Is genetic code part of fundamental physics in TGD framework?

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Abstract

Topological Geometrodynamics (TGD) leads to 3 basic realizations of the genetic code. Besides the chemical realization, there is a realization in terms of dark proton sequences (dark nuclei) with 3-proton state representing codon. Ordinary DNA strands would be accompanied by dark magnetic flux tubes carrying the dark proton triplets. Also RNA, amino-acids and tRNA would have dark proton analogs.

The third realization is in terms of dark photon triplets and involves the notion of bio-harmony modelled in terms of icosahedral and tetrahedral geometries with 3-chords of light assigned to the triangular faces of icosahedron and tetrahedron. 12-note scale is realized as a Hamiltonian cycle for icosahedron with the step between nearest neighbor vertices for the cycle realised as a quint scaling of frequency. The 3-chords correspond to the triangular faces of the icosahedron. Also tetrahedral realization of 4-note scale is necessary in order to obtain genetic code. DNA codons correspond to triangular faces and the orbit of a given triangle under the symmetries of the icosahedral harmony correspond to DNA codons coding for the amino acid assigned with the orbit. Vertebrate genetic code emerges as a prediction.

Codon corresponds to 6 bits: this is information in the usual computational sense. Bio-harmony codes for a mood: emotional information related to emotional intelligence. Bio-harmony would be a fundamental representation of emotional information realized already at the molecular level. Dark photon 3-chords and more generally, 3N-chords representing genes, would mediate interaction between various realizations.

Why both icosahedron and tetrahedron? Could this relate to the fact that the tesselations of a hyperbolic space H^3 are in fundamental role in quantum TGD. There is one particular tesselation known as tedtrahedral-icosahedral honeycomb. Could the genetic code be realized at the level of fundamental physics as a tedrahedral-icosahedral tesselation of H^3 emerging as a cognitive representation for space-time surfaces at the level of M^8 and by M^8-H duality also in $H=M^4\times CP_2$. Biological realization could be only one particular realization.

It should be possible to unify all models of the genetic code to single model so that the codon as a dark proton triplet is assigned to a representation as an "active" triangle of icosahedron or tetrahedron containing at it vertices dark protons defining the same codon as the triangle as 3-chord for a given icosahedral harmony. Could these "activated" triangles be assigned with tetrahedral-icosahedral tesselation? Could genes correspond to sequences of these icosahedron-tetrahedron pairs at magnetic flux tubes defined dark generatic code?

Why there should be 3 icosahedral harmonies and one tetrahedral harmony? There is a partial answer to this question. The correspondence with 64 dark proton triplets representing codons and triangles requires 3 icosahedral harmonies. What distinguishes stop codons from other codons? It turns out that stop codons could be dark proton triplets for which the corresponding triangle does not exist in tetrahedral-icosahedral realization! The lack of a dark proton triplet would mark the end of gene.

Contents

1 Introduction

Topological Geometrodynamics (TGD) proposes 3 basic realizations of the genetic code [L4]. The first realization is the standard chemical realization. The second realization is in terms of dark proton sequences (dark nuclei) with proton triplet representing a codon. Ordinary DNA strands would be accompanied by dark magnetic flux tubes carrying the dark proton triplets. Also RNA, amino-acids and tRNA would have dark proton analogs.

The third realization is in terms of dark photon triplets and involves the notion of bio-harmony described in terms of icosahedral and tetrahedral geometries with 3-chords of light (perhaps also sound) assigned to the triangular faces of icosahedron and tetrahedron. 12-note scale is realized as a Hamiltonian cycle for icosahedron with the step between nearest neighbor vertices for the cycle realised as quin (scaling of frequency by factor 3/2). The 3-chords correspond to the triangular faces of the icosahedron. Also tetrahedral realization of 4-note scale is necessary in order to obtain genetic code. DNA codons correspond to triangular faces and the orbit of a given triangle under the symmetries of the bio-harmony corresponds to DNA codons coding for the amino acid assigned with the orbit. Vertebrate genetic code emerges as a prediction.

