, not only exp which is single valued, but periodic, arise in groups as symmetries and spaces for energy locations can have different dimensions. Measurements have to be extended and new symmetries added to those used in physics in 2019.

3. Additional Remarks

A remark to physics is added. The projective duality from D3 to D4 is in the 8-dimensional octonians. Projective spaces are written by adding a cross product coordinate. This ninth dimension is hidden but shows up in Gell-Mann's 3x3-matrices for the strong SI symmetry SU(3) [5]: the three σ3 exdended matrices σ3j are linearly dependent and generate a 2- not 3-dimensional space for 8 gluons. The *rgb*-graviton as GF projects the first 3 Gell-Mann matrices with a third row and column having 0 coordinates down to the 3 generating Pauli matrices of the weak WI symmetry SU(2). The eight'th Gell-Mann diagonal matrix adds and scales σ32,33 and may be used for the SU(3) toroidal geometry as a trivial fiber bundle product of a 3- with a 5-dimensional sphere. The S^3 is for rgb-gravitons and its SU(2) Hopf space geometry [6], [7] also a fiber bundle. The 5-dimensional sphere is projective normed as fiber bundle to a complex 2-dimensional space for the deuteron inner space with a S^2 bounding sphere of the hedgehog. All fiber bundles [8] have as fiber a 1-dimensional circle U(1). SU(3) has for its matrices another multiplication table, not the octonians Fano table in the above memo.

Concerning the octonian and other coordinate constructions: the e7 U(1) circle is obtained by a projective coordinate extension from x7 to [x7,u] where u = 1 is for e7 and u = 0 for a projecctive point at infinity. The stereographic projection allows its linear form R where the e0 vector sets for radius a unit vector. It can turn up or down and generates this way positive and negative rays for real numbers. On the circle it sets mpo counterclockwise and cw clockwise orientations. This corresponds to the symmetry of the dihedral D1 of order 2 while U(1) corresponds to D0 which has as symmetry the identity map. In constructing higher dimensions from n =2 on as real 2-dimensional or complex 1-dimensional space, in the real both cases the cross products are used up to 8 coordinates. Alternatively, the projective extension can be used by adding a projective coordinate at infinity. For the real case the spaces P^n, n = 1,..,7 are obtained, for the complex case C^n, n = 1,2,3,4 which give rise to unit spheres, a circle in C, a Hopf sphere S^3 in C^2, a sphere S^5 in C^3. For n =4 the geometry is set differently by the strong interactions geometry. The Pauli matrix SU(2) generators of the Hopf sphere as symmetry are 2x2-matrices. The SU(3) extension is for them to Gell-Mann 3x3-matrices with one row and column of coordinates 0 added. Since the diagonal σ3 extensions are linearly dependent only two Gell-Mann matrices are obtained for two more gluons of SU(3). This shows up in the geometry for SU(3) which is a trivial fiber bundle S^3xS^5, not a 7-dimensional sphere. If the dihedral extension is used, new points added on its circle are for D3, a nuvcleons triangle, D4 a tetrahedron, D6 an octahedron for deuteron. The octahedron is for an inner spacetime of deuteron. It is obtained form the S^5 sphere as fiber bundle with fiber S^1 by a projective norming to its base, a complex 2-dimensional space with a bounding S^2 sphere. S^3 as fiber bundle with fiber S^1 has the base S^2 through the use of the Hopf map. This map, its inverse ad an additional stereographic projection from S^2 to a plane are other geometries which add to the above coordinates for local spaces of energy systems or for orbits of systesm in motion. There are also coupling of already exisitng coordinates. The Heisenberg coupling of e1, e5 in λp =h is for the particle character energy can show in an experiment. The angle φ extension is for angular momentum e3 in φL =h and for the whirl character energy can show in an experiment, the extension for the wave character energy can show in an experiment time e4 as interval Δt and its e6 inverse frequency 1/Δt are related as energy EΔt = h. The different energy characters allow for whirls and waves superpositions, for particles with identical quantum numbers the Pauli principle forbits this. The Heisenberg couplings are for a coordinate u and its differential du or d/du of functions in the variable u. If considered as intervals: if one is measured precisely the inverse is getting unsharp. One e2,e3 coupling effect on rotations is that all three spin S, angular momentum L and their sum J = S + L have to rotate as conic whirls about a central axis. The neutrino oscillation is an e1, e5 coupling particle effect, maybe also for photons as light waves red shift. The e4, e6 coupling can be responsible for the mirror reflections of light where it brakes its worls lines direction when hitting at a surface like matter or a huge star. In the first case it releases some anergy, in the second case it absorbes energy for the double lensing. Both occur through the Schwarzschild radius Rs rescaling of Minkowski metric when light waves with relativistic mass get in gravity interaction with a second system. Rs is for the radius r inversion from quark matter in the universe to dark matter as Higgs locations in a Horn torus with tiny radius Rs/r. For the Minkowski metrics geometry as double cone, speed v is $v'v = c^2$ inverted at a rotated pair of lines $r^2 = c^2t^2$, c speed of light, t time. It is closed at projective infinity to a Horn torus arising from closing by one point a cylinder carrying waves frequency as helix line. Dark energy inside this kind of Horn torus has speed v'>c.

4. Conclusions

In the Tool Bag is a set of 8 models for teaching highschool students in 8 units modern physics related to deuteron states. What the Moebius transformations can do is in a video demonstration for the students under [11]. This symmetry is for including gravity.

In this article a new big bang model is described which starts with the decay of a Higgs mass (figure 1) which is a location of a dense set of quarks in a tiny volume and releases the quarks (first as 1-

dimensional lemiscates or circles) by removing their join at infinity, the singularity of the Horn torus. Single quarks decay also.The particle scene is continued by the use of the strong interaction which confines with gluon exchanges three quarks in a nucleon. Its 2-dimensional triangle with quark edges has a rotor (6 roll mill in figure 4) for integrations (figures 3). The six energies as cross ratio invariants under Moebius transformations (G-compass in figure 4) are also used for the energy exchange of the deuteron with its environment (figure 2). The deuteron atomic kernel with a pair of nculeons and a weak isospin exchange between them is demonstrated in the Tool Bag by an octahedron with a 3-dimensional location inside a volume. The dihedrals and polynomials for roots of unity guide the evolution as well as projective duality. Gravity has its particles inside the octahedron and its mass representation in the decaying Higgs boson and the setting of barycenters. Minkowski metric rescalings and also the general relativvisitc factor as G matrix are included in the deuteron model. Length stretching/squeezing, observed for graviton waves is demonstrated by central projections, using the model deuteron (figure 4) where the shadow in the floor is longer or shorter according to the distance of deuteron to the floor. The addition of an octonian e7 coordinate extends the deuteron 6-dimensional energy space e1,.e6 such that atoms can live in this world. The octonians 8 dimensions have also a Gell-Mann SU(3) matrix presentation Octonians add through their multiplication table the seven GF measures (Fano memo figure 2) where space as spin SU(2) coordinates is only one and *rgb*-gravitons are another one from SU(3). The need of a vectorial projector e0 (see also [12]) is for localizations where an intial point is set and the length of the vector is a unit for the energy measure (meter, second, kg, Ampere, Volt, Kelvin, frequencies). It can also be reduced to setting a scalar at a point like mass at a barycenter. As force or speed vector it fixes a spacetime direction in which the energy acts.

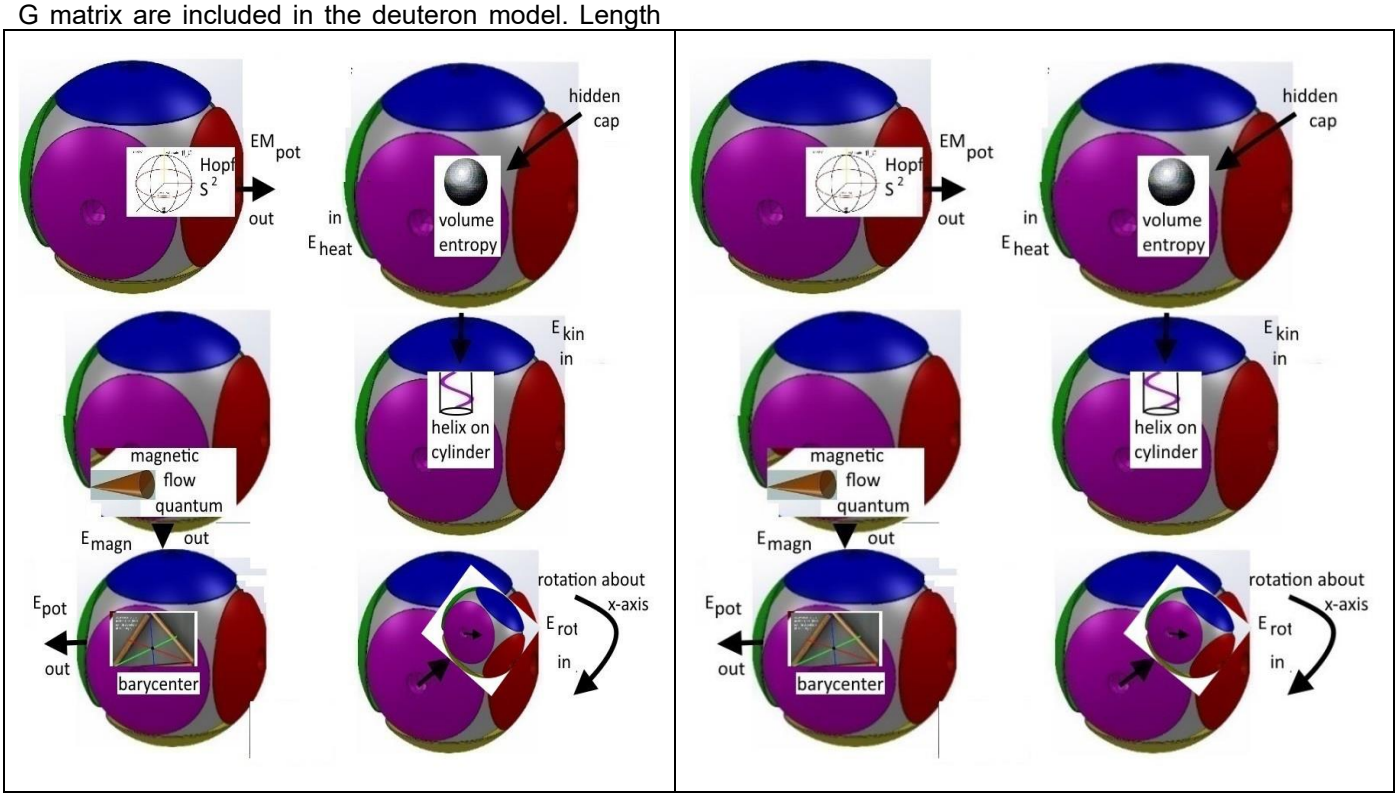
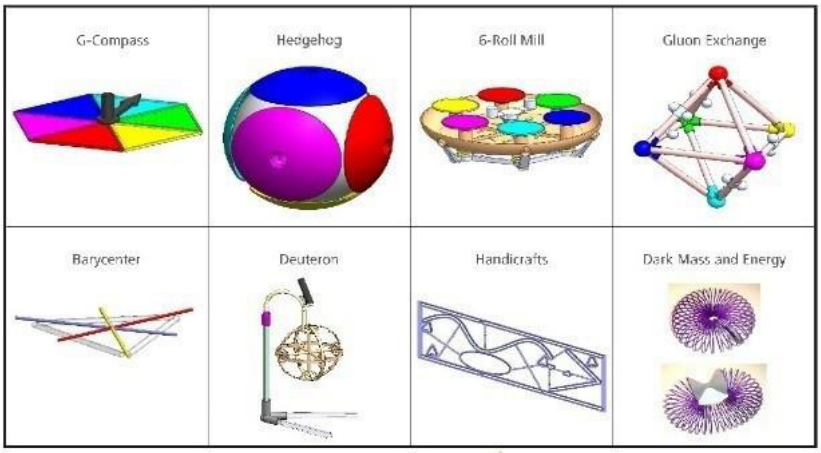


Figure 3

MINT-Wigris: projective spaces and measures are for the G-compass and deuteron [spingrav 4567 + whirl 123], hedgehog [heatfreq 1357 + heat 246], 6 roll mill [rotachs 1256 + orbit 347], gluon exchange [siquark 1247 + 356 sirotor], [wimags 2367 + 145 magtime], barycenter [Higgsmass 1346 + 257 particle], handycrafts [emyloop 2345 + 167 wave], dark matter and energy [singular Horn torus, see barycenter]



Fano memo octonian coordinates (vertices 1,2,...), lines abc (measures) and affine subspaces efgh (spaces) are listed for the names

Figure 4

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4-dimensional projections similar to the above octonians coordinates into spacetime (e1,e2,e3,e4), the deuteron space (e2,e3,e5,e6) and a scalar field (e1,e4,e5,e6).)