

Crop Cirles and Life at Parallel Space-time Sheets

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1 Introduction

Crop circles as a hoax is one of the illusions of century created by the market economy media. Strangely, this claim which was made without a single thread of evidence, was generally accepted, and has remained a general belief. This despite the fact that already for more than half decade it has been known that all crop circles cannot be hoaxes. The articles in the BLT homepage [1] provide detailed scientific information about crop formations and the reading of these articles changed also my own attitudes thoroughly.

1.1 Strange phenomena associated with crop formations

For instance, microwave induced explosions in growth nodes of crops are regularly involved [2]. Also meteoric material is often associated with the crop formations [3] but not to the region exterior to them: this is absolutely impossible if the formations were made by human artists. Routine laboratory tests allow to judge whether the formation is man-made.

Models involving plasma flows from the ionosphere to the crop field formation have been developed [4]. The regions where the soil has a high content of calcium carbonate (chalk) helping to charge it electrically are the places where the circles appear predictably from year to year. There is also evidence suggesting that this interaction exists during the entire growth period so that there would be a continual connection to ionosphere [5].

Simplest crop circles indeed have a form similar to plasma self-organization patterns but there are also differences suggesting that the formations are not natural. Small plasma balls have been observed in the fields both before and after the appearance of the crop formation [5]. There are also irregular, 'non-geometric', patterns of downing which must have been created by same mechanism as crop circles involving the interaction with the ionosphere [5]. These are ideal bits of data for developing in detail hypothesis that any living system, even plants and plant populations, has a magnetic body, and that also magnetosphere is a conscious and intelligent entity receiving information from and controlling the biosphere. The resulting model supports the view about crop circles as an attempt of (geo-, planeto-, helio-, or some other) magnetospheric selves to tell about their existence to us.

1.2 What aliens are and where they might live?

There are two especially fascinating crop circle formations: Chilbolton [6, 7] and Crabwood [8, 9]. Both formations suggests very strongly the interpretation as a message from intelligent civilization living at parallel space-time sheets in our solar system. These messages indeed allow to deduce a lot of information about the genetic code and other biocodes associated with these lifeforms.

a) The message suggests strongly the existence of also doublet code and this inspires a simple model for our genetic code allowing to see the triplet code as resulting from much simpler product code by a small symmetry breaking due to the interaction between singlets and doublets. Doublet code would correspond to exotic form of RNA generated also in the simulation of primordial sea and against which ordinary life forms have immune reaction. Also various alien codes results in the same manner. The model suggests strongly that DNA triplets have resulted as a fusion of DNA singlets and doublets defining simpler genetic codes. It turns out that one can deduce surprisingly detailed information about the alien genetic codes. In fact, almost a unique codes result if one accepts the proposed model of the genetic code having symmetries obeyed also by our genetic code.

b) The Chilbolton message tells that also silicon is of fundamental importance for this lifeform at DNA level. Crabwood message contains a variant of the genetic code for which the simplest interpretation is that DNA doublets of form XT are effectively doubled: perhaps doublets of form XT_S besides XT ,

where T_S denotes a compound of T and silicon, have emerged. This increases the number of DNA triplets from 64 to 80 and thus also the information content of the genetic code. Same could have occurred to amino-acids and increased the number of amino-acid like molecules by three: this in turn would increase the expressive power of the genetic code. The difference between man and ape is enormous although genetic codes are almost identical. It is difficult to even imagine the level of intelligence of these creatures as compared to that of us.

c) Chilbolton message contains two different DNA (or RNA) strands. This could have several interpretations, not necessarily excluding each other.

i) RNA could indeed be asymmetric and one can understand the pre-evolution of life if the RNA strands associated with singlet and doublet RNA were fused to this kind of strands so that translation of of boths RNAs to pre-aminocid sequences occurred using tRNA which was fusion of singlet and doublet tRNAs and predecessor of recent tRNA.

ii) Alternatively, there could be two genetic codes for the same lifeform: the 80 DNA-23 amino-acid code would involve silicon. This lifeform could even live outside the solar system.

iii) There are two separate higher level lifeforms perhaps living in symbiosis inside same organism (like mitochondria and cell nucleus inside our cell).

d) Plasmoid like lifeforms could correspond to more primitive singlet and doublet codes. The fact that the Sun, whose convective zone contains a magnetic field of order .2 Tesla making it an ideal environment for this lifeform, is described to be smaller than in Arecibo message, suggests that this lifeform might populate also solar magnetosphere. The plasmoid like lifeforms could serve as kind of less intelligent medium like messengers, quantum entanglers, making possible a telepathic sharing of mental images between members of different civilizations. The light balls observed near crop formations would represent this lifeform. Also UFOs could be identified as plasmoid like lifeforms inducing telepathic encounters with the alien lifeforms. Being predecessors of the recent lifeforms, plasoinds would generate immune response in higher lifeforms: otherwise the direct encounters would be lethal. Even multicellulars formed by nannobacterium like lifeforms could be in question.

e) Life loves boundaries where the gradients are and energy currents flow. Active life requires also something to manipulate easily and liquid and liquid crystal phases are especially interesting in this respect. Therefore the solid-liquid boundaries in the Earth's interior are especially interesting seats for lifeforms. The presence of the small glass balls and of the magnetized iron in crop formations suggest that the transparent molten quartz (glass) in the mantle-core boundary, and molten iron in core-inner core boundary of Earth's interior, perhaps both allowing also liquid-crystal phases, might have replaced water as the basic element of life. Temperature is not a problem in many-sheeted space-time and assuming that the size of the space-time sheet corresponds to the thermal de Broglie wavelength one ends up with the conclusion that $k = 131$ space-time sheets having size of $1/8$ Angstroms are the carriers of the liquid glass and iron whereas $k = 137$ atomic space-time sheets can be even in room temperature. Same mechanism might explain the ability of people in trance to dance on burning charcoals.

f) This crazy sounding hypothesis is testable. One could search for IT lifeforms and fossiles in volcanoes. One could try to detect tectonic waves and sound waves of unidentified origin as signals possibly generated by ITs. One could use "tectonic" radar waves in order to identify possible technological artefacts in the mantle-core layer. In the Chilbolton message a crop circle which appeared one year earlier in the same crop field plays the same role as the image of the radio telescope in the Arecibo message. Rather remarkably, this fractal structure brings in mind Earth and its magnetosphere. The interrepretation consistent with the overall view is that the construction of this and other crop circles indeed involves entire magnetosphere and that intraterrestrial life forms are involved with the sending of the message. One can also ask whether crop

formations could quite generally be interpreted as pictorial representations of the alien technology?

1.3 What are the genetic codes of aliens?

There is some uncertainty concerning the identification of some ASCII code words appearing in the Crabwood message (as Martin Keitel has emphasized in private communications). In the following two possible forms are discussed. In particular, the number of different capital letters is a crucial factor: if it is smaller than 20, one is forced to interpret also capital letter part of the message as associated with 80 DNA, 23 amino-acid code.

Despite these uncertainties, very general symmetries deduced from our own genetic code fix the identification of the alien codes highly uniquely. All these codes result by the same universal mechanism, and are characterized by the same imbedding of the amino-acid space to the DNA space implying that a considerable part of the code is universal. The symmetries are the exact A-G permutation symmetry and the almost exact T-C permutation symmetry for the last base of the DNA triplet, and the approximate decomposition to a product of codes associated with DNA doublets (the first two bases of triplet) and singlets (the third base of triplet). The success of this model inspires the view that molecular life first evolved to form DNA singlets and doublets coding for 2-plet *resp.* 10-plet of 'pre-amino-acids'. After that DNA doublets and singlets fused to triplets coding for the ordinary amino-acids, which are perhaps an outcome from the fusion of the two kinds of "pre-amino-acids". 2×10 dichotomy might relate to the hydrophilic-hydrophobic dichotomy for the amino-acids.

1.4 A model for primordial evolution

Thanks to the enormous power of symmetry arguments in general (now A-G and T-C symmetries), it is possible to find a detailed physical realization for the purely formal mathematical model for the evolution of the genetic code. Remarkably, the cross like shape of tRNA reflects directly the fact that it has resulted as a fusion of linear singlet and doublet tRNA molecules.

a) Singlet *resp.* doublet pre-aminoacids correspond to selected subsets of DNA singlets *resp.* doublets, and the generation of the product code corresponds to the fusion of these selected DNA doublets and singlets to selected triplets. Asymmetric RNA strand served the role of mRNA and both singlet DNA and doublet DNA sequences were translated simultaneously using the fused tRNA.

b) During the primordial evolution aminoacids served as catalysts for the attachment of singlet DNA to singlet tRNA. At some stage the structure of the tRNA changed such that the aminoacids remained stuck to the singlet part of tRNA up to the moment when the tRNA was attached to the pre-mRNA. At this stage aminoacid was unfastened and joined to the growing aminoacid sequence: the standard genetic code was established.

Nannobacteria, discovered during the last decade have been claimed to be the dark matter of the bio-universe [11, 12]. Nannobacteria are too small to possess the usual genetic machinery, and are thus excellent candidates for the primordial lifeforms based on singlet and doublet codes.

Summarizing, whatever the fate of the proposed identification of crop circle artists as ITs is, the discovery of the fundamental mechanism behind the evolution of the recent genetic code is something which more than compensates the pains of getting ridiculized by colleagues who know better. This article is a brief summary of the model for crop circle formations developed in the chapter "Crop circles and life at parallel space-time sheets" of [16].

2 Existing wisdom about crop circle formations

In this section a model basic facts about crop circle formations and some models for them are discussed.

2.1 Why crop circles cannot be hoax?

There are several findings making it very difficult to believe that all crop circles are hoax, and on basis of these findings it is possible to deduce with high reliability whether a hoax can be in question in a particular case.

a) There are clear alterations in growth nodes in the crop formation areas [2, 17]. In particular, an expansion of growth nodes relative to normal is observed: this expansion is about 115 per cent for regular and 200 per cent for the irregular crop formations. Also tufts of standing plants within formation have node expansions equal to or exceeding the expansion level in flattened plants.

Expanded nodes contain expulsion cavities which can be understood as resulting from a rapid and intense heating by microwaves causing pressure buildup [2]: cellular components have literally blown out through epidermal cell walls. Node expansion is also accompanied by a bending. This suggests that the node expansion makes possible the downing of the crops. It is difficult to believe that artificial generation of crop circles by mechanical means could produce expanded nodes or generate microwaves.

b) Magnetic material confined to localized, dust coated vortices of radius about .5 meters has been found in two thirds of all cases studied [4]. In the case studied in [3] these vortices were located within the boundaries of two larger more typical circular sites of downed plants approximately 15 meters in diameter and 60 meters. Magnetic iron 'glaze' of thickness 400-600 microns is composed of fused iron oxide particles of size 2-200 microns and causes coatings of the soil and within interstices of leaves and stems.

The iron particles most probably originate from the fusion crust of a meteor resulting from the heating caused by the entry into the atmosphere. The congealed droplets are known to drift to Earth several days after the major shower and are found surrounding the known iron meteorite falls. The case studied in [3] occurred few days after Perseid meteor shower 1993. Since the phenomenon is concentrated entirely within the crop formation, it is difficult to believe that crop circle could be a hoax.

c) The growth characteristics have been compared for the seeds taken from the heads inside crop formations and outside them and differences depending on the time of the formation have been found [2, 17]. For instance, for seeds taken from the crop formations occurring near the late maturity states rate and the uniformity of plant growth were significantly enhanced. Also this is difficult to understand if hoax were in question.

2.2 Further facts about crop formations

A lot of data about crop formations have been gathered. In the sequel some of the newest data items which can be also found from [5, 4] are listed.

a) Crop formations need not be only regular, 'geometric' formations. Also randomly downed crop formations caused by the interaction with the ionosphere are possible and are actually more frequent than the regular ones [5]. These two types can be seen as reflecting the character of magnetic flux tube structures in question. Node length increase is 115 *resp.* 200 per cent for the regular *resp.* chaotic formations.

b) Expulsion cavities, lengthening and bendings associated with the growth nodes are common to all formation, and it seems that the bending is caused by the softening of the growth nodes. It has been found that the stems are charged immediately after the emergence of the crop formation and the bending is proportional to the amount of charge. This supports the view that downing

is caused by an electromagnetic mechanism. Over-fertilization does not explain downing. Germination abnormalities were mentioned already.

c) A new and very important plant abnormality has been identified. A massive spiralling and twisting of the somatic tissues in the peduncle (stem at the base of the seed head) could not have occurred at the same time as the flattening of the crop [5]. A continual exposure to radiation, and possibly also an interaction with the ionosphere already at the very early developmental stage, suggests itself.

d) Balls of light (BOLs) have been also observed in crop formation regions: soccer ball sized balls of orangey light and tennis ball sized balls of white opaque light in particular [4, 5]. The witnesses got the impression that BOLs are inspecting the crop formation. BOLs have been observed also before the formation of the crop circles. It would not be surprising if more complex structures formed from BOLs where responsible for the formation of crop circles.

e) Failures of electrical and mechanical equipment in near or flying over crop circles occur more often than normally [5]: cameras, recording devices, cell phones and even tractors fail to function properly. Electric perturbations caused by the plasmons are the most plausible cause.

f) Animal and human reactions to crop formations have been studied [5]. Many animals tend to avoid the formations and animals behave abnormally during the appearance of the crop formations. There are also effects on people: dread, euphoria, experiences of peace and oneness, and feeling of love have been reported. Sound sensations like buzzing noise and crackling footsteps have been reported: these could be induced by microwave audition [18]. That the buzzing noise has been tape recorded once does not however fit with the hypothesis of endogenous microwave hearing. Sensations of presence have been reported. Always newly formed crop circles are in question.

3 TGD based model

The presence of meteoric iron seems to require plasma currents from ionosphere, but it is difficult to imagine how dissipation could allow this kinds of currents. TGD based model allows to resolve this and many other counter arguments against the standard physics based models. The basic vision is following and obviously differs from the standard models in some respects.

a) Manysheeted space-time and topological quantization imply dramatic deviations from the single-sheeted standard physics.

b) Supracurrents running along magnetic flux tubes are responsible for the currents of charged particles between ionosphere and the Earth's surface.

c) Microwaves generated by the patterns of small sized plasmoids with sizes in microwave wavelength range induce the bridges connecting atomic space-time sheets of soil and plants to the super conducting magnetic flux tubes. The surplus of negative ions present in the soil makes the formation of the plasmon structures probable. The electrons inside plasmoids generate microwaves 'eaten' by the plasmoids so that plasmoids are able to raise their own 'food'.

d) Crop formations reflect the structure of the magnetic flux tubes structures connecting crop field to magnetosphere and could be perhaps seen as an attempt of the magnetospheric conscious entities to tell about their presence. Remarkably, crop formations can change their shape after their generation. A simple model for the motion of superconducting ions along the spiral like magnetic flux tubes from ionosphere to Earth in the electric field of Earth allows to understand the size scales of the crop formations.

e) BOLs are intelligent plasmoid like lifeforms participating actively to the construction of the crop formations by inducing the supra current leakage in desired positions causing the flattening of the crops.