The 3-chords of dark photon triangles are assigned with the triangular faces of icosahedron and tetrahedron [L1, L4, L10] such that their corners are labelled by the notes of the 12- and 4-note scales realized as a icosahedral and tetrahedral Hamiltonian cycles, which are closed paths connecting vertex to neighboring vertex and going through every vertex once.

Genetic code corresponds to a fusion of tetrahedral harmony with 4 chords and of 3 icosahedral harmonies with 20 3-chords having as group of symmetries Z_6, Z_4 and Z_2 - Z_2 can correspond either to reflection or rotation by π. There are also 6 disharmonies without any symmetries (Z_1) with single DNA codon coding for single amino-acid. There is a considerable number of different icosahedral harmonies and the 3 icosahedral harmonies can be in different key so that a large number of bio-harmonies is possible [L10]. The details of the model of bio-harmony are not completely fixed. In particular, the understanding of stop codons is not completely satisfactory. The small deviations from the vertebrate code (say bacteria and mitochondria) could be understood as being due to the incomplete mimicry of the dark code by chemical code in accordance with the idea that the mimicry has gradually evolved more complete.

Dark photon 3-chords mediate interaction between various realizations. Both dark proton and dark photon triplets would be dynamical units analogous to protons as color confined states of 3 quarks and in the adelic vision the notion of color confinement is replaced with Galois confinement [L10, L14]. Also genes could be seen as Galois confined states of 3N dark protons and dark photons. 3N-photon exchange would be realized as 3N-fold frequency - and energy resonance (mere energy resonance) between dark levels with the same value (different values) of h_{eff} . The possibility to modify the value of h_{eff} for flux tube makes it possible to have for a given codon single resonance energy [L14, L12, L13].

There are several questions relating to the bio-harmony.

1. The gluing of icosahedron and tetrahedron along the face looks ugly in the original model. Why both icosahedron and tetrahedron and why the gluing? The recent progress with M^8-H duality [L7, L8] suggests an answer. The tesselations (honeycombs) of hyperbolic 3-space H^3 appear at the fundamental level and induce sub-tesselations of the magnetic flux tubes. One of these honeycombs- tetrahedral-icosahedral honeycomb (TIH)- involves all Platonic solids with triangular faces - tetrahedron, octahedron, and icosahedron. Could genetic code relate to TIH?

   Cognitive representation [L3, L5, L6] as a set of points of space-time surface in the space of complexified octonions O_c with points having O_c coordinates in extension of rationals associated with the polynomial defining the space-time surfaces are central for for both quantum TGD and TGD inspired theory of cognition leading to adelic physics [L2]. The cognitive representation is mapped to $H = M^4 \times CP_2$ by $M^8 - H$ duality [L7, L8].

   Could the genetic code be realized at the level of fundamental physics as a TIH in H^3 emerging as a cognitive representation [L3, L5, L6, L11] for the space-time surfaces in M^8 and by $M^8 - H$ duality also in $H = M^4 \times CP_2$. If so, the biological realization could be only one particular realization of the code.

2. Why there should ber 3 icosahedral harmonies and one tetrahedral harmony? There is a partial answer to this question. The correspondence with 64 dark proton triplets representing codons and triangles requires 3 icosahedral harmonies. What distinguishes stop codons from other codons? It turns out that stop codons could be dark proton triplets for which the corresponding triangle does not exist in THI realization! The lack of dark proton triplet would mark the end of the gene.

It should be possible to unify various TGD inspired models of genetic code to a single unified description. Is the time ripe for this?

1. The realizations in terms of dark protons and dark photons are related: dark photon 3N-plets would be emitted by dark proton 3N-plets in 3N-proton cyclotron transitions. In the 3N-resonance interaction with DNA, RNA, amino-acids, and tRNA the dark photon 3N-plet would transform to ordinary photons (bio-photons). Energy resonance could select the basic information molecules.

2. How the dark level interacts with the ordinary matter? Music expresses and creates emotions. Light 3-chords for a given bio-harmony could therefore represent an emotional state of MB (emotions as sensory perceptions of MB?). Fourier transform in terms of frequencies represents non-local holistic information and emotional information indeed is holistic information. Codons as units of 6 bits would represent ordinary temporily local, reductionistic information.

   Each emotional state corresponds to a particular collection of 3-chords as allowed chords of the bio-harmony and therefore the resonance occurs with different biomolecules or induces different transitions of these bio-molecules. Could this serve as a universal mechanism of bio-control? Could epigenesis as a control of DNA transcription rely on this mechanism? As a matter of fact, the model described in this article emerged from an attempt to understand epigenesis in the TGD framework.

3. Is it possible to unify all models of the genetic code to single model so that the representation of a codon as dark proton triplet is assigned to a representation as an "activated" triangle of icosahedron or tetrahedron of TIH containing at it vertices dark protons defining the same codon as the triangle as 3-chord for a given icosahedral harmony. Could these "activated" triangles be selected faces of TIH. Could genes correspond to sequences of these icosahedron-tetrahedron pairs at magnetic flux tubes?

In the sequel the questions raised above are discussed.

2 Genetic code and hyperbolic tesselations

Why 3 different icosahedral harmonies with symmetries Z_6, Z_4, and Z_2 plus one (there is only one) tetrahedral harmony is needed to get $3 \times 20 = 60 + 4$ chords in correspondences with 64 codons of the genetic code?

2.1 Hyperbolic tesselations and genetic code?

What comes into mind, are fundamental lattice like structures - tesselations - having as basic building bricks icosahedron and tetrahedron - at least these. This would make sensical to speak about gluing of tetrahedron to icosahedron, which looks a strange operation in the original formulation of the model.

1. Platonic solids correspond to finite tesselations at 2-sphere or equivalently 3-D solid polyhedrons in 3-D space Euclidian space E^3. Maybe one could answer the question by increasing dimension and by studying 3-D polyhedrons of 4-D space defining tesselations of the hyperbolic space H^3.

   By $M^8 - H$ duality [L7, L8], these tesselations appear at the fundamental level TGD as cognitive representations since the 3-D mass shells with the geometry of H^3 appear naturally in the solutions of dynamical equations as algebraic equations at the level of M^8 identifiable as real section of complexified octonions O_c. The dynamics reduces to the associativity of the normal space of the space-time surface determined as a root for the real part of an octonionic polynomial obtained as an algebraic continuation of a real polynomial. Real part is defined in quaternionic sense by decomposing octonion to two quaternions in the same manner as a complex number is decomposed to its real and imaginary parts.

The algebraization of the octonionic counterpart of Dirac equation forces its identification as the counterpart of momentum space version of the ordinary Dirac equations and the identification of M^8 as an analog of momentum space so that space-time surface is analog of Fermi ball.

2. The tesselations of H^3 are analogs of lattices in an Euclidian momentum space E^3. In adelic physics they define cognitive representations providing unique discretizations of space-time surface both at the level of M^8 and H. $M^8 - H$ duality maps tesselations to their analogs of $H = M^4 \times CP_2$. Contrary to my long held belief, Uncertainty Principle forces the map to be instead of a direct identification an inversion for $M^4 \subset M^8 \rightarrow M^4 \subset H$ [L7, L8]. Mass hyperboloids correspond in H to light-cone proper time constant sections of space-time surface: light-cone proper time defines Lorentz invariant cosmic time.

3. The tesselations of H^3 can have several different analogs of unit cells glued together along their 2-D faces. The positive curvature of sphere forces Platonic solids as tesselations of 2-sphere to be closed and be finite. H^3 as a negative curvature space does not allow a closure. This implies a large number of tesselations as infinite analogs of regular solid polyhedra. Both icosahedron, octahedron and tetrahedron have triangular faces so that they might allow gluing together for the simplest tesselations. Also more complex tesselations are possible.

2.1.1 Details about hyperbolic tessellations

Consider now in more detail some tessellations of H^3 possibly relevant for the bio-harmony [L1, L4, L10] involving icosahedral and tetrahedral geometries.

Some basic concepts and notations are necessary to help the reader to understand the Wikipedia articles, which give detailed explanations and illustrations.

1. Regular polytopes are tesselations consisting of single polytope. There are subtle differences between tesselations and honeycombs: tesselations are more general than honeycombs. These differences are not relevant for what follows so that I will use both terms interchangeably.

2. Schläfli symbol [A7] `https://cutt.ly/7jagV1T` $(p, q, r, ..)$ characterizes regular polytopes in both Euclidian spaces and hyperbolic spaces locally but does not tell anything about the object globally. For a 3-D regular polytope (p, q, r) in 4-D space (say tessellation of H^3 the faces have p vertices, q identical faces meet at given vertex, and r identical 3-cells meet along given edge. For instance, $(3, 5, 3)$ characterizes a regular tessellation having icosahedron as fundamental cells with 3 icosahedrons meeting along given edge.

3. Vertex figure [A10] `https://cutt.ly/yjagMQn`) represents the neighboring vertices as seen from a given vertex. Formally it is defined by contracting all edges emanating from the vertex to their middle points and connecting these points by lines along faces. For a n-D polytope (p,r,s,..) the vertex figure is n-1-D polytope (r,s,...). For instance, for icosahedron (3,5) the vertex figure is (5) telling that 5 edges meet at vertex. For the regular honeycombs in H^3 the vertex figure is a regular polyhedron. For instance, for $(3, 5, 3)$ it is (5,3) identifiable as dodecahedron. Second notation for the vertex figure is as the list of numbers of edges meeting at the vertices of the face: For icosahedron this list is 3.3.3.3.3 telling that the faces of the edge figure has 5 vertices at which edges meet.

4. Edge figure [A10] (`https://cutt.ly/djag9Q9`) is the vertex figure of the vertex figure of the polytope. For D-dimensional polytope it is polytope of dimension D-2. For a regular polytope $(p, q, r, ..., s)$ the edge figure is $(r, ..., p)$: for Platonic solids (r,s) edge figure is () telling that two faces meet along a given edge. For the regular polytope (r,s,p) the edge figure tells the number of identical 3-cells meeting at given edge. For cubic lattice it is 4. For semiregular honeycombs the 3-cells need not be identical.

5. The notion of dihedral angle (see https://cutt.ly/vjs2OBI) is very useful in trying to understand whether a given tessellation of E^3 and H^3 is possible. Dihedral angle is defined as the angle between the faces of the polytope meeting along a given edge. For tetrahedron it is 120 °, for octahedron 90 ° and for icosahedron 138.19 °. Since at least 3 polyhedra must meet at a given edge, the sum of these angles must be smaller than 360 degrees in E^3. This prevents icosahedral tessellations in E^3.

   In H^3 negative curvature allows the sum to be larger than 360 ° (think of polygons at a saddle surface as a visualization) so that 3 icosahedra might meet at a given edge as indeed occurs for $(3,5,3)$ tessellation. The sum of the the dihedral angles of T, O, and I assignable to to tetrahedral-icosahedral honeycomb in H^3 is 348.19 ° and smaller than 360 ° but rather near to it.

6. An important notion is Coxeter group [A3] (https://cutt.ly/FjdEJeG) acting as the symmetry group of the honeycomb. Coxeter group is generated by reflections meaning that honeycombs can be generated by reflections in suitable mirror planes. Honeycomb is constructed kaleidoscopically: a concretization of Leibniz's monadology is in question. Coxeter group and therefore also the honeycomb is characterized by Coxeter diagram [A2] (https://cutt.ly/SjdEZiH) having as its nodes the mirrors and connected by edges labelled by the dihedral angles $\phi = \pi/n$ between the mirror planes. The value of n is written explicitly to the diagram except when it is the minimal value $n = 3$. For instance, the sequence [(5,3,3,3,3)] characterizing tetrahedral-icosahedral honeycomb in H^3 tells that the dihedral angles between the 5 mirror planes are $(\pi/5, \pi/3, \pi/3, \pi/3, \pi/3)$.

Consider now honeycombs in hyperbolic space H^3.

1. The simplest tessellations - regular honeycombs - of H^3 consist of icosahedra and dodecahedra having the same isometry group. That 3 of the 4 most symmetric honeycombs in H^3 have icosahedral symmetries whereas the fourth has cubic symmetries, is a highly encouraging sign. These 4 regular honeycombs are icosahedral honeycomb $\{3,5,3\}$ with 3 icosahedrons meeting along edge; order-5-cubic honeycomb $\{4,3,5\}$ with 5 cubes (rather than 4 as in E^3) meeting along a given edge; and dodecahedral honeycombs of order 4 (5) with 4 (5) dodecahedra meeting along edge. In all these cases the sum of the dihedral angles is larger than 360 ° so that the negative curvature of H^3 is essential for the existence of these honeycombs.

2. What about the combinations of Platonic solids having triangles as faces - tetrahedron, octahedron, and icosahedron? From Wikipedia article [A8] (https://cutt.ly/cjaheWC) one learns that there exists honeycombs of H^3 characterized by Schläfli symbol $\{(3,3,5,3)\}$ and Coxeter group with symbol $[(5,3,3,3)]$ consisting of reflections and generating the honeycomb. The regular honeycombs are characterized by 3 integers (say $(3,5,3)$) and the meaning of the code is not quite clear to me but must reflecs the fact that the honeycomb is semiregular.

   Tetrahedron corresponds to (3,3) and icosahedron to (3,5) and octahedron (3,4) as a rectified tetrahedron obtained by contracting edges to their middle points and expanding vertices to faces, has symbol $r(3,3)$. Perhaps (3,3) in (3,3,5,3) refers tCoxetergroupo both tetrahedron and its rectification and (3,5) in (3,3,5,3) to icosahedron. The last "3" tells that 3 identical solid icosahedra, tetrahedra, or octahedra meet at given edge.

   In particular, the tetrahedral-icosahedral honeycomb (TIH) is a compact uniform but not a regular honeycomb, having icosahedra, tetrahedra, and octahedra, all of which have triangular faces, as analogs of unit cells [A5, A4, A9] (see https://cutt.ly/xhBwTph, https://cutt.ly/lhBwPRc, and https://cutt.ly/OhBwUOO)). The Wikipedia article [A8] contains beautiful illustrations of these honeycombs.

   One can wonder why "tetrahedral-icosahedral honeycomb" does not involve octahedron. This is said to reflect the fact that only tetrahedral and icosahedral cells of the tessellation are regular 3-cells. All these polyhedra are regular as Platonic solids, and it remains unclear to me what the lacking regularity of the octahedron as 3-cell means in the recent context.

   For TIH $\{(3,3,5,3\}$ the vertex figure is rhombicosidodecahedron (RID) [A6] (https://cutt.ly/yjahitS) discovered already by Kepler. Kepler talked about Harmonices Mundi and I cannot but smile as I recall how I read as a young man a book having fun with Kepler's medieval belief on celestial harmonies and laughed also! Maybe the celestial harmonies are making a glorious comeback!

RID is an Archimedean solid [A1] (`https://cutt.ly/njahaGN`) having 60 vertices corresponding to 12 disjoint pentagons and 20 disjoint triangles with 60 vertices both. RID has as faces 20 triangles assignable to icosahedron, 12 pentagons assignable to dodecahedron plus 30 squares - 62 faces altogether. RID is obtained by radially scaling the distance of icosahedral and dodecahedral faces from origin but keeping the area of the spherical faces the same: this yields squares as additional faces. Triangles and pentagons have only squares as edge neighbors.

Edge figure tells the number of edges meeting at given edge. For TIH it is 3. Regular and single-ringed Coxeter diagram uniform polytopes to which also TIH belongs have a single edge type. Therefore icosahedron, tetrahedron, and octahedron must meet at given edge. That vertex figure contains 3 types of faces (triangles, and squares, and pentagons) presumably reflects this. Recall that the sum of the dihedral angles of T,O, and I is 348.19 °.

One can try to build a more concrete picture about how the Platonic solids are glued together along their triangular faces in the icosahedral-tetrahedral honeycomb.

1. Must to make this concrete, one can regard Platonic solid as a kind of mini Earth with two other Platonic solids glued to its surface like mountains. In all cases one has Platonic analog of a planar lattice of triangles at this mini Earth. To minimize typing call the 3 different Platonic solids T, O, and I.

2. Due to the symmetries one expects that for O and I the triangles correspond to different Platonic solids if they are edge neighbors. For T this is not possible since all faces are edge neighbours. All 6 2+2 configurations of B and C are however related by a rotational symmetry. This already gives a rather satisfactory picture about what the situation looks like at the surface of each mini Earth (I cannot avoid the analogy with inner planets, the living Earth as the largest one would correspond to I!).

3. The radius R of circumscribed inner or or outer sphere gives an idea about the size scales of these Platonic solids when the edge length a is the same for them as it is in the recent case. The following gives the radii of the outer sphere.

$$\begin{array}{llll} \text{tetrahedron} & \frac{R_{T,out}}{a} = \sqrt{\frac{1}{2}} \ , & & \frac{R_{T,in}}{a} = \sqrt{\frac{1}{24}} \\ \text{octahedron} & \frac{R_{O,out}}{a} = \sqrt{\frac{3}{4}} \ , & & \frac{R_{O,in}}{a} = \sqrt{\frac{1}{6}} \ , \\ \text{icosahedron} & \frac{R_{I,out}}{a} = \frac{1}{2}\sqrt{\phi\sqrt{5}} \ , \phi = \frac{(1+\sqrt{5})}{2} & , & \frac{R_{I,in}}{a} = \frac{\sqrt{3}}{12}\sqrt{3+\sqrt{5}} \ . \end{array} \tag{2.1}$$

4. The ratios of the outer radii are given by $R_{I,out} : R_{O,out} : R_{T,out} = \sqrt{\phi\sqrt{5}} : \sqrt{\frac{3}{4}} : \sqrt{\frac{1}{2}} \simeq 1.9021 : 0.8660 : 0.7071$. The ratios of the inner radii are given by $R_{I,in} : R_{O,in} : R_{T,in} = \sqrt{\phi\sqrt{5}} : \sqrt{\frac{3}{4}} : \sqrt{\frac{1}{2}} \simeq .756 : 0.408 : 0.2041$. That icosahedron has the largest size, is natural since the total solid angle defined as a sum of the solid angles of the 20 triangles is $4/pi$ and the contribution of an individual triangle is smallest for I and largest for the 4 triangles of T.

2.1.2 Could TIH allow to unify the models of genetic code?

Does this picture help to say anything interesting about the model of bio-harmony and even to unify the models of genetic code?

1. Tesselations define in a natural manner discretizations of MB defining cognitive representations suggested to relate to the geometric representations for the states of the brain at MB and more generally, for the states of various parts of the biological body at MB. There

is evidence for an effective hyperbolic geometry of brain realized in a statistical sense [J1] (http://tinyurl.com/ybghux6d) : functionally similar neurons are near to each other in this effective hyperbolic geometry. This evidence is discussed from TGD point of view in [L9]: one ends up with a proposal that the MB of the brain provides a geometric representation for the statistical aspects of the brain - kind of abstraction? Information from the brain would be sent by dark Josephson radiation from similar neurons to positions of MB near to each other. This model could generalize to other parts of organism. MBs could form a kind of abstraction hierarchy representing more and more abstract data about the state of organism.

2. Could the icosahedral-tetrahedral tesselation allow a justification for the fusion of 3 icosahedral harmonies with the tetrahedral harmony? Why does the octahedral harmony disappear? Octahedral harmony would mean 6 additional notes assignable to the vertices of octahedron and 8 3-chords and this does not fit with facts.

   Remark: In the Wikipedia article about TIH it is said that octahedrons of TIH are not regular, unfortunately in the sense that I do not understand. Note also that tetrahedral and octahedral harmonies are unique because there is only a single Hamiltonian cycle.

3. Geometrically the tesselation means identification of the neighbouring faces, which gives a justification for the strange looking proposal of gluing tetrahedron to icosahedron in order to fuse 3 icosahedral and one tetrahedral harmony. If also the 3-chords associated with the faces are identified, one can ask whether only icosahedral and tetrahedral harmonies are needed and the chords of the octahedral harmony are determined by them.

   2 3-chords of tetrahedral harmony are the same as those for icosahedral harmony but the 2 3- chords associated with the 2 T-O faces are independent. This would give 62 independent chords (amusingly, 62 happens to be the number of faces of RID).

   One of the tetrahedral chords is necessary since purely icosahedral harmony allows to get only 19 amino-acids identified as the orbits of the chords under the symmetries of a particular icosahedral harmony with 20 chords: one additional chord is needed for the missing amino-acid. Since two icosahedral triangles facing the tetrahedron "eat" 2 further tetrahedral chords, this leaves 1 tetrahedral chord from 4: 3 chords as tetrahedral codons are missing. Could the 3 missing tetrahedral 3-chords correspond to the ordinary DNA codons acting as stop codons? Could the stop codons lack a representation as dark photon triplets or could their frequencies be such that they do not allow 3-resonance with any tRNA?

4. How genes would be realized in the tesselation? Could dark genes correspond to flux tubes forming 1-D sub-tesselations of H^3 induced to the flux tubes? Could gene correspond to a sequence of icosahedron-tetrahedron pairs such that neighboring codons are associated with icosahedron-tetrahedron pairs as cell-neighbors. Two subsequent icosahedrons would have a tetrahedron between them.

   Could the tesselation induced from H^3 to MB be dynamical involving an "activation" of a particular triangle as a codon inside each icosahedron and tetrahedron? Could dark genes at the flux tubes have these codons as induced dark codon sequences? Could "activation" mean that the triangle representing particular codon is accompanied by 3 dark protons at its vertices and representing the same genetic codon? The representations in terms of dark protons triplets, as triangles of icosahedron and tetrahedron, and as dark photon triplets would fuse to single representation. There could be a representation also for stop codons in terms of 3 dark protons but there would not be no triangle where to locate them so that coding would stop! The missing dark codon would signify the end of the gene.

   This would give the long-sought connection between dark codons realized as dark triplets and dark codons realizing bio-harmony and dark codons realized as dark photon triplets generated in the cyclotron transitions of dark codons. An essential role would be played by Galois confinement [L10] stating that these triplets behave like dynamical units - just like 3 confined quarks forming a baryon. Galois confinement generalizes to the level of genes.

5. This proposal is of course one of the many variations of single theme developed during years. What is new that the proposal would make the roles of the icosahedral and tetrahedral geometries concrete, not at the level of bio-molecules but at the level of their MBs. A

profound dramatic generalization of the notion of genetic code from biology to the level of fundamental physics is also suggestive. Even a hierarchy of genetic codes in various scales can be considered.

The interpretation of various harmonies as correlates of emotions implies that each icosahedral-tetrahedral unit of the tesselation would have its own varying emotional state expressed and affected by biochemical level via different interaction actions with ordinary biomatter realized in terms of dark photon N-resonance with targets depending on the emotional state [L14, L12, L13]. This could serve as a universal mechanism of bio-control by MB applying also to epigenesis.

There are still several open questions: in particular, what is the deeper reason for the fusion of just 3 icosahedral bio-harmonies. That the number of the dark codons is 64 is a partial reason but is this enough.

6. There are reasons to ask whether the cell membrane and microtubuli could provide a 2-D realizations of the genetic code [L14]. If genes are induced as 1-D sub-tesselations from that of MB, there is no reason to exclude 2-D or even 3-D induced tesselations.

7. I cannot avoid the temptation of mentioning the notion of memetic code [K1], which was my first idea about genetic code and proposed as a generalization of genetic code by starting from a speculated hierarchy of Mersenne primes, whose members would come as $M(n+1) = M_{M(n)}$, $M_n = 2^n - 1$, $(M(2) = 2$. This gives the Mersenne primes $M(2) = M_2 = 3$, $M(3) = 2^3 - 1 = 7$, $M(4) = M_7 = 2^7 - 1$, $M(5) = M_{127} = 2^{127-1}$. It is not known whether the hierarchy continues. M_7 would correspond to the ordinary genetic code and M_{127} to memetic code with codons realizable as sequences of 20 codons.

   Could memetic code be realized by TIH? Could one consider a planar or cylindrical sub-tesselation with a width of 20 tetrahedral-icosahedral pairs? If the size assignable to single pair is that of DNA codon - 1 nm roughly - the width would be about 20 nm which might relate to the radial scale of the microbutubuli.

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