3.1 Magnetic bodies and magnetosphere as a living system

TGD based view about classical fields differs radically from the Maxwellian one. Topological field quantization means that classical fields and matter form a Feynmann diagram like structure consisting of lines representing matter (say charged particles) and bosons (say photons). The matter lines are replaced by space-time sheets representing matter (elementary particles, atoms, molecules,...), and virtual bosons are replaced by topological light rays ("mass-less extremals", MEs). Also magnetic flux tubes appear and together with MEs they serve as correlates for bound state quantum entanglement.

The classical fields associated with MEs interfere only at the nodes, where they meet, and one has a hologram like structure with nodes interpreted as the points of a hologram. Thus one avoids the loss of information caused by the interference of all signals everywhere. This aspect is crucial for understanding the role of em fields in living matter and brain. The MEs corresponding to 'real photons' are like laser beams entering the hologram and possibly reflected from it. What is new that the nodes can be connected by 'virtual photon' MEs also analogous to laser beams. Hence also 'self-holograms' with no laser beam from external world are possible (brain without sensory input).

The hologram has a fractal structure: there are space-time sheets at space-time sheets and high frequency MEs propagating effectively as mass-less particles inside low frequency MEs serving as quantum entangling bridges of even astrophysical length. The particle like high frequency MEs induce 'bridges' between magnetic flux tubes and atomic space-time sheets at the receiving end. This makes possible the leakage of supra currents from magnetic flux tubes to atomic space-time sheets analogous to the exposure of film producing hologram. The leakage induces dissipation, self-organization, and primitive metabolism as a cyclic flow of ionic currents between the two space-time sheets, and thus a Darwinian selection of the self-organization patterns results. The low frequency MEs are responsible for bound state entanglement, macroscopic quantum coherence and co-operation whereas high frequency MEs are responsible for self-organization and competition.

TGD framework differs from Maxwellian also in that it is possible to assign to a given physical system a magnetic body having usually a size much larger than that of the system itself. The magnetic body provides kind of a monitor screen at which higher level information about the system is represented and defines thus sensory representations about the system. Magnetic body as a manual for a system is also a useful metaphor. Besides our own magnetic bodies (of astrophysical size), the magnetosphere of Earth is especially interesting magnetic body, and can be regarded as a living system receiving sensory input from biosphere, in particular our brains (see the chapter "Magnetospheric sensory representations" of [16]).

Also the magnetosphere in the Earth's interior is highly interesting. Especially interesting are various boundary layers since energy currents occur here and make complex self-organization patterns possible. Magnetosphere contains many layers of this kind and in the Earth's interior mantle-core and core-inner core layers are of special interest as possible seats for intelligent life and the lifeforms responsible for the crop formations might be ITs (intra-terrestrials).

The magnetospheric sensory representations associated with the lifeforms in questions (say ITs) could induce the interaction between ionosphere and biomatter and make also the plasma leakage possible. These magnetic bodies would be there all the time and this conforms with the finding that alterations to crop stem below head must have occurred long before the crop formation emerged.

3.2 Supracurrents as a mechanism of the charge transfer between ionosphere and the surface of Earth

The flow of charged particles between ionosphere and Earth requires new physics and TGD provides it. The ions from ionosphere could flow as supra currents along the magnetic tubes of the magnetic body and vice versa: no lightning nor strong electric fields are needed. What is needed is a mechanism allowing the leakage of the ions from atomic space-time sheets to the magnetic flux tubes where they become superconducting.

The ions flowing along magnetic body to Earth would leak to the atomic space-time sheets along the bridges generated by microwaves when they meet soil and the crops. Of course, the process might occur for positive ions in the reverse direction from the soil to the ionosphere. Heating would occur at atomic space-time sheets and would be due to the energy dissipated by the originally superconducting ions. The negative ions are indeed highly energetic since they have accelerated in the electric field along the magnetic flux tubes coming from the ionosphere: the energies are of order $10 - 10^3$ MeV if ions travel 100 km in Earth's electric field with strength in range $1 - 100$ V/cm.

In case of electron this means relativistic velocities. For a negative ion with mass number A the final velocity would be in the range $(.1 - 1) \times 1/\sqrt{A} \times c$. For iron ($A = 56$ this would give the range $(.01 - .13)c$. The meteoric iron might enter in ionic form, get heated to a high temperature at atomic space-time sheets, and molten iron would form the iron glaze while cooling. Also semimolten negatively charged particles of iron might flow along the magnetic flux tubes. If magnetic field strength is that for Earth's magnetic field carrying single flux quantum, the sizes of these particles could be in micron range. For small degrees of ionization the velocities of micron sized iron particles (containing roughly 10^{12} iron nuclei) would be in the range $3 - 30$ meters per second.

Magnetic flux tubes could also allow also a current of iron particles from the interior of Earth. TGD suggests that the recently found 'inner-inner' core of Earth [19] consisting of iron in magnetized solid state (see the chapter "Crop circles and life at parallel space-time sheets" of [16]). The magnetized iron could originate from the region, which is above the 'inner-inner' core and in magnetic spin glass state. There is however a correlation with the meteoric showers so that the magnetized iron should at least partially originate from the ionosphere.

3.3 Do plasmoids generate the microwaves inducing the bridges connecting atomic space-time sheets to the magnetic flux tubes?

Bridges connecting atomic space-time sheets of crops and soil to the magnetic flux tubes should be the key control mechanism for the flow of the charged particles between Earth's surface and ionosphere. Microwaves are the mechanism generating this kind of bridges in living matter and should be at work also now. There are several mechanisms generating microwaves.

a) The rotational transitions of water molecules and their clusters generate microwaves. Also amino-acid conformational transitions do this. Tectonic activity could also generate microwave beams.

b) Microwaves make possible the flow of ions from magnetic flux tubes to atomic space-time sheets and back to the magnetic flux tubes and induce the self-organization of plasmoids. plasmoids can be thus seen as primitive life forms 'eating' microwave radiation. Plasma patterns are known to involve microwaves so that they seem to be able to some degree to generate their 'food' themselves. The microwaves are believed to be generated by electrons rotating around magnetic flux lines. If microwaves are generated by electronic cyclotron transitions, the strength of the magnetic field should be of order $.2$ Tesla inside the spiralling flux tubes inside which electrons flow. This corresponds to the p-adic length scale $L(k = 157) = 80$ nm, the p-adic length scale next to the cell membrane

length scale ($k = 151$). The zero point kinetic energy liberated when ions drop from $k = 151$ space-time sheet to larger space-time sheet corresponds also to microwave range.

c) Plasma balls (BOLs) are often seen around crop formations. This suggests that plasma balls or structures formed by them generating microwave radiation could initiate the flux of supra currents. In TGD framework plasmoids represent intelligent life forms serving as messengers and quantum entangling mediums of higher life forms. If so, the detailed structure of crop formation is dictated by the purposeful activity of the plasmoid like lifeforms, and magnetic flux tube structure would provide only the general constraints such as fixing the size scale. The plasmoid like structure would be naturally of the size of order microwave wavelength and about 5-10 cm according to visual observations. The electrons associated with these plasmoids would come from the soil which is known to be negatively charged in the areas of crop circle formations.

d) Tectonic activity could feed energy to the light balls. Many crop formations are known to contain small glass balls of average radius r of 10-30 micrometers consisting of SiO_2 , that is quartz [22]. Quartz crystals, being piezoelectrics, amplify a wide range of em waves, also microwaves. parameterizing the velocity of sounds waves in quarts as $v = x$ km/s, one has for the frequency amplified by these glassballs $f \sim v/r$, which is in the range $.16 \times x - .5 \times x$ GHz, $x \sim 2 - 3$. This supports the hypothesis that tectonic activity feeds energy to the plasmoid like life forms. Si ions or quartz could flow along magnetic flux tubes from the spot of the tectonic activity to the plasmoid, and become heated to a high temperature, when entering to the atomic space-time sheets and colliding with oxygen atoms of the atmosphere. This would give glass balls as a result. Alternatively, the glass balls could enter to Earth's surface from Earth's interior along magnetic flux tubes.

e) In TGD framework coherent photons in microwave range could be also generated by microwave topological field quanta (MEs) in the central regions of crop formations. Microwave MEs could be naturally associated with plasmoids and amplify the microwaves generated by electrons associated with magnetic structure defined by the plasmon. The model for the sensory representations at magnetic body and magnetosphere predicts the presence of MEs and even plant systems could give to magnetospheric sensory representations. For microwaves in the range $.1 - 3$ GHz the wavelengths are in the range of $3 - .1$ meters which is indeed the size scale of the crop formations. The lower limit corresponds to the size of BOLs and the simplest hypothesis is that the microwave radiation from BOLs is responsible for the downing of the crops by causing the softening the growth nodes. Just by passing, it should be noticed that the 2.7 K cosmic microwave background corresponds to a wavelength of about 5 cm: one cannot exclude the possibility that the cosmic microwave background might have some biological significance.

f) As already explained, some animals tend to avoid the crop formations and some humans experience altered states of consciousness in their vicinity, in particular sense of presence. If crop formation involves the presence of a conscious magnetic body, these experiences could be understood to result from the telepathic sharing of mental images by quantum entanglement perhaps mediated by plasmoids playing the role of a medium as in the model of UFO experiences. This view is consistent with the idea that crop circles are messages of magnetospheric conscious entities to human kind about their existence.

3.4 What determines the geometry of the crop formations?

The geometry of crop formations should be partially determined by the intentional action of microwave sized plasmoid like life forms (BOLs) and constrained by the geometry of the magnetic flux tube structure connecting the crop field to the magnetosphere. If plasmoids act as intelligent messengers quantum en-

tangled with higher level life forms, they do only the hard job of building the microwave bridges at the desired points of the existing magnetic flux tubes structures. This would mean that the crop formation could be build gradually and even refined in the course of time as the appearance of BOLs indeed suggests. This option is the most plausible one, and suggests that crop formations are an attempt of a conscious magnetospheric (with Earth's interior included) intelligence to tell about its existence.

3.4.1 What is the mechanism causing the crop formations?

One can imagine three different but not completely mutually exclusive mechanisms responsible for the build-up of the crop formation.

a) The mechanical explanation for the formation of crop circle is in terms of a plasma vortex. The swirling air containing the ions would cause the downing much like ordinary wind. A model of vortex with rigid body rotation in core region and 'irrotational' rotation outside the core region with velocity behaving as 1/distance has been discussed in [2, 17]. Downing occurs inside the core region. The model allows also the formation of narrow ridges in the interior of flattened regions. Two plasma vortices with opposite directions generate strongly reduced pressure in the region between them and this raises the crops up in this region. This mechanism makes sense in the proposed model with small plasmoids and conforms with the observation of the light balls.

b) The stems of crops are charged after the emergence of the formation and the amount of charge and the bending of the crop correlate. On the other hand, the expansion of growth nodes involving generation of expulsion cavities causes the softening of the growth nodes and makes bending possible. The mere flow of a supra current to the growth node causes the bending and bending could involve domino mechanism. The choice of the initial direction of bending could be fixed by some external perturbation induced by the plasmoid like life form, perhaps the vortical flow of ions associated with plasmoids.

c) The direction of the bending could be determined by the intentional action of the BOLs. For centuries it is known that plasma discharge in air causes also a flow of ordinary air known as corona wind [23]. Corona wind is believed to be caused by the scattering of plasma ions with the neutral atoms of air. Plasmoid like lifeforms could be able to control the direction of the corona wind.

3.4.2 Estimates for the size scales associated with the crop formations

It is assumed that the motion along magnetic flux tubes occurs adiabatically in the sense that the spiral orbit at a given moment has the radius determined by the values of the velocity component transversal to the magnetic field and of the magnetic field at corresponding height. A further approximation, expected to hold when the magnetic field is strong enough, is that the velocity vector is orthogonal to the magnetic field. Using these assumptions, one obtains an estimate for the radius of the ionic orbit at the surface of Earth or at ionosphere.

For a charged particle of mass m and charge q , one has

$$r = \frac{v}{\omega} \quad , \quad \omega = \frac{qB}{\gamma m} \quad , \quad \gamma = 1/\sqrt{1 - \frac{v^2}{c^2}} \quad . \quad (1)$$

Here v denotes the transversal velocity of the charged particle approximated with total velocity, ω the cyclotron frequency in magnetic field B .

One can solve the differential equation for the motion

$$\frac{d(\gamma v)}{dt} = \frac{qE}{m} \quad (2)$$

of a charged particle of charge q in a constant electric field. This gives

$$v = \frac{\sqrt{(x+1)^2 - 1}}{x+1}, \quad x = \frac{qV}{m}. \quad (3)$$

Here V denotes the potential difference between ionosphere and Earth.

From this one obtains for the radius r of the orbit the expression

$$r = \sqrt{(x+1)^2 - 1} \times \frac{m}{qB}. \quad (4)$$

1. Electron

For electron the value of x is in the range $10 - 10^3$ and one has in a reasonable approximation

$$r_e \simeq x \times \frac{m_e}{qB}. \quad (5)$$

The magnetic field strength of $B_0 = .5$ Tesla at flux tubes at the surface of Earth is suggested by the requirement that electrons generate microwave radiation as cyclotron radiation at about frequency 6 GHz and plasmoids have size about 5 cm corresponding to the wavelength of this radiation. The radius of the orbit varies in the range .5-50 meters. Due to the negative charge density of the soil and the minimum density of electronic charge in ionosphere during sunspot maxima, one expects that x corresponds to its lower limit. This means that the radius of the orbit is about .5 meters. This corresponds to the diameter of the smaller structures associated with the magnetic material. It would seem that the magnetic material should have been attached to the electronic magnetic flux tubes entering from the ionosphere.

The identification of the space-time sheet carrying the magnetic field depends on whether Earth's magnetic field correspond to the p-adic length scale $L(k)$, $k = 167$ or $k = 169$ (the favored value of k). For $k = 167$ scaling argument implies that $k = 151$ corresponds to a field of about 3.2 Tesla and larger than .5 Tesla: electronic cyclotron frequency is 38.4 GHz ($\lambda = .8$ cm) and in the microwave range but above that for microwave hearing. For $k = 169$, the value of the magnetic field at $k = 157$ space-time sheets is .2 Tesla: electronic cyclotron frequency is 2.4 GHz ($\lambda = 12.5$ cm) and corresponds to the upper limit for frequencies involved with the microwave hearing and sizes of the observed light balls. If soil is negative charged, the potential difference tends to decrease so that $B = .2$ Tesla allows orbits with radii .5 m. This argument favors $k = 157$. One must be not however draw too hasty conclusions. The zero point kinetic energies of proton and ions at $k = 151$ space-time sheet are in microwave range: $\lambda = 3.9 \times A$ cm, where A is atomic mass number, and the dropping of ions from $k = 151$ space-time sheet could also induce the self-organization and at least be part of it. Note that life at parallel space-time sheet, say $k = 151$, should involve breaking of superconductivity at this space-time sheet.

2. Proton

In the non-relativistic limit one has

$$r = \sqrt{2x} \times \frac{Am_p}{qB} = \sqrt{2A} \times \frac{\sqrt{qVm_p}}{qB}. \quad (6)$$

For proton the value of $x = eV/m_p$ varies from $x = 5 \times 10^{-3}$ to $x = .5$ and non-relativistic approximation holds true in the lower limit. This gives $r \simeq 10$ meters in the magnetic field of .5 Tesla. Protons from soil and plants could flow along these magnetic flux tubes to the ionosphere and the size of the orbit in the ionosphere would have this size. This gives an estimate for the size scale of the possible protonic sensory representations in the ionosphere.

3. Negatively charged light ions

For negatively charged ion of mass number $A = 4$ (Helium) from ionosphere the size of the orbit would be about 20 meters. For doubly charge He ions the size would be about 14 meters. Negatively charged ions from the ionosphere would give rise to structures of increasing sizes with radii proportional to $\sqrt{A/q}$. This could give rise to fractal structures. The interpretation suggesting itself is that the structures involved are duals of the magnetospheric sensory representations: magnetosphere represents and crop field plays the role of the sensory canvas!

4. Iron ions and particles

Quite generally, one has for the radius r of the non-relativistic spiral orbit at the surface of Earth

$$r = \sqrt{\frac{1}{n\gamma}} \times \sqrt{\frac{A}{A_{Fe}}} \times \sqrt{\frac{E_{Earth}}{E_{Earth,min}}} \times \frac{B_0}{B} \times r_{Fe} ,$$

$$A_{Fe} = 56 , \quad E_{E,min} = 1 \text{ V/cm} , \quad B_0 = .5 \text{ Tesla} , \quad r_{Fe} = 75 \text{ m} . \quad (7)$$

Here the mass of the negatively charged particle is $m = Am_p$, A is mass number and m_p proton mass, the charge is $q = -ne$. The radius varies for a singly charged iron ions in the range 75 – 750 meters and this scale range indeed contains the size range for the formations. The fact the actual value of the transversal velocity is smaller than the estimate, lowers the estimate for the value of r somewhat. This would suggest that the radii of the orbits associated with negatively charged iron ions determine the size scale of the whole formation and that the iron particles end up to the electronic magnetic flux tubes by a reconnection type process in which the magnetic flux tubes containing iron and electrons touch each other.

The assumption that iron is in the form of macro particles does not affect the result considerably if one assumes that the density of iron ions is constant inside the particle. If the ionization is concentrated at the surface of the iron particle, the radius r is predicted to increase a factor of order $\sim \sqrt{d/a}$, where d and a denote the radius of the iron particle and atomic radius respectively. This gives a factor of 100 for a micron sized iron particle, which is obviously too large.

4 Chilbolton and Crabwood messages

In TGD universe parallel spacetime sheet are an obvious candidate for the world where the life forms responsible for crop formations and Chilbolton and Crabwood messages live. Since these spacetime sheets are very cold, these life-forms could control material in temperature which is quite too hot for ordinary life forms. Since life loves boundary layers, the mantle-core and core-inner core boundary layers are especially promising candidates for the seats of these life-forms.

These life-forms could appear in several varieties. They could be magnetoterrestrials (even in the interior of the planets involved). Also plasmoidlike life-forms for which magnetic field strength would be around .2 Tesla from the requirement that electronic cyclotron radiation generates microwaves serving as the 'food' of the plasmoids, are possible. Balls of light (BOLs) of microwave wavelength size have been indeed observed in the areas of crop formations. Plasmoid life forms could also serve as quantum messengers of these civilizations. This field strength is also favoured by the explanation of the typical sizes of the crop formations. Note that solar convective zone carries magnetic fields of this strength: could the smaller size for Sun suggest that solar convective zone

is populated by the plasmoid like life-forms and that the civilization itself is something more complex.

4.1 Chilbolton message

The crop formation in Chilbolton [6, 7] which appeared in August 2001 contained a bit image which had the format of the message sent from Arecibo for the first time 27 years ago. The fact that the radiowaves from Arecibo cannot have reached their destiny suggests that the message comes from nearby space. The use of the format of Arecibo message would be an ingenious manner to tell that this is indeed the case. This is supported by the fact that the number of planets is same as in our solar system. The use of Arecibo format would be an ingenious manner to tell that the senders are from parallel spacetime sheets.

Arecibo message represented a sequence of $N = 23 \times 73$ bits. The fact that a product of primes is in question was meant to tell to the receiver that the bits represent two-dimensional figure consisting of a graphic array consisting of 73 rows of 23 columns each. Each element of this matrix is either on (1) or off (0). The bits were represented as shifts of the signal between two frequencies in the 2.38 GHz microwave band. The beam was aimed at globular star cluster M13, some 22,800 light years away and consisting of some 300,000 stars in the constellation of Hercules.

Arecibo message represented basic information about human life in graphic form: which planet we inhabit in our planet system, what our bodies look like and how tall we are, what is the human population of Earth, what our double DNA strand looks like and what is its amount, and what how did the instrument used to send the message look like.

The differences between Arecibo message and Chilbolton message are analyzed in [6, 7].

a) The solar system contains same number of planets but Sun is depicted to be somewhat smaller. Besides Earth also Mars ja Jupiter are told to be inhabited. The most natural interpretation is that ITs (intraterrestrials) living at mantle-core and core-inner core boundary layers of Earth, Mars and Jupiter are in indeed in question. Liquid or liquid-crystal glass *resp.* iron has replaced water as a medium controlled by these life-forms. The DNA and amino-acids of these life-forms reside at non—atomic spacetime sheets which are cold.

This identification also explains why the civilization in question has been able to receive Arecibo message. Arecibo message is sent at microwave wavelengths, and microwaves are amplified by quartz crystals appearing in Earth's crust and correspond to just those wavelengths which induce supra-currents between different spacetime sheets. The Chilbolton message also implicitly tells that the populations at the three planets are aware of each other and might be able to communicate. Also this supports the view that some of these life forms are at higher evolutionary level than we.

An objection against this interpretation is that magnetosphere is crucial for life and since the magnetic field of Mars is very weak, there cannot be any life in Mars. This could indeed be interpreted as being the one reason for why ordinary life has disappeared from Mars: magnetosphere has served as a magnetoimmune system preventing the leakage of extra-Martian life-forms to the magnetosphere. Of course, the magnetic field of Mars could be so weak that we have not yet detected it. It is also possible that the magnetosphere of Mars is confined inside the interior of Mars and that Mars is populated only by the simple plasmoid like life forms associated with the magnetic flux tubes corresponding to magnetic fields of strength of order .2 Tesla. They could reside at the boundary of the Martian counterpart of the 'inner-inner' core of Earth having radius of order 300 km (a core of roughly the same size is known to be possessed also by Moon).

b) Besides the elements necessary for our life also silicon (very similar to carbon) is mentioned as an element appearing in DNA. The appearance of silicon in DNA would be natural at mantle-core boundary. The analysis of Crabwood

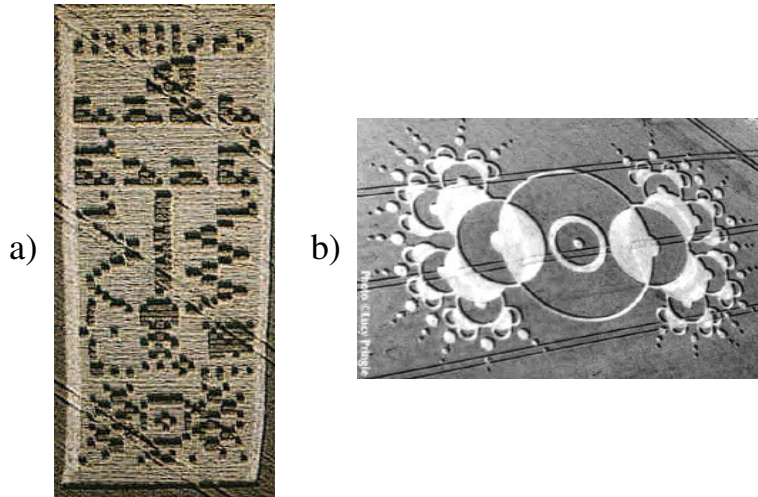


Figure 1: The counterpart of the Arecibo antenna in Chilbolton message which corresponds to earlier crop formation brings in mind Earth's magnetosphere and suggests the presence of intraterrestrial life.

message provides further support for this interpretation.

c) The strands of DNA are depicted as different. The trivial interpretation as asymmetric DNA does not seem plausible. The following two mutually consistent interpretations are more plausible.

i) IT identification suggests that there are two different life-forms with different genomes corresponding to mantle-core and core-inner core boundaries.

ii) The arguments below suggest that the second strand could also correspond to a rare variant of DNA in which two triplets of DNA correspond to a full 2π twist. In our DNA 10 DNA triplets are required for a full twist containing an integer number of DNAs (this corresponds to the length of cell membrane). This simpler genome defined by 16 DNA doublets replacing 64 DNA triplets could be associated with the plasmoid like life-forms serving as messengers.

d) The amount of DNA is somewhat higher than in human genome.

e) The population of these aliens is much higher than that of humans: 21.3 billions. The typical size of aliens is about one meter.

f) Arecibo message depicts also the radio telescope used to send the message. In Chilbolton message the radio telescope is replaced by a crop formation of year 2000 which had appeared in the same field (see figure below) Rather remarkably, this fractal structure brings in mind Earth and its magnetosphere. The interpretation consistent with the overall view is that the construction of this and other crop circles indeed involves entire magnetosphere and that intraterrestrial life forms are involved with the sending of the message. One can also ask whether crop formations could quite generally be interpreted as pictorial representations of the alien technology?

4.1.1 Strange silicon is associated with crop formations

If silicon is indeed necessary for the life-forms responsible for the Chilbolton message, it should appear at the spacetime sheets in question and might be transferred to our spacetime sheets when crop circles are formed. Silicon has been indeed found. Here I represent citation from bio-logist Dr. Levengood:

Human genetics has been altered by ancient space travelers, then it would be very strange if human genetic makeup were not very similar to that of our parent ETs. There is something about Silicon that is being conveyed in this message. It is not

clear at all that Silicon must play a role in the DNA. But it is clear that it plays some important role. Dr. William Levengood, who has pioneered the bio-chemical assessment techniques that differentiate real crop formations from hoaxes, has found anomalous deposits of Silicon, silicone, and silicates in real crop formations. In one such formation, a layer of extremely pure, micro-crystalline white silicon was found in an 8"-wide layer 4" under all the affected plants, with no visible soil disturbance to show how the hoaxers put it there. The Silicon was of a purity and crystalline structure that was previously unknown. Furthermore, plants that grew in soil containing this white powdery silicon displayed a 300 % to 400% growth in bio-mass, compared to control plants. The seeds taken from plants that grew in the real formations looked fine, but showed a 40% decrease in seed weight and were dry inside. But, when planted, they germinated and grew tremendously fast, with a deep, lush green color and robust health, compared to control plants. There is something going on with Silicon, and true scientists would respect these clues and examine the real data instead of concluding that it cannot be, therefore it isn't. That is just bad science.

4.1.2 Evidence for strange RNA

Chilbolton message could tell that two types of DNAs exist and that for the second DNA 64 DNA triplets have been replaced by 16 doublets. This idea leads to a successful model of genetic code. The simpler DNA would be naturally associated with the plasmoid like life-forms able to serve as messengers.

$k = 157$ is the spacetime sheet carrying the magnetic field of about .2 Tesla guaranteeing that electronic cyclotron transitions generate microwaves serving as 'food' of plasmoidic life forms. In the solar magnetosphere magnetic fields of this order of magnitude are common (note that there can be very cold even at the magnetic flux tubes of the convective zone!). Thus Sun might thus be an ideal seat for plasmoid like life-forms residing at the magnetic flux tubes. Sun was represented to be smaller than in the Arecibo message: perhaps this was a hint. The fact that the magnetic field of Earth has been weakening continually might explain why plasmoid like life-forms are appearing into the Earth's magnetosphere. The fact that Sun's convective core is an ideal source of plasmoids, would explain why also UFO observations correlate with the sunspot activity which correlates with the flow of plasmoids from Sun.

It has been quite recently discovered that Earth's interior contains previously unidentified structure with radius of about $r \sim 300$ km. If the Earth's magnetic field behaves like dipole field down to these distances, the value of the magnetic field is about .4 Tesla at this distance, and happens to correspond to the field value relevant for the plasmoid like life forms. The many-sheeted model of magnetospheric sensory representations implies that also the magnetic fields at the spacetime sheets corresponding to various structures in the Earth's interior are parts of the conscious magnetosphere. In this region the magnetic field would result via spontaneous magnetization having as a seed the magnetic field created by the spontaneous magnetization of a super-conductor consisting of $J = 2$ Cooper pairs.

If these plasmoid like life-forms serve as messengers and if abduction experiences are real, then physical signatures for these encounters should exist. In particular, the immune system of the persons who have suffered abduction should be activated against the exotic form of RNA. There is evidence for this. Red Setter, a research bio-logist says:

The central part of the Chilbolton pictogram shows that a DNA double helix as found on Earth, with 10 base pairs per turn, has been replaced on one side by a novel single-stranded helix with just 6 bases per turn. I had to work hard for several days, to discover that the single-stranded helix with 6 bases per turn refers to 2', 5'-linked RNA or DNA, as opposed to the normal 3', 5' variety. This is known to hardly any molecular bio-logist, and I found out only by making an accurate model. ...There is no other plausible way of constructing a 6-fold helix as indicated. [published research] shows that 2', 5'-linked RNA will form double helices, but prefers to remain single stranded. [Other research] explores the use of 2', 5' RNA as an antiviral drug; it

seems we have been exposed to such strange molecules in the past, and have evolved an interferon-RNAase L system against them.

Recall that origin-of-life experiments in the 1980s by Leslie Orgel, found that RNA would often polymerize into two different forms, namely 2', 5' versus 3', 5'; and it was a mystery to chemical evolutionists why 3', 5' was favored on Earth. Note that many abductees remain ill with chronic fatigue, which generally includes a high level of RNAase L; just as if their immune systems have been activated by contact with 2', 5' RNA. The clear implication is that 2', 5' RNA may represent an alternative system of genetic coding to 3', 5' RNA or DNA as found on Earth; and that the makers of the Chilbolton pictogram wished us to understand that fact. Whether a secret band of elite scientists could hoax such a result seems doubtful; since 2', 5' nucleic acids are mentioned rarely in the literature, and nowhere does it say that they form a single-stranded helix with 6 bases per turn. That I found only recently, by painstakingly constructing an accurate model.

4.2 Crabwood crop formation as a representation of DNA-amino-acid codes?

For year and day later after the appearance of the Chilbolton formation a new crop circle was found in Crabwood [8, 9]. I am in debt for Martin Keitel for learning about this fascinating formation in a local UFO meeting and also for interesting discussions and for concrete help.

4.2.1 The message

Crabwood message consists of two parts. An alien picture and a picture representing spiral like bit sequence starting from the center of the picture and proceeding counterclockwise. It has been proposed [8, 9] that the message is coded using 9-bit code and that 8-bit portions obey ASCII code. With this assumption the message reads as

Beware the bearers of FALSE gifts&their BROKEN PROMISES.Much PAIN but still time.EELI!UVE.There is GOOD out there.We OPpose DECEPTION. Conduit CLOSING

Obviously there are one or two incomprehensible words involved (EELI!UVE). There are also two variants of the message in the net. OPpose appears at Paul Vigay's homepage [8] and Oppose at at Martin Keitel's homepage [9]. In the following only OPpose option is considered.

One could consider the possibility that the message has much deeper layer than the somewhat oraclelike statement in ASCII code, and that the presence of the little inconsistency might be intended to make clear that a deeper level is involved. What these aliens would like to communicate is something very essential about themselves as a life form. The image of an alien accompanying the bit sequence indeed suggests this. This something very essential could obviously include the code for translating ordinary DNA triplets to amino-acids. Perhaps also the code for translating the exotic DNA doublets to the analogs of amino-acids. These analogs could be even electromagnetic waves. There could be also other codes: just at the time when the Crabwood message had arrived I developed entire hierarchy of cognitive codes based on Mersenne primes and regular polygons constructible using only compass and ruler (see the chapter "p-Adic physics as physics of cognition and intention" of [15]).

The first guess is that the message should be represented by some universal code. The appearance of $3 \times 3 = 9$ -bit codewords decomposing naturally to 3 sequences of 3-bits suggests that a cognitive code consistent with genetic code might be involved. This guess was very useful in that it led to the identification of the genetic code of exotic DNA and the decomposition of 3 3-bit portions also suggests immediately that information about DNA is in question.

It however turned out that ASCII code is the proper manner to interpret the message, ninth bit serves as a separation sign only. The interpretation

relies on extremely general aspects of the ASCII code: capital and small letters correspond to amino-acids and capital and small forms of a given letter denote for the same amino-acid. Control signs denote the amino-acidic counterparts for the code associated with the exotic DNA. The ordering of the symbols does not matter. One could also use different kinds of symbols: only the numbers of various kinds of symbols telling how many codewords are mapped to a particular amino-acid (or whatever counterpart of it) matter.

4.2.2 The degeneracies associated with capital letter code

There are 20 different capital letters with total number of 56: this is consistent with the genetic code and implies that stopping sign is coded by 8 DNAs. There is no need to tell the number of DNA triplets coded to stopping sign because it can be deduced from the known number 64 for DNA triplets.

The message reads as follows

Beware the bearers of FALSE gifts&their BROKEN PROMISES.Much PAIN but still time.EELI!UVE.There is GOOD out there.We OPpose DECEPTION. Conduit CLOSING

The numbers for the appearance of various capital letters are given by the following table.

A	B	C	D	E	F	G	I	K	L
2	2	3	2	8	1	2	5	1	3
M	N	O	P	R	S	T	U	V	W
2	4	7	4	2	4	2	1	1	1

Table 1: Numbers of capital letters appearing in the Crabwood message. The number of blancos is correspondingly 10.

Note that the less important amino-acids at the end of the table correspond to largest ASCII numbers. The largest maxima E, I and O could correspond to the 3 amino-acids coded by 6 DNAs in our genome: these amino-acids are leusine, serine and arginine.

Let us denote by n the number of DNAs coding a given amino-acid: now it corresponds to the number of appearances of a given capital letter in the message. The number $N(n)$ of amino-acids corresponding to the same value of n gives overall view about genetic code and about the importance of the amino-acid in question. These numbers are represented in the following table:

n	1	2	3	4	5	6	7	9
N(alien)	5	7	3	3(2)	1	0	1	1
N(us)	2	9	2	5	0	3	0	0

Table 2: A comparison of number $N(n)$ telling the number of proteins coded by n DNAs for capital letter code and our genetic code.

The lowest row represents the numbers of n-plets for our genetic code. What looks strange is that as many as 8 DNAs are coding the same amino-acid and that stopping sign is also coded by 7 codons.

4.2.3 The degeneracies of the code associated with small letters plus special signs

The numbers of the small letters, of blancos besides those associated with the capital letter code, of \es (ASCII number is larger than 64) in the message are represented by first four rows of the table 3 below. The last rows represent the numbers of special signs with ASCII number smaller than 64.

a	b	c	d	e	f	g	h	i	l	m
2	2	1	1	13	2	1	5	6	2	1
n	o	p	r	s	t	u	w	stop	\	
1	4	1	6	5	9	4	1	11	1	
!	&	.								
1	1	5								

Table 3: The numbers n of small letters and special signs appearing in Crabwood message.

Since the aliens seem to be more intelligent than us, the idea about higher genetic expressive power seems natural. Also the appearance of two different strands in the Chilbolton message suggests two different genetic codes and there is no reason to assume that these codes would have a same number of amino-acid like molecules. Thus the hypothesis that both small letters and special signs define the code is favoured. A discussion of other options can be found in the chapter "Crop circles and life at parallel space-time sheet" of [16].

The observation that the total number of small letters plus special signs is $24 = 12 \times 2$ suggests that the code is obtained by a modification of ordinary genetic code by adding 3 new 'amino-acids' and yielding the additional expressive power. 2×10 decomposition for real amino-acids could have expanded to $2 \times (10 + 2)$ for generalized amino-acids with stopping sign included now.

5 Where do aliens live?

Chilbolton message tells that the aliens live at Earth, Mars and Jupiter and perhaps even in Sun. The Sun is smaller than in Arecibo message, which might mean that the aliens live in below the corona, perhaps at the magnetic flux tubes of the convective zone carrying magnetic fields of order .2 Tesla for which electronic cyclotron radiation is at microwave range. The question is where in Earth's magnetosphere aliens could be hiding. The Freudian answer is that since they are not visible they must lurk in the cellar, that is underground. One can indeed build a vision about alien life based on this idea and consistent with the hints provided by the crop formations.

5.1 At what space-time sheet do the aliens live?

The number of code words in Crabwood message is $k = 151$. $k = 151$ is the prime coding for the p-adic length scale corresponding to the cell membrane thickness. $k = 151$ is also associated with the chromosome's helical structure. There is actually a hierarchy of helical structures and $k = 151$ corresponds to the lowest level of the hierarchy.

a) The first possibility is that $k = 151$ tells that the DNA and amino-acids of the lifeforms in question are at $k = 151$ space-time sheets rather than at atomic space-time sheets. This would make sense if atomic space-time sheets are hot. This could be the case if these lifeforms are ITs. This would also mean that $k = 151$ refers to the space-time sheet at which superconductivity is broken. For our life it would be $k = 137$ space-time sheet.

b) Second, and a more realistic, possibility is that $k = 131$ space-time sheets with size which is $1/8$ of the size of the atomic space-time sheets are also present and correspond to the hot space-time sheets. Alien DNA and aminoacids would reside at atomic space-time sheets at a temperature which might be near to the room temperature. The assumption that the size of the space-time sheet corresponds to the thermal de Broglie wavelength for the typical particles involved, is consistent with this assumption, as will be found later.

Option b) suggests a different interpretation for $k = 151$. This length scale corresponds to the cell membrane thickness and a minimum length for DNA double helix such that an integer multiple of full turns results. This might be

crucial for the establishment of the genetic code based on DNA triplets. Since the velocity parameter given by the scaling law of homeopathy (see the chapter "Homeopathy in many-sheeted space-time") is $v \simeq 6$ m/s for $k = 151$ and equals to the phase velocity of alpha waves, this space-time sheet must be important for our life too. Alpha band in EEG, in particular Schumann resonance, might relate to communications between life forms at $k = 137$ and $k = 151$ space-time sheets. The communications with higher level lifeforms might relate with the fact that the alpha band in EEG seems to be associated with creativity. If the aliens assume that we know about p-adic physics, this number might be interpreted as a message telling that also these lifeforms have cell membranes and all that is made possible by the presence of $k = 151$ space-time sheet.

5.2 Are aliens intra-terrestrials (ITs)

The following arguments lead to the hypothesis that aliens are actually ITs.

a) Boundary layers are ideal places for self-organization since they contain gradients which give rise to energy currents feeding self-organization. Liquid state is certainly crucial for life since this makes it possible quantum control the atomic space-time sheets very effectively. Ordinary life relies actually on the liquid crystal property of water which suggests that the same is case quite generally. Thus those parts of the planetary core which correspond to boundary regions between solid and liquid phases, should be ideal places for IT life forms to flourish, and it is actually difficult to imagine any other state of matter making possible life able to control the surrounding world effectively. This picture is consistent with and would realize concretely the general vision about magnetosphere as a living system. In Earth's interior the mantle-core and core-inner core boundaries are especially interesting in this respect since these boundaries represent solid liquid boundaries. Thus intra-terrestrial (IT) rather than extraterrestrial (ET) lifeforms would be in question.

b) According to the Chilbolton message, also silicon is an element involved with the alien DNA. Magnetized iron and SiO_2 (glass, quartz) balls of radius about 10-30 micrometers are found from crop circles, and these elements must have been solidified from molten state in situ. Molten state for quartz and iron indeed suggest that it is planetary interiors, where these lifeforms reside. Molten glass would be associated with the mantle-core boundary and molten iron with the core-inner core boundary. The small size of Sun could thus also mean that these lifeforms receive much less solar radiation than us.

c) A further possibly important aspect is the transparency of the liquid state implying that visible light propagates over long distances without absorption. This might be absolutely essential for the possibility of visible photons to propagate through sufficiently long distances. For terrestrial life the photonic MEs propagating along radio frequency MEs corresponding to kHz frequencies are key element of bio-control besides the microwave MEs propagating along ELF MEs. If the transparency depends on atomic properties only, also quartz is transparent in liquid state, and thus an optimal candidate for a medium whose behavior is quantum controlled from larger space-time sheets.

5.3 Doesn't the presence of DNA and proteins require space-time sheets at about room temperature?

Ordinary life is possible only in a very narrow temperature range. If DNA and proteins are crucial for the biocontrol of IT life, space-time sheets at a temperature around room temperature should be present also in the Earth's interior. The most natural identification for these space-time sheets would be as $k = 137$ space-time sheets. This would suggest that the hot matter (liquid quartz or iron) resides at the $k = 131$ space-time sheets.

This guess is supported by the following argument. A rough estimate for the typical size of the space-time sheet for a system consisting of particles of

mass $m = Am_p$, A mass number, at temperature T is obtained as the thermal de-Broglie wavelength $L = 1/\sqrt{3Am_pT}$. For water with $A = A_w = 18$ at room temperature one has $L \simeq .3$ Angstroms with so that $k = 137$ is a reasonable identification for the p-adic prime characterizing the atomic space-time sheet in this case ($L(137) = .78$ Angstroms).

T increases by an order of magnitude from $T_0 = 330$ K to $T = 3700$ K at the mantle-core boundary, and to $T = 4300$ K at core-inner core boundary. The relevant p-adic length scale L is predicted to decrease by a factor of order $x = \sqrt{A_w/A} \times \sqrt{T_0/T}$. This factor should be near to the ratio $L(131)/L(137) = 1/8$. For $A(Fe) = 56$ and $T = 4300$ K one obtains $x \simeq 6.4 < 8$. For $A(SiO_2) = 60$ and $T = 3700$ K one obtains $x \simeq 6.1 < 8$. The estimates look rather sensical do that it might make sense to assume that the hot atomic spacetime sheets correspond to $k = 131$ whereas the $k = 137$ spacetime sheets would contain DNA and proteins and perhaps even water at about room temperature.

5.4 Structure of the Earth's interior and IT life

Combining the above described general ideas with the knowledge about Earth interior, one ends up with a more detailed picture.

a) Earth's interior decomposes into a relatively thin crust; a plastic mantle consisting mainly of Si, O, Mg, Fe, and Al; liquid core containing mainly Fe and S; and the inner core consisting mainly of solid Fe. There are thus two solid-liquid boundary regions. The upper boundary region could contain at least glass in liquid crystal form and the lower boundary region Fe in liquid crystal form. Remarkably, it is just glass and Fe solidified in situ, which are found from crop circles, and there Crabwood message indeed contains two different genetic codes. Also silicon-based crystal structures not encountered in Nature are found from crop formations: the interpretation as artifacts suggests itself. The richer chemical structure of the mantle is consistent with the hypothesis that the glassy life is based on 80 DNA-23 amino-acid code whereas iron-men correspond to 64 DNA- 20 amino-acid code.

b) Theoretically, the thickness for the mantle-core layer is expected to be of order few meters. The reflection of tectonic waves from mantle-core boundary has given evidence for a rich structure at this boundary and suggests that this expectation is not quite correct [20]. Structures of thickness about 150 meters and with of several kilometers and between liquid and solid state have been identified at the top of the liquid core. One explanation is that lighter elements in the core-inner core boundary saturate and condense to solid form and being lighter than iron, raise up and form kind of puddles at the highest points of core. A more radical explanation is that these structures are artifacts built by ITs. In the mantle-core layer the velocity of tectonic waves gets ultra-low. The velocity of sound in solid phase is quite generally higher than in liquid phase: this reflects directly the fact that the approximately harmonic forces between atoms are stronger. If liquid crystal phase is present the velocity in transversal liquid directions should be low. What is fascinating that sooner or later the analysis of reflected tectonic waves could give detailed information about mantle-core boundary.

c) Quite recently it has been announced that Earth contains a previously unidentified core region with size of 300 km [19]. Assuming that the magnetic field behaves like a dipole field down to the distances of order 300 km, the electronic cyclotron frequency at this distance is 5 GHz which corresponds to the wavelength of about 6 cm, the size scale of BOLs. If the magnetization density below this distance is constant (so that the core would be like ordinary magnet), the magnetic field would be constant below this length scale.

Also some other experimental findings support this picture. It has been found that the times for of the compressional waves to travel through Earth in magnetic north-south direction and equatorial direction differ by 2-3 seconds [21]. This suggests a gigantic crystal structure with symmetry axis parallel to

magnetic field. If the join along boundaries condensate associated with atomic space-time sheets is hollow with a hole of radius 300 km, and if only $k = 151$ space-time sheet consisting of cold and magnetized iron is at this space-time sheet one can understand the crystal structure and how Earth's magnetic field results by magnetization. The estimated velocity of propagation for compressional waves in the crystal is about 3 km/s which is rather near to the 5 km/s for steel in room temperature. The appearance of a relatively small hole at the atomic space-time sheet is not so surprising since typically the field equations of TGD imply hole like singularities at given space-time sheet, and the hole could be analogous to black hole like singularity carrying inertial and gravitational masses at its boundary.

The simplest hypothesis is that the magnetic field associated with the plasmoids is the Earth's magnetic field in the core region of Earth. This would mean that some kind of life forms could reside also at the boundary layer associated with the new core. If the $k = 151$ space-time sheet is not ferromagnet above the radius $r = 300$ km, the boundary region could be in spin glass type magnetic phase and the biocontrol from magnetic flux tubes would operate on the local direction of magnetization of the magnetized regions in the boundary region. This simpler lifeform perhaps obeying doublet code might reside at the most inner boundary and be associated with the plasmonic life forms.

5.5 Where did those 223 genes pop up?

The reports of the Public Consortium about human genome in Nature, Feb 15, 2001 [24] and of Celera Genomics in Science of Feb 16th, 2001, [25] contained two big surprises.

5.5.1 Are we really so near to fruit flies?

The first astonishing discovery was that the amount of human genome differs relatively little from those of lower organisms: we have only about 30,000 genes, little more than twice the number 13,601 of genes for fruit fly. This paradoxical finding forces to think that our genome is not solely responsible for what we are and that the intronic portion of DNA (only about 1 per cent codes of human DNA codes or aminoacid sequences), is not "junk DNA", but contains important biological information and expresses it non-chemically.

In TGD Universe introns would express memes as the classical field patterns associated with MEs ("topological light rays") responsible for the basic expressions of language understood in an extremely general sense. This language includes body language and even cellular signalling, and could quite well make possible (not necessarily conscious) interspecies communications based on memes expressed by communicating species and forming a common vocabulary. All eukaryotes (cells with nuclei), even bacteria, would possess part of the vocabulary of this universal language. This language might even make possible symbolic communications between us and ITs using common memes. The memetic code word is predicted to consist of a sequence of 21 DNA triplets and carries 126 bits of information instead of 6 bits of genetic code. Of course, also genes are expressed in terms of MEs and define a lower level language.

In this framework the actual role of DNA can be understood using the computer analogy. Memes represent the program modules written using the programming language defined by the memetic code, and realized in terms of the field patterns associated with MEs. Genes represent the necessary hardware needed to realize these programs. System builds only the hardware needed, that is cell expresses only part of the genome. DNA engineering requires besides the addition of the new programs (memes, introns) also the insertion of the necessary hardware (new genes). Memes and corresponding genes should have very intimate relationship. In this conceptual framework the standard view is wrong since it identifies the build-up of a new hardware as the sole activity at

the DNA level. This would be like identifying the addition of a net card to a computer as the fundamental activity related with computers.

5.5.2 The head-scratching discovery

The "head-scratching discovery" by the public consortium, as Science termed it, came when the genome was compared with the genomes of our predecessors. It was found that human genome contains 223 genes not possessed by invertebrates. Contrary to what one might expect, these 223 genes could make an enormous difference. The reason is that this number is more than two thirds of the number of the 300 genes differentiating between humans and chimpanzees so that these genes could be the main determinant of the dramatic difference between humans and chimpanzees in standard genetics.

Of course, in TGD framework the most important differences would probably relate to the intronic portion of the DNA responsible for language. Dramatic differences between our intronic DNA that of our invertebrate and perhaps even vertebrate predecessors, in sharp conflict with the idea of continuous evolution, should be discovered.

5.5.3 Are the enigmatic genes a horizontal gene transfer from bacteria?

Biologists can explain the presence of the enigmatic genes only by a "rather recent horizontal transfer from bacteria". Here "rather recent" refers to the evolutionary time scale.

This explanation can be challenged on various grounds.

a) The simplest working hypothesis is that the transfer from bacteria is a probabilistic process. The problem is however why the horizontal transfer did not occur to the genomes of other vertebrates and invertebrates and gradually through the whole evolution. One could argue that something characteristic to the vertebrate genome should have made this process possible. In TGD framework one could imagine that the intronic portion of the vertebrate genome could have contained something which made the transfer possible: a common part of memone with the bacteria involved and making possible language based communications ("language" understood in a generalized sense) at DNA level perhaps?

b) The enigmatic genes are involved with important physiological functions. In particular, they are responsible for important neurological enzymes which stem from mitochondria having its own genome. According to my non-professional interpretation this statement means that also mitochondrial genome contains these enigmatic genes. Thus both mitochondrial and nuclear genomes would have been altered by this horizontal transfer from bacteria. Simultaneous double horizontal transfer does not however look a probable event.

c) Only 113 of the 223 enigmatic genes are widespread in bacteria: it would be easier to believe in the horizontal transfer if all of them were widespread. These 113 widely occurring genes are not encountered in invertebrates at all. As a matter fact, this finding suggests that the transfer occurred from the vertebrate genome to the bacterial one and only partially, rather than vice versa. The analysis of proteins expressed by the enigmatic genes demonstrated that out of 35 identified, only 10 had counterparts in other vertebrates. 25 of them were unique to humans. This suggests that a considerable part of the horizontal transfer has occurred relatively recently and together with associated introns might even distinguish us from chimpanzees.

5.5.4 Horizontal transfer as DNA engineering?

The objections against the horizontal transfer from bacteria force to consider seriously the possibility that the horizontal transfer represents an intentional DNA engineering, both memetic and genetic. The most important transfer

should have been to the intronic part of the DNA. The addition of memes would be like adding a new program to a computer. The addition of genes would be like adding a new hardware (say net card or data cable) required by the program to run. The comparison of the intronic portions of DNA of humans and lower vertebrates might thus lead to further "head-scratching" discoveries. The data are consistent with the assumption that genetic/memetic engineering activities have occurred in several steps during the evolution of the vertebrates although a considerable portion of the enigmatic genes and associated introns, perhaps even two thirds, have been "injected as a single dose".

The evolution of the hominides in Africa had a stagnation period of about 1.5 million years as demonstrated by the study of the ancient stone tools. Then, for about 50 thousand years ago, a sudden jump to creativity occurred. The first ornaments appeared meaning that hominides had become artists and started to express their position in the social hierarchy by clothing and ornaments. This signals about development of highly refined social structures. A general belief is that also language began to develop rapidly and made possible a cumulation of knowledge. It seems that modern human was born and started to migrate from Africa to North. Could it be that memetic engineering induced this crucial step in evolution? Could it be that Neanderthals had to leave because they were not subject to this memetic engineering? Also the emergence of the first civilizations for about 10 thousand years ago might have involved memetic engineering. The ancient Sumerian myths about Gods who came from Heaven and made us their images might be memetic fossils reflecting what occurred.

5.5.5 Who performed the (memetic and) genetic engineering?

One can imagine two identifications for the ancient genetic/memetic engineers.

a) The guess that the engineers were extra-terrestrials (ETs) is supported by ancient myths. The Sumerian and Akkadian texts found inscribed on clay tablets, in which the role of the Elohim in Genesis is performed by the Anunnaki, tell about "Those Who From Heaven to Earth Came". According to Zecharia Sitchin these myths can be seen as narratives about genetic engineering by lifeforms, which were technologically much more advanced. These myths would relate to the last step in the sequence of engineering activities.

b) The second guess, intraterrestrials (ITs), is natural if one accepts the TGD based identification of the lifeforms responsible for the art of crop formations as ITs. The term intra-planetaries (IPs) is actually more appropriate: the Chilbolton crop formation, which obeyed the same format as the Arecibo message sent to the outer space and telling about our species, suggests that the lifeforms responsible for the crop formations live in our own solar system and inhabit besides Earth also Mars and Jupiter. Taking the ancient mythologies seriously, IPs from Mars or Jupiter would be the most plausible candidates for the ancient memetic/genetic engineers.

5.5.6 Is the genetic/memetic engineering an ongoing process?

If IPs are in question, the memetic/genetic engineering by ITs or even IPs from other planets might be an ongoing process. This is consistent with the idea that also other vertebrates than humans might have been a target of genetic/memetic engineering. The following arguments, which restate what has been already said elsewhere in this chapter, support this view.

a) The seeds from crop circle formations have been reported to have better germination and growth properties, and it has been proposed that this is due to genetic and/or memetic engineering.

b) There exists a rare form of RNA for which the role of RNA triplet as the code word is taken by RNA doublet. We have in our immune system so called interferon-RNAase L system against this RNA. Does this mean that we have been in contact with this form of RNA, or even lifeforms for which this form of RNA carries genetic information? On the other hand, the model of the

genetic code inspired by the Chilbolton and Crabwood crop formations and by the symmetries of the genetic code, leads to the conclusion that RNA triplets responsible for our genetic code have resulted in a fusion of RNA doublets and RNA singlets. If this is the case, the ability of immune system to produce RNAase L would be natural.

c) Some persons who have reported abduction experience remain ill with a chronic fatigue and their immune system has been reported to contain high levels of RNAase L, as if they had been in contact with an exotic life form.

A TGD inspired identification for the primitive life form with RNA consisting of sequences of exotic RNA doublets would be as a plasmoid, plasma ball, serving as an intelligent quantum medium making possible telepathic communication with IPs by the sharing of mental images. Telepathy might be the only reasonable means of communications since a direct physical contact between ITs and us would probably be a catastrophic event. The reason is that the immune system of both ours and of ITs would be powerless against invaders obeying different genetic code. The stories about intelligently behaving light balls are indeed the basic stuff of UFO reports. Balls of light have been reported to appear also around crop formations and there is even a report about ball of light caught in an act of constructing a crop formation.

5.6 Some questions

Unpleasant questions help to clarify thoughts and to see the weak points of the thought constructs.

5.6.1 Why crop circles?

The basic goal of aliens is to get us to realize that they are there and that they are receiving information about us. The task is to wake up us from our anthropocentrism and only "miracles" could wake-up us.

Aliens could send radio waves but no one would take seriously a radio amateur telling about messages from aliens. As a matter fact, they might be trying also this: so called electronic voice phenomena (EVP) involve often radio waves ([26], see also the chapter "Quantum model of paranormal phenomena" of [15]). In some cases the senders of the messages are believed to be physically deceased persons. Very few professional scientists take EVP seriously. UFOs could be also as an attempt to tell to us about the presence of other lifeforms but academic community, which is the natural target group, has filtered UFOs from its public consciousness. By their subjective character UFO observations and encounters with aliens can be also claimed to be just hallucinations or hoax. UFOs are also problematic because apart from very few exceptions [27] they are interpreted as being of extraterrestrial origin. Crop circles might be a more successful attempt since they are static formation and anyone can see them.

The only reasonable strategy for ITs to communicate about their existence is to maximize "miracles" and the basic means to communicate is by inducing supra current leakage from their space-time sheets, or space-time sheets that they can control, to our space-time sheets.

a) Using the format of Arecibo message for a crop circle is an ingenious choice. It immediately tells what the message is about; that it cannot be a "natural" phenomenon; and that the senders cannot be at a distance larger than a couple of light decades. All this together with the content of message leaves only the interpretation that they are really here.

b) The small glass and magnetic iron particles and magnetic iron around crop stems are an equally ingenious manner to tell both that the formations are neither "natural" phenomena nor hoax; that mantle-core and core-inner core boundary layers are the places, where the aliens might live; and that alien life forms control liquid glass and iron at atomic space-time sheets. Also the observed artefact like silica crystals suggest the presence of a conscious intelligence.

c) The microwave induced explosions in growth nodes are a further manner to tell the serious researcher that hoax cannot be in question and that microwaves are crucial aspect for the communications.

d) Of course, there are also other means to communicate. For instance, seismic waves from Earth's interior might be one manner to communicate and it would be interesting to search for "unnatural" sounds having no identifiable source at the surface of Earth.

5.6.2 Why not earlier?

There are many reasons for why not earlier.

a) We are now ripe to learn that we are not alone and there is much more advanced civilization just below our feet. This kind of news might have destroyed us just like the encounter with more advanced culture has been fatal for many of the so called primitive cultures. We are now at the verge of having the first TOEs and theories of consciousness, and our self esteem is not destroyed even if we now that those below us have 80 DNAs of something to say and 23 amino-acids to say it (well, this *is* somewhat humiliating!).

One cannot underestimate the importance of web. Web makes it possible to communicate the facts about crop circles demonstrating that they are not hoax. Two decades ago the academic community would have simply silenced these phenomena away.

Everyone knows what fractals are nowadays and also that crop circles do not represent "natural" fractals but those constructed by a mathematician with high aesthetic sense. Thus the fractals are an ideal manner to communicate about the presence of a higher level intelligence.

The explosion of the knowledge about genetic code motivates the attempts to communicate information about the genetic code. Since the images about crop formations are well documented in the web and accessible to anyone, there are good hopes that someone sooner or later notices that the number of the capital letters in the Crabwood message is 20, the number of amino-acids, and gradually realizes that every detail of message is beautiful hint about what the aliens are and where they live. We are also approaching the time when a good theory about alien genetic codes allows us to conclude something about these lifeforms and perhaps even produce small alien bacteria in our labs. If code allows to develop new understanding about our own genetic code and how it was evolved, there are even better hopes to get us convinced that the crop formations communicating the code are not hoax.

b) Second reason might be that the situation is getting so catastrophic that they must tell that they are there and willing to help us.

i) The magnetic field of Earth has started to flip and this catastrophic event could dramatically affect magnetospheric consciousness.

ii) There are good reasons to argue that we are an exhausted civilization and decaying, self at a very high age. A period of healing sleep followed by a wake-up to a new magnetospheric day in maximally entangled state of collective one-ness is highly well-come. Magnetic flip is perhaps needed for this and it might be induced intentionally. Earth's magnetic field is indeed highly un-predictable self-organizing structure.

Note that solar magnetic field has memory [28] and 11+11 year cycle: the interpretation as a sleep-awake cycle of a conscious entity deserves a serious consideration. If the duration of the magnetospheric sleep-wake cycle scales like the inverse of the magnetic field strength, and if the fields strength at the surface of Sun *resp.* Earth is taken to be $\sim .2$ Tesla *resp.* $.5$ Gauss, this gives 4.4×10^4 year duration for the magnetospheric sleep-wake cycle. 10^4 light years seems to be the average duration between magnetic flips. This rough estimate is too high by a factor of 4. The Earth's magnetic field has reduced during the last thousand years by a factor of two so that by using the peak values for the magnetic fields of Earth and Sun a better estimate should result. Unlike solar magnetic field, Earth's magnetic field flips in an ir-regular manner (also

the sleep-wake periods of infants are irregular, perhaps magnetic Earth lives its magnetic infancy!).

iii) The magnetospheres of also other planets and helio-magnetosphere have been also changing rapidly during last decades. In [29] Russian scientist A. M. Dmitriev proposes that a dramatic transformation catalyzed by the collision of the solar system with large plasma clouds in outer space is taking place and affects the whole heliosphere. In TGD based cosmology of consciousness these plasma clouds could correspond to an external plasmoid like intelligence. What is happening would be the heliospheric counterpart for what occurs when I am in a dark wood and suddenly realize that I am not alone: there is something there and it might be dangerous. My every cell is suddenly in a state of full alertness and ready to react, and my brain intensely develops ideas about what might be there and how to react for various options. Perhaps the very fact that human kind is intensely developing consciousness theories, and even what I am writing just now, is part of this intense alertness.

c) Third kind of reasons might relate to the physical prerequisites for sending these messages. There are stringent conditions to be satisfied. Magnetic flux tubes carrying strong local magnetic field of about .2 Tesla are needed: magnetized meteoric iron at magnetic flux tubes might be one means to make flux tubes of Earth's magnetic field to carry this field. Two thirds of the circles involve the meteoric iron. Meteoric iron is not always available. The overall size of the structure depends strongly on the magnitude of the electric field in the region between earth and ionosphere. If it is normal the size scale of circles would be too large and the phenomenon would remain un-detected. The local negative charge possible in limestone regions could be the crucial factor reducing the electric potential and in reducing the size scale of the formations. Also the state of ionosphere depending on factors like the presence sunspots might be important.

Interestingly, during the last decade two sub-belts have emerged inside the inner radiation belt [29]. The first belt is electronic and at $r \sim 2R$, R the radius of Earth. The second newcomer contains mainly O^+ ions. Van Allen belts are carriers of magnetospheric sensory representations in TGD. Both the state of van Allen belts and the appearance of crop circles correlate with the solar activity.

5.6.3 How to communicate with ITs?

These considerations motivate the question how to communicate with the ITs.

a) Aliens have received and understood the Arecibo message so that one could continue communicating using this microwave wavelength using the same frequency modulation based binary code.

b) $k = 151$ sheets space-time sheets could couple with DNAs and also with micro-tubules which seem to be basically responsible for our long term memories. The zero point kinetic energy liberated when ion drops from this space-time sheet corresponds to microwave energy and scaling law of homeopathy implies that the velocity parameter involved with the process is about 6 m/s: the phase velocity of alpha waves. If DNA provides a direct connection to their world we could try to communicate via DNA: this communication might be occurring unconsciously all the time and alpha waves are the correlate for these communications. Gariaev has found that DNA responds to a visible coherent light by emitting radio waves, and one might imagine of using DNA to transform messages represented using visible light to radio waves and understood by the aliens.

c) Schumann resonances, being cavity resonances, might provide especially effective manner to communicate. In standard physics these waves would not propagate to the interior but in TGD framework this would be possible at non-atomic space-time sheets. Hypnagogic states during which the lowest Schumann resonance dominates in EEG could correspond to these communications.

d) Situation might be even simpler than this: the Crabwood message suggests that aliens talk English and ASCII code fluently, and are at a higher level in the understanding of biology. Perhaps the aliens are receiving information about us all the time and the problem is how to get us to receive the information sent by them! Perhaps the hardest challenge for the aliens is to get us convinced that they really are there.

5.6.4 Shouldn't volcanoes contain signatures of IT life?

If IT life is really there, volcanoes should be ideal places if one wants to find evidence for it since volcanic eruptions could have brought into daylight both organic material at the colder space-time sheets and liquid glass, perhaps even characterized by complex self-organization patterns. Why traces of life haven't then been found from the surroundings of old volcanoes?

This question does not kill the IT hypothesis. The oldest structures identified as bacterial and cyanobacterial fossils are accompanied by very complex structures consisting of quartz. The fact that these structures are associated with volcanoes has led to suspect that they do not represent genuine life forms, and a heated debate is going on about this [30]. The puzzle might be resolved if life has developed also underground, and even before the ordinary life so that the photosynthesizing life as we know it might have developed from primitive IT life forms. The complex quartz structures could be seen as results of an intelligent quantum control. The study of the material associated with the volcanic eruptions provides direct means to test the IT hypothesis.

IT life forms could perform remote metabolism by sending negative energy photons inducing the dropping of ions between atomic spacetime sheets and magnetic flux tubes so that zero point kinetic energy becomes usable energy. Negative energy photons of visible light might even make possible primitive remote photosynthesis and ADP-ATP cycle. What I have called miracle wavelengths correspond to p-adic length scales between cell membrane thickness and cell size defined by four Gaussian Mersennes def $\lambda_h(k) = L(k) = 2^{(k-151)/2} \times 10$ nm, $k = 151, 157, 163, 167$. The photon energies are (126, 15.68, 1.96, .49) eV and correspond to the wavelengths (10, 80, 640, 2560) nm. Remarkably, the last two photon energies correspond to the energies of photon absorbed in photosynthesis and the energy liberated when single ATP molecule is used respectively.

6 Number theoretical model for genetic codes

The naive thinking would suggest that the DNA-amino-acid correspondence is unique and same in the alien biology as in our biology. This is not the case. The tRNA molecules mediating DNA-amino-acid correspondence could be different for various lifeforms. TGD inspired biology suggests that mRNA-tRNA interaction involves mass-less extremals serving as em bridges between them and that the stability of various possible tRNA type molecules is determined by the electromagnetic environment. Thus one must take genetic code as a result of selection. The findings about the alien codes suggest guesses about the origin of the genetic code.

The basic new result inspired by the attempt to identify the alien genetic code is the finding that both our and alien genetic codes factorize in a good approximation to a product codes associated with DNA doublets and singlets. This suggests factorization also at the level of amino-acids. Perhaps DNAs triplets have resulted as a symbiosis of singlets and doublets whereas amino-acids might have been developed via a symbiosis of 2 molecules coded by 4 DNA singlets and 10 molecules coded by 16 DNA doublets.

Product code as such predicts degeneracies approximately but fails at the level of detailed predictions for DNA-amino-acid correspondences. A "volume preserving flow" in discrete DNA space is needed to produce realistic DNA-amino-acid correspondences. This flow has the general tendency to cluster

amino-acids to connected vertical stripes inside the 4-columns appearing as elements of the 4×4 code table, whose elements are labelled by the first two bases of DNA triplet. One can invent an information maximization principle providing a quantitative formulation for this tendency.

6.1 Number theoretical model for the terrestrial genetic code

The study of the terrestrial genetic code allows to deduce the process leading to the breaking of the product symmetry and T-C symmetry. This process turns out to work as such also in case of alien codes.

6.1.1 Approximate reduction to a product code

The dependence of the amino-acid coded by DNA on the third codon of DNA triplet is weak and Crabwood message suggests that both doublet and triplet codes are realized. This inspires the guess that triplet code might have evolved as a fusion of doublet code and singlet codes.

The decomposition $20 = 2 \times 10$ for real amino-acids suggest that singlet code maps four bases to 2 'pre-amino-acids' such that A and G resp. T and C are mapped to same pre-amino-acid, and 16 doublets to 10 'pre-amino-acids'. The exact A-G symmetry and almost exact T-C symmetry of our genetic code support this interpretation.

Product code hypothesis is very strong since the degeneracies of the product code are products of the degeneracies for the composite codes so that the number n_{AB} of DNA triplets coding a given amino-acid having the product form 'AB', to be referred as the degeneracy of the amino-acid, is given by the product

$$n_{AB} = n_A \times n_B$$

of the degeneracies of the 'pre-amino-acids' A and B. Here A and B can refer to $(A, B) = (3, 7)$ or $(A, B) = (2, 10)$ respectively.

The number $N_{AB}(n)$ of amino-acids with given degeneracy n is given by the formula

$$N_{12}(n) = \sum_{n_1 \times n_2 = n} N_1(n_1)N_2(n_2) ,$$

where $N_1(n_1)$ resp. $N_2(n_2)$ is the number of pre-amino-acids with the degeneracy n_1 resp. n_2 .

For 2×10 case singlet sector allows only single candidate for the code since the genetic code has exact A-G symmetry and almost exact T-C symmetry with respect to the last base. Thus A and G code for the first pre-amino-acid and T and C the second one. A breaking of the T-C symmetry is needed to obtain realistic code.

6.1.2 Our genetic code as result of symmetry breaking for 2×10 product code

In case of 2×10 code the decomposition of 16 DNA doublets giving almost the degeneracies of our genetic code is (3322 111 111).

$$(2 \oplus 2) \times (3 \oplus 3 \oplus 2 \oplus 2 \oplus 6 \times 1)$$

This gives

n	1	2	3	4	6
N(prod)	0	12	0	4	4
N(real)	2	9	2	5	3

Table 4: The numbers $N(n)$ of amino-acids coded by n DNAs for unperturbed 2×10 product code and for the real genetic code for 2×10 option.

It is important to notice that the multiplets appear as doubled pairs corresponding to A-G and T-C symmetries. One generalized amino-acid (which cannot correspond to stopping sign) is lacking and must result by a symmetry breaking in which one amino-acid in the code table is transformed to a new one not existing there.

6.1.3 Failures of the product structure and the symmetry breaking as "volume preserving flow" in DNA space

A slightly broken product structure allows to understand the degeneracies of our genetic code relatively easily. It however leads also to wrong predictions at the level of DNA-amino-acid correspondence.

a) Exact product structure predicts that all 4-columns XYU , $U = A, G, T, C$ appearing as elements of the code table labeled by first and second bases of DNA triplet should have similar amino-acid structure. For 3×7 code the 4-column should have $AABC$ structure. This is not case. Almost all 4-columns have $AABB$ structure and there are also many $AAAA$ type 4-columns. For 2×10 code the prediction is that all 4-columns should have $AABB$ structure and this prediction breaks down only for $AAAA$ type 4-columns.

b) For 3×7 code a given amino-acid should be coded by DNA pairs of form (XYA, XYG) , or DNA of form XYC or XYT . For 2×10 code a given amino-acid should be coded either by DNA pairs of form (XYA, XYG) or of form (XYC, XYT) . This is not the case. A given amino-acid tends to appear as connected vertical stripes inside the elements of the 4×4 table (4-columns). For instance, all 4-columns of form $AAAA$ (A=leu, val, ser, pro, thr, ala, arg, gly) and 3-column ile break the prediction of the product code.

c) For 3×7 each 2n-plet formed by degenerate (XYA, XYG) -pairs is accompanied by n-plets of type XYT and XYC . In case of 2×10 2n-plet formed by (XYA, XYG) -pairs is accompanied always by an 2n-plet formed by (XYT, XYC) pairs. By studying the degeneracies of the codes one can get idea about how good these predictions are.

It seems that the breaking of the product symmetry tends to form connected vertical clusters of amino-acids inside a given element of the 4×4 code table but that one cannot regard stripes longer than 4 elements as connected structures. The 2×10 structure is favored by approximate T-C symmetry, and one can imagine that relatively simple "flow" in DNA space could yield the desired condensation of the amino-acids to form connected vertical stripes. The most general flow is just a permutation of DNAs and obviously preserves the degeneracies of various amino-acids. There are $64!$ different permutations but A-G and T-C symmetries reduce their number to $32!$.

The idea about discrete "volume preserving flow" in DNA space can be made more precise. A-G and T-C gauge symmetries suggest the presence of a discrete symplectic structure. Perhaps one could regard 16×4 DNAs as 16 points of 4-dimensional discrete symplectic space so that the canonical symmetries of this space (volume preserving flows) acting now as permutations would be responsible for the exact A-G gauge invariance and approximate T-C gauge invariance. This brings in mind the canonical symmetries of CP_2 acting as $U(1)$ gauge transformations and acting as almost gauge symmetries of the Kähler action.

A natural guess is that the DNAs coding same amino-acid tend to be located at the same column of the 4×4 code table before the breaking of the product symmetry. If this is the case then only vertical flows need to be considered and A-G and T-C symmetries imply that their number is $8!^4$ corresponding to the four columns of the table.

a) The simplest hypothesis is 2×10 option is realized and that the flow permutes entire rows of the code table consisting of A-G and T-C doublets.

There are 3 6-plets leu, ser, and arg, and it is easy to see that one cannot transform them to the required form in which all 6-plets are on A-G or T-C row alone using this kind of transformation. For instance, one could require that leu doublets correspond to T-C doublets before the symmetry breaking. This is achieved by permuting the G_1 row with the C_2 row. Since A_2 contains also ser-doublet, also ser must correspond to T-C type 6-plet, and since arg is contained by G_2 row, also arg must correspond to T-C type 6-plet. Thus there would be 4 T-C type 6-plets but the product code gives only 2 of them.

b) The only manner to proceed is to allow mixing of suitable 6-plet of A-G type and 4-plet of T-C type in the sense that A-G doublet from 6 is moved to T-C doublet inside 4-plet and T-C doublet in 4-plet is moved to A-G doublet inside 6-plet. Permuting AG_2 (ser doublet) with TG_1 (trh-doublet) represents this kind of permutation.

The tables below summarize the three stages of the construction.

1. Table 5a): Code table before the flow inducing the breaking of the product symmetry

	A	G	T	C	
A	phe	ser	tyr	cys	A
	phe	ser	tyr	cys	G
	leu	thr	asn	thr	T
	leu	thr	asn	thr	C
G	val	ala	glu	gly	T
	val	ala	glu	gly	C
	leu	pro	gln	arg	T
	leu	pro	gln	arg	C
T	ile	ser	stop	ser	A
	ile	ser	stop	ser	G
	met	thr	lys	arg	T
	met	thr	lys	arg	C
C	val	ala	asp	gly	A
	val	ala	asp	gly	G
	leu	pro	his	arg	A
	leu	pro	his	arg	G

2. Table 5b): The code table after the action of the flow inducing the breaking of product symmetry

	A	G	T	C	
A	phe	ser	tyr	cys	A
	phe	ser	tyr	cys	G
	leu	ser	stop	thr	T
	leu	ser	stop	thr	C
G	leu	pro	his	arg	A
	leu	pro	his	arg	G
	leu	pro	gln	arg	T
	leu	pro	gln	arg	C
T	ile	thr	asn	ser	A
	ile	thr	asn	ser	G
	met	thr	lys	arg	T
	met	thr	lys	arg	C
C	val	ala	asp	gly	A
	val	ala	asp	gly	G
	val	ala	glu	gly	T
	val	ala	glu	gly	C

3. Table 5c): The code table after the T-C symmetry breaking

	A	G	T	C	
A	phe	ser	tyr	cys	A
	phe	ser	tyr	cys	G
	leu	ser	stop	stop	T
	leu	ser	stop	trp	C
G	leu	pro	his	arg	A
	leu	pro	his	arg	G
	leu	pro	gln	arg	T
	leu	pro	gln	arg	C
T	ile	thr	asn	ser	A
	ile	thr	asn	ser	G
	ile	thr	lys	arg	T
	met	thr	lys	arg	C
C	val	ala	asp	gly	A
	val	ala	asp	gly	G
	val	ala	glu	gly	T
	val	ala	glu	gly	C

At the last stage the T-C symmetry breaking giving rise to bla-trp and ile-met doublets occurs.

a) thr 6-plet is transformed to 4-plet by replacing thr-thr in AC_2 by bla-trp. trp is the missing amino-acid.

b) TA_2 met-doublet is transformed to ile-met so that the realistic genetic code results.

A working hypothesis worth of studying is that the symmetry breaking mechanism is universal and applies also to the capital letter code and even to the small letter + special symbol code in an appropriately generalized form. This hypothesis is highly predictive, and the fact that one can produce these codes using the product ansatz, the same "volume preserving flow", and T-C symmetry breaking, encourages to think that the picture has some truth in it.

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6.1.4 The deviations from the standard code as tests for the basic symmetries of the model

The deviations of the terrestrial genetic code from the standard code [10] provide a testing ground for the postulated symmetries of the genetic code and might also help to deduce the alien codes. The deviations from universality of the start codon (coding for met) and stop codons are very rare. With two exceptions all known deviations from the standard code are located in the first and fourth columns of the code table. For the first exceptional case the codon is ATC in the third column and codes for both stopping sign and pyrrolysine, which is an exotic amino-acid. It is somewhat a matter of taste whether one should say that the universality of the third column is broken or not since, depending on context, ATC codes stopping sign or pyrrolysine. Second exceptional case corresponds to the use of two stop codons to code amino-acids and this necessarily breaks the universality of the third column in T-C 2-subcolumns. The construction of the small letter code indeed forces to assume this kind of breaking of universality. No violations of the predicted A-G symmetry and the universality of the second column of the code table are known.

The deviations from the standard code [10] provide valuable hints when one tries to deduce information about the alien codes.

a) Consider first the mitochondrial genes.

i) Mitochondrial codon ACT from animals and micro-organisms (but not from plants) codes trp instead of stopping sign.

ii) Most animal mitochondria use TAT to code met instead of ile.

iii) Yeast mitochondria use GAX codons to code for thr instead of leu. This suggests that also in the case of the capital letter code the amino-acid coded 8 times is thr. In case of the small letter + special sign code the 13-fold degenerate amino-acid could be thr.

b) The violations of the universality are very rare for nuclear genes. A few unicellular eukaryotes have been found that use one or two of three stop codons to code amino-acids instead. The use of two stop codons to code amino-acids necessarily violates the universality of the third column but need not break the universality for the imbedding of amino-acid space to DNA space.

c) There are also two non-standard amino-acids: selenocysteine and pyrrolysine.

i) Selenocysteine is encoded by ACT (fourth column) coding stopping sign normally. Interestingly, ACT codes also stopping sign and the translation machinery is somehow able to discriminate when selenocysteine is coded instead of stop. This codon usage has been found in certain Archaea, eubacteria, and animals. This deviation means that the number of amino-acids is 21 or 20 depending on context. This conforms with the view that number 21 indeed has a deep number theoretical meaning and that one can regard stopping sign formally as amino-acid.

ii) In one gene found in a member of the Archaea, exotic amino-acid pyrrolysine is coded by ATC, which corresponds to the lower stopping sign in the code table. This case represents the only deviation from universality of the third column of the code table but even in this case also stopping sign is coded. How the translation machinery knows whether to code pyrrolysine or to stop translation is not yet known. TGD would suggest that electromagnetic signaling mechanisms ('topological light rays') might be involved.

The small variants of the letters K and V are lacking from small letter + special sign code. This might signal that the corresponding amino-acids are replaced by selenocystein and pyrrolysine represented by h and \backslash in the small letter code.

7 Genetic codes of aliens

The discussion of the previous article demonstrated that there are at least two genetic codes involved with the Crabwood message: capital letter code and the code associated with small letters and special symbols. Perhaps also a third code defined by DNA doublets associated with the plasmoid like life forms is present. In the sequel these codes are deduced using the proposed model with a universal breaking of the product symmetry and code dependent breaking of T-C symmetry.

7.1 Capital letter code as a product code with broken T-C symmetry

What about capital letter code: does it also have approximate product structure? Product structure predicts that many degeneracies, in particular the largest degeneracies should be divisible by two. In case of 2×10 code all degeneracies are predicted to be divisible by two. This is not the case now as the table above shows. One can however try to find a product code which is as near as possible to the real one.

The degeneracies 111111234 for the doublet 2×10 representation differs from our genetic code in that 1111112233 is modified to 111111234. These

degeneracies would be the degeneracies most naturally associated with the 16 DNA doublet code with 10 'pre-amino-acids' possibly associated with plasmoid like life forms serving as messengers of the aliens.

The simplest option would be that this correspond to taking one doublet from second 2 and adding it to second 3 so that one additional singlet results. Unfortunately, the fact that stopping sign has degeneracy 7 excludes this option.

The 1111111234 decomposition for doublet code predicts the following numbers for DNAs with various degeneracies. Also the corresponding numbers for capital letter code are included.

n	1	2	3	4	5	6	7	8
N(product)	0	14	0	2	0	2	0	2
N(capital)	5	7	2	3	1	0	2	1

Table 6. The numbers $N(n)$ of amino-acids coded by n DNAs as predicted by the 2×10 product model for the capital letter code in comparison with the degeneracies deduced from the Crabwood message: 2×10 option.

The following process gives the degeneracies of the code.

- a) Take one DNA from second 8-plet and add it to 6-plet to get two 7-plets so that one has $N(7) = 2$ and $N(6) = 1 > 0$.
- b) Change one DNA in 6-plet to the DNA which does not exist in the table to get $N(6) = 0$, $N(5) = 1$, $N(1) = 1$. The non-existing DNA is generated in essentially the same manner also in case of our code.
- c) One can transform 7 2-plets into 2 3-plets, 4-plet and 4 singlets as follows. Take from two doublets one DNA and move them to third doublet to get $N(1) = 3 < 5$, $N(2) = 11 > 7$, and $N(4) = 3$. There are four superfluous doublets remaining and forming pairs. For each pair take DNA from one doublet and move it to second one to get $N(1) = 5$, $N(2) = 7$ and $N(3) = 2$.

Assuming that the decomposition of DNA doublets is obtained from that for our code in the proposed manner and that the same flow induces T-C symmetric part of the breaking of the product symmetry, one can fix the DNA-amino-acid correspondence highly uniquely for the capital letter code. The unbroken code contains two octets. Since for yeast mitochondria both GA and TA columns code for thr, the guess is that the second octet corresponds to thr. The second octet must be ser from the product symmetry. The requirement that the code table resembles as much as possible the code table of our genetic code leads to the following working hypothesis for the code table before symmetry breaking.

3. Table 7): Capital letter code table after the T-C symmetry breaking

	A	G	T	C	
A	phe	ser	tyr	cys	A
	phe	ser	tyr	cys	G
	phe	ser	stop	stop	T
	leu	ser	stop	trp	C
G	thr	pro	his	arg	A
	thr	pro	his	arg	G
	thr	stop	gln	arg	T
	thr	stop	gln	arg	C
T	ile	thr	asn	ser	A
	ile	thr	asn	ser	G
	ile	thr	lys	arg	T
	met	stop	lys	stop	C
C	val	ser	asp	gly	A
	val	ser	asp	gly	G
	val	asp	asp	gly	T
	val	ala	glu	gly	C

7.2 T-C symmetric models for small letter plus special symbol code

One can apply T-C symmetric product model with symmetry breaking also to the code candidates involving small letters. There are three candidates for these codes.

a) $4 \times (16+4)$ code with 23 generalized amino-acids (\backslash , h , and special symbols $!$, $\&$, $.$ are interpreted as belonging to the extended family of amino-acids).

b) The $4 \times (16+4)$ code with 20 amino-acids (\backslash and h are interpreted now as amino-acids). This code results from the code with 23 generalized amino-acids by assuming that the DNAs coding for $!$, $\&$ and period code for the stopping sign.

The product model for the genetic codes suggests an interpretation of the small letter codes. The Chilbolton message tells that also silicon is fundamental for the alien life at DNA level so that one can consider the possibility that one of the DNA and RNA doublets is modified by an addition of something containing silicon to give an additional doublet.

For $(4+16) \times 4$ codes four additional doublets must be present. The simplest possibility is that the doublets of form XT have doubled by silicon modification of the second T to XT_S . This modification explains the replacement of T by U at RNA level as being forced by consistency. Also $T_S X$ type modification is in principle possible but the construction of the code favors the XT_S option (in this case code table gets a fifth column whereas for $T_S X$ gives rise to a fifth row).

The optimal candidate for the code involving 64+16 generalized DNAs involves 20+3 generalized amino-acids. There are two options corresponding to the decompositions $24 = 3 \times 8$ and $24 = 2 \times 12$. The assumption that small letter plus special sign code follows from the capital letter code as extension favors 2×12 option. 2×12 option for the small letter + special sign code allows highly unique model since one can assume that the code results as a simple extension of the capital letter code and is obtained by the same symmetry breaking procedure as the capital letter code and terrestrial genetic codes.

The first step is to deduce the composition in the set of 4+16 DNA doublets defining the product code. The only working option has the decomposition 11111112235, which corresponds to the decomposition

$$20 \times (2 \oplus 2) = (5 \oplus 3 \oplus 2 \oplus 2 \oplus 8 \times 1) \times (2 \oplus 2) .$$

This gives the following table for the degeneracies.

n	1	2	3	4	5	6	8	9	10	12	13
N	0	16	0	4	0	2	0	0	2	0	0
N	10	4	0	3	2	3	0	1	0	0	1

Table 8: The numbers $N(n)$ of amino-acids coded by n DNAs for code containing small letters and special symbols for 2×12 option.

3. T-C symmetry breaking

The basic assumptions are that the G-column of the code is universal for the alien code just as it is universal for the terrestrial codes, and that the code table resembles maximally to our code table and capital letter code table.

	A	G	T	C	T_S	
A	phe	ser	tyr	cys→scys	.	A
	phe	ser	tyr	cys→scys	.	G
	phe	ser	stop	stop→trp	thr	T
	leu	ser	stop	trp	thr	C
G	thr	pro	his	arg	trp	A
	thr	pro	his	arg	trp	G
	thr	stop	gln→phe	arg	trp	T
	thr	stop	gln	arg	trp	C
T	ile	thr	asn	ser	.	A
	ile	thr	asn	ser	.	G
	ile	thr	lys→ile	arg	.	T
	met	stop	lys→plys	arg	&	C
C	val→ser	ser	asp	gly→scys	ser	A
	val→ser	ser	asp	gly→scys	ser	G
	val→ser	asp	asp	gly→asp	asp	T
	val	ala	glu	gly	!	C

Table 9: Small letter special sign genetic code resulting from T-C symmetry breaking. The replacements $X \rightarrow Y$ tell how the code in the sector of ordinary DNAs is obtained from the capital letter code.

7.3 Summary

To sum up, both the terrestrial and hypothetical alien genetic codes can be constructed from the A-G and T-C symmetric product codes by assuming a breaking of both product- and T-C symmetries. Product structure and symmetries suggests strongly that genetic codes have evolved as a fusion of much simpler doublet and singlet codes. Hydrophilic-hydrophobic dichotomy is a good candidate for the dichotomy implied by the 2×10 product structure. The assumption that the breaking of the product symmetry induced by the "volume preserving flow" in DNA space tending to cluster amino-acids in the vertical direction of the code table is universal, and the hypothesis that the imbedding of the amino-acid space to the DNA space is universal, together fix the identification of the codes highly uniquely.

The small letter-special symbol code with 80 DNAs and 23 amino-acids is favored because it maximizes both the information content and the expressive power of the code. The degenerate code with 80 DNAs and 20 amino-acids is obtained from the 23-amino-acid code by assuming that the exotic DNAs coding for special signs !, & and period code for stopping sign. To my own opinion the small letter code special symbol code with 80 DNAs and 23 amino-acids is the most plausible alternative.

8 Physical model for genetic code and its evolution

The models for the generation of the triplet code as product code and for the sub-sequent breaking of the symmetry in terms of a "flow" in DNA space are purely formal mathematical models. One should be able to identify the possibly new physics involved with this evolution. This requires a more detailed view about what happens when mRNA is translated to aminoacids.

The basic questions are following.

- a) What were the physical counterparts of the pre-aminoacids and pre-tRNAs for singlet and doublet codes?
- b) How the doublet code emerged from the singlet code and triplet code from the doublet code? How the tRNA molecules evolved and how the aminoacids replaced pre-aminoacids?
- c) Can one identify singlet and doublet lifeforms as existing lifeforms?

In an attempt to answer these questions p-adic length scale hypothesis and the vision about the molecular evolution as a sequence of spontaneous symmetry breakings induced by the generation of new space-time sheets serve as valuable guide lines. A crucial idea is that a palace revolution occurred in the transition to the triplet code. For singlet and doublet code DNA sequences were the pre-aminoacid sequences acting as a coded hardware. In the transition to the triplet code they become the controlling agent and coding software. At this stage aminoacids received the role of hardware. A second key idea is that the structure of tRNA codes for the genetic code and has resulted as fusion of singlet and doublet tRNAs and thus contains fossilized information about singlet and doublet lifeforms. Rather amazingly, these ideas allow to answer to the questions and very precise and the outcome is a highly predictive model for the molecular evolution. Nannobacteria claimed to be even the dark biomatter are excellent candidates for singlet and doublet lifeforms.

Second group of questions relates to the quantum control of the translation process. There are many questions also now.

- a) What makes a codon stopping codon?
- b) What led to the breaking of the product- and T-C symmetries of the code?
- c) What is the origin of breaking of the canonical A-T, C-G rules for mRNA-tRNA association?

Of course, these considerations do not directly relate to crop circles and are included to demonstrate how powerful consequences the openminded attitude towards crop circles, often regarded as hoax even by people taking seriously paranormal phenomena, has.

8.1 The era before the triplet code

The primordial evolution should correspond to a sequential appearance of the space-time sheets characterized by p-adic length scales. The most important p-adic length scales are primary p-adic length scales but also secondary and higher p-adic length scales might be important.

- a) $k = 137$ corresponds to atomic spacetime sheets.
- b) The emergence of $k = 139$ and $k = 149$ could correspond to the emergence of DNA singlet code and doublet code respectively.
- c) The emergence of the triplet code and its further evolution should correspond to appearance of the space-time sheets with sizes characterized by the p-adic "miracle" length scales defined by the Gaussian Mersennes associated with $k = 151, 157, 163, 167$ inducing symmetry breakings at the level of the genetic code. The $k = 169$ space-time sheet corresponding to the flux tubes of the magnetic field of Earth should have been present from the beginning.

This picture seems to make sense. $k = 151$ corresponds to the cell membrane space-time sheet. The p-adic length scale $L(151)$ is the minimal length for DNA allowing an integer number 10 of 2π -twists for DNA double helix. The role of

this kind of units in the model of cognitive codes (see the chapter "Quantum model for cognition" of [15]) encourages to think that $k = 151$ space-time sheets and DNA triplet code appeared simultaneously.

In the same manner one can argue that doublet code was established only after the emergence of the p-adic length scale making possible sequences of 3 exotic RNA doublets (minimum number of RNAs in the helix giving rise to a twist which integer multiple of 2π). A simple calculation shows that 6 exotic RNAs correspond to a length of 6 nm if the radius of the exotic RNA helix is same as that of the DNA helix. This supports the view that $L(149) = 5$ nm is the p-adic length scale above which doublet life becomes possible.

If the generation of the triplet code occurred only after the emergence of $k = 151$ space-time sheet, one can say that it does not make sense to talk about triplet as a basic structural unit in the absence of the cell membrane. This is true even in the case that DNA sequences were present. Therefore ordinary RNA sequences shorter than 10 units could be interpreted as the representatives of the singlet lifeform. Also the sequences of the exotic RNA doublets containing no more than 2 doublets could have been present already during the singlet period.

8.1.1 Replication and translation mechanisms for the singlet code

The minimum requirement for the system deserving to be called living is that it can replicate, produce RNA and translate RNA to pre-aminoacids.

a) The replication of singlet DNA occurred via the predecessor of the standard mechanism and involve a temporal splitting of the double strand to strands which were completed to double strands. Also the association of RNA to RNA could have been realized in the standard manner. This does not yet make possible genetic code. To my best knowledge there is no evidence for the existence of double strands consisting of exotic DNA doublets. Therefore the replication and transcription mechanisms are assumed to work only in the case of singlet DNA (essentially identical with the ordinary DNA).

b) The association of DNA to RNA sequences with the mediary of primitive tRNA molecule defines the predecessor of the RNA-aminoacid translation process. Since singlet code maps A and G to A and T and C to say T, tRNA₁ could in principle break the canonical rules A-T, C-G at the level of mRNA-tRNA association.

In the case of the singlet code the simplest mechanism for RNA-DNA translation would be following.

- a) Pre-aminoacids were simply DNA sequences of a special kind.
- b) The translation process associated to a RNA sequence a DNA sequence by a mechanism analogous to gauge fixing: say $(U, C) \rightarrow A$, $(A, G) \rightarrow T$. This is a natural assumption since for singlet code all nucleotides are in the same role.
- c) This process cannot occur without the mediary of primitive tRNA molecules because this would mean that the process would be simply the reversal of DNA-to-RNA association.

8.1.2 The translation mechanism for the doublet code

Geometrically the doublet code reduces to a representation of the space of pre-aminoacids as a surface in the space represented by 16 DNA doublets. It is possible to deduce detailed information about the details of this imbedding from the product model of the genetic code. The model for the terrestrial genetic code before the breaking of the product symmetry suggests that the 16 RNA doublets are mapped to 10 DNA doublets with the degeneracy structure 3322 111 111 for various pre-aminoacids defined by the conjugate DNA doublets XY. The Boolean interpretation suggests that the 10 DNA doublets XY decompose to 8+2 doublets such that 8 doublets correspond to 8 statements consistent with a given atomic statement and the remaining 2 doublets correspond to the negation of the atomic statement plus some other statement.

The RNA-DNA translation mechanism works also for the doublet code. If the replication and DNA-RNA transcription mechanism were not realized for the doublet lifeforms, these life forms met the problem how to generate the doublet RNA. One possibility is that exotic RNA is generated by some kind of catalytic process from the ordinary RNA produced by the singlet lifeforms.

A symbiosis of a singlet life form able to replicate DNA and generate from it RNA and of a singlet or doublet lifeform able to transform RNA to DNA representing pre-aminoacids by the singlet code would yield the analog of a simple cell nucleus. The pre-aminoacids for singlet lifeform were DNA sequences consisting of A and T nucleotides only. Conjugate DNA strands, if present at all, contained only C and G. Encouragingly, short sequences containing only A and T actually appear often in DNA, and one can divide DNA into A-T and C-G rich regions. Since doublet RNA did not possess replication mechanism, it is conceivable that it lived in a symbiosis with a singlet lifeform producing the RNA sequences transformed to exotic RNA sequences.

8.1.3 The general structure of pre-tRNA molecules

The general structure of the pre-tRNA molecule could be deduced from the requirement that it codes for the code but follows also from the consistency of singlet and doublet codes with the triplet code identified as their fusion.

Consider first tRNA₁.

a) The simplest assumption would be that tRNA₁ contained the codon X conjugate to RNA₁ nucleotide making possible the attachment of tRNA₁ to RNA₁ strand. For the ordinary mRNA-tRNA association with respect to the third A-G codon however breaks canonical rules in the sense that only A codon is associated to both A and G. The breaking of the canonical rules is analogous to a gauge fixing. This must occur also in case of tRNA₁ to achieve consistency with the triplet code. This means that $X = A$ would attach to RNA nucleotides U and C. In the case of tRNA₂ no gauge fixing is possible since nothing like this occurs for the triplet code. Note that the doublet XY must be the exotic doublet conjugate to RNA₂.

b) Since triplet code breaks T-C symmetry, one cannot assume gauge fixing in T-C sector for the singlet code so that singlet code cannot reduce to mere RNA-DNA correspondence. Thus tRNA₁ contained also the conjugate X of the coded DNA singlet X or playing the role of pre-aminoacid. To this the DNA singlet or doublet was attached. When pre-tRNA was attached to the mRNA, DNA was added to the growing DNA sequence.

An analogous picture applies to tRNA₂. RNA codons consists now of 16 exotic RNA doublets $(XY)_2$. tRNA₂ contained the conjugates of $(XY)_2$ as exotic doublets so that they could attach to RNA₂ sequence plus the conjugates of the DNA doublets $(X'Y')$ coded by $(XY)_2$. The DNA doublet XY was attached to the latter and added to the growing sequence of DNA doublets at RNA₂ site. Note that the model does not require that free DNA appears as exotic doublets (only exotic RNA doublets have been observed).

Of course, this picture is oversimplified. Pre-tRNA probably contained additional structure but this structure did not contain information about the codes. What is remarkable that pre-tRNA coded the code and this must be true also for the tRNA of the triplet code.

8.2 How DNA-aminoacid translation emerged as a fusion of singlet and doublet codes?

There are several guidelines helping to answer the question how DNA-aminoacid translation might have emerged from singlet and doublet codes producing only RNA from DNA.

8.2.1 Gross view about what happened

The gross view about the establishment of DNA-aminoacid translation machinery relies on the symbiosis of cell nucleus with its host cell.

a) The complex translation machinery DNA \rightarrow mRNA \rightarrow aminoacid sequence involving cell nucleus was not present during primordial stage. For singlet DNA replication of DNA and its transcription to RNA plus the machinery producing DNA sequences from RNA sequences using a primitive variant of tRNA operating as RNA \rightarrow tRNA \rightarrow DNA were present. In the last step DNA sequence consisting of A and T was produced. An analogous machinery was realized for the doublet RNA and produced sequences DNA. Doublet DNAs did not form doublet helices and could not replicate. Therefore they had to live in symbiosis with singlet lifeforms, which produced ordinary RNA part of which was catalytically transformed to exotic RNA.

b) tRNA₁ and tRNA₂ fused to the predecessor of the triplet tRNA. This meant that the translation processes yielding DNA from RNA started to occur simultaneously yielding from ordinary and exotic RNA strands two separate DNA sequences. The cross like structure of the recent tRNA reflects directly this fusion (see figure 3).

c) At some stage the codes fused at the level of RNA so that tRNA₂ part of tRNA₃ began to code for the translation of ordinary RNA triplets to DNA triplets. Exotic RNA₂ become un-necessary in this process as also did tRNA₁ which remained as a fossil in the recent tRNA.

d) Aminoacids and their sequences acted as catalysts for RNA-DNA translation. In the case of tRNA₁ singlet aminoacid catalyzed a particular RNA-DNA association so that RNA-aminoacid coding was realized at the level of catalytic action. The de-activation of tRNA₁ meant that aminoacids began to attach to tRNA₂ part of tRNA and left it only when the tRNA was attached to RNA sequence and were added to the growing aminoacid sequence. Thus both DNA and aminoacid sequence began to be produced in the process.

e) Since there was no need for the RNA to produce DNA anymore, pre-tRNA was modified in such a manner that it did not anymore catch DNA triplets from the cytoplasm and ceased to manufacture DNA. This led to the shortcircuiting of the former tRNA₂ part of tRNA so that it did not anymore catch DNA triplets and only aminoacid sequence resulted in the translation. Later this mechanism developed to the usual translation machinery for which DNA was safely isolated inside the nucleus and transcribed mRNA translated to an aminoacid sequence.

Since the cell nucleus inside cell can be seen as a lifeform inside a lifeform, doublet-singlet symbiosis indeed suggests itself as the mechanism needed to achieve the last step in the process. Both participants had something to give and receive. The predecessor of the DNA inside nucleus was a singlet lifeform able to replicate and to produce pre-mRNA but did not possess genetic code. The predecessor of the cell in turn contained both the singlet and doublet lifeforms able to produce DNA from RNA. Doublet lifeform could not however produce RNA. Symbiosis was a gift from heaven for the both lifeforms and led ultimately to the cell as we know.

8.2.2 The structure of the tRNA molecule

The study of the structure of the ordinary tRNA molecule is of considerable help in the attempts to guess what might have been its predecessor. tRNA molecule has a crux like appearance, and decomposes into a body coded by tRNA gene and an acceptor stem which is same for all aminoacids and added separately and can be replaced during the lifetime of the tRNA molecule. Acceptor stem, to which the aminoacid is attached with the mediary of amino-acyl-tRNA synthase, can be said to be a passive component and is same for all tRNAs so that its structure does not determine which aminoacid is attached to it. The stem is not coded by genes and contains 4 nucleotides.

The body of the tRNA consists of four arms, three of which are accompanied

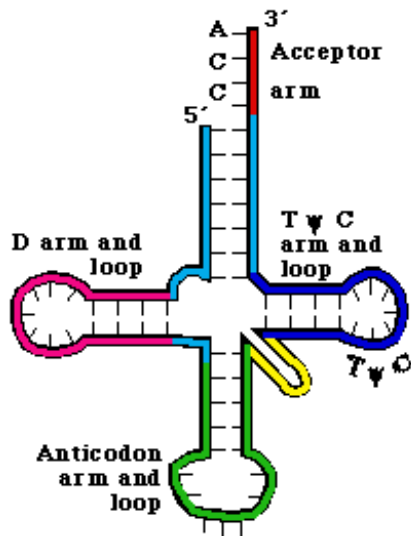


Figure 2: The structure of tRNA

by loops. The arms can be regarded as a double DNA strand with the standard base pairing although there are some anomalous features involved.

a) The so called D arm and loop and T ψ C arm and loop are opposite to each other and form the horizontal part of the crux. Both arms contain 5 DNA triplets, and one can regard both systems as consisting of 2 triplet-conjugate triplet pairs plus 1 triplet without conjugate and located at the extremity of the loop. The total number of DNA triplets in these arms is 10 which defines the critical length of linear DNA sequence above which triplet code is expected to establish itself.

b) The acceptor arm (without stem) and anticodon arm and loop are at the opposite sides of the vertical part of the crux. Anticodon arm contains the anticodon of mRNA codon and thus corresponds to DNA (recall however that the canonical correspondence is broken by the gauge fixing made possible by the exact A-G symmetry). Acceptor arm contains $14 = 4 \times 3 + 2$ and anticodon arm $17 = 5 \times 3 + 2$ nucleotides. This does not make even number of DNA triplets. Could this mean that the build-up of these structures might involve also doublet code? Note that the total number of nucleotides is 31 which corresponds one nucleotide more than the critical number of linearly arranged nucleotides defining the p-adic length scale $L(151)$ at which the triplet code should emerge.

The precise identification of the anticodon loop is as a structure containing a minimal number of conjugate DNA triplet pairs. With this definition the loop contains the DNA codon XYZ representing the coding DNA at the end of the arm and a pair of conjugate triplets which most naturally provide a representation for the aminoacid coded by XYZ. This representation is consistent with idea that aminoacids are imbeddable to the DNA space as a 'surface'. Thus tRNA would code for the genetic code. This prediction is testable.

8.2.3 The fossilized components of tRNA as record about the evolution of the recent form of the genetic code

The ordinary tRNA indeed seems to contain in its structure fossilized components providing a record about how the molecular evolution proceeded. tRNA₁ and tRNA₂ correspond naturally to the horizontal and vertical segment in the recent tRNA formed as a fusion of tRNA₁ and tRNA₂ to form a cross like structure (see figure 3). Hence tRNA₁ and tRNA₂ should represent in their structures

the respective genetic codes.

a) tRNA₂ should contain both the coding nucleotide attaching to RNA₂ plus the conjugate of the coded nucleotide to which DNA nucleotide was attached and then transferred to RNA₂ and added to the growing DNA sequence. This means that the structure of tRNA should help to deduce the doublet code experimentally. The pairs formed by the DNA triplet XYZ at the end of the anticodon arm of the ordinary tRNA and the pair formed by the triplet $X'Y'Z'$ and its conjugate on right and left sides of XYZ should provide detailed information about the doublet code. The pairs $XY - X'Y'$ should represent the doublet code apart from possible symmetry breaking effects. These effects might be induced at the level of $X'Y'Z'$ -aminoacid correspondence level and thus not visible in the structure of tRNA.

b) The transition to the triplet code added one DNA nucleotide to both the exotic doublet $(XY)_2$ and the doublet $X'Y'$ and its conjugate coded by it. The simplest assumption is that these DNAs came from D arm and T ψ C arm. This is possible since all loops are physically near to each other. The structure of D and T ψ loops conforms with the assumption that the predecessor of the first *resp.* second loop has lost the coding *resp.* coded DNA. The structure of these loops forces also to conclude that all tRNA loops have been stem like structures before their de-activation just as the acceptor stem is. Deactivation of DNA₁ and DNA translation and process must have meant the completion of these stems to loops by addition of a conjugate of the conjugate of the coded DNA.

8.2.4 How the RNA-aminoacid translation process evolved?

The task is to understand how the translation mechanism assigning to RNA sequence both aminoacid sequence and DNA sequence.

1. Aminoacids and their sequences as catalysers of RNA-DNA translation

Aminoacids and their sequences were very probably present during the primordial stage. Aminoacid sequences do not only provide hardware but act also as catalysts. The simplest hypothesis is that aminoacids catalyzed the generation of singlet DNA sequence from RNA by attaching to the pre-tRNA₁. Quite a many aminoacids catalyzed the attachment of A or T nucleotide to pre-tRNA₁. What was absolutely essential from the point of view of the DNA-aminoacid code was that the catalysing aminoacids decomposed into two groups depending on whether the DNA nucleotide coded by tRNA₁ was A or T. In the case of a tRNA₂ longer sequences of aminoacids analogous to amin-acyl-tRNA synthase catalyzed the generation of the DNA₂ sequence. In this case there was no specificity to DNA.

2. Fusion of the singlet and doublet RNA-DNA translation machineries

The next important event was the fusion between singlet and doublet life forms.

a) The singlet and doublet translation machineries fused together and began to co-operate. At the level of pre-tRNA molecules this corresponds to the fact that tRNA has a shape of crux e consisting of two orthogonal segments. Anticodon arm + acceptor arm has more DNA and corresponds naturally to tRNA₂ where as D arm + T ψ C arm corresponds naturally to tRNA₁.

b) In the new situation the pre-decessor of the amin-acyl-tRNA synthase catalyzed not only the attachment of the exotic DNA doublet XY to its conjugate in tRNA₂ but also the attachment of the aminoacid catalyzing the attachment of the singlet DNA to tRNA₁ (rather than to the acceptor stem as during triplet code) in the composite tRNA. What was the aminoacid whose attachment was catalyzed, was dictated by the $(XY)_2 - X'Y'$ pairing characterizing the doublet code and a by the $Z - Z'$ pairing characterizing the singlet code. This meant the emergence of DNA-aminoacid correspondence at the level of the composite tRNA and realization of DNA-aminoacid genetic code as a selection of the

catalyzing aminoacid.

c) The composite tRNA transferred DNA₂ and DNA₁ to the vicinity of the RNA₁ and RNA₂ sequences which were probably parallel to each other to make co-operation possible. DNA₂ was attached to the growing RNA₂ sequence and RNA₁ to the growing RNA₁ sequence.

3. *The moment of crucifixion*

Then a cruel episode occurred. The RNA₁ sequence which differed from an ordinary RNA₃ sequence only in that the number of RNA nucleotides was not necessary a multiple of three, took the command and RNA₂ lost the control. What happened that the anticodon arm of pre-tRNA₂ was modified in such a manner that both the coding and coded DNA₂ and DNA₁ fused to triplets located in anticodon arm of tRNA₂.

This meant that pre-tRNA₂ part of tRNA₁+tRNA₂ composite started to catch DNA triplets from the primordial cytoplasm. The triplets were attached in each step to the growing DNA₁ sequence which became DNA₃ sequence. The only surviving RNA doublet lifeforms were those which avoided the dangerous symbiosis with singlet lifeforms: perhaps nannobacteria. There was however compensation for the loss at material level: doublet lifeforms took the control at the level of tRNA and expanded to triplets whereas singlet tRNA became passive.

4. *The establishment of aminoacid synthesis*

Before the establishment of the aminoacid synthesis the predecessor of the amin-acyl-tRNA synthase and aminoacid only catalyzed the attachment of DNA₂ and DNA₁ to the pre-tRNA. When the aminoacid previously attached to the T ψ C arm began to attach to the acceptor stem, the lifetime of the aminoacid-pre-tRNA₁ composite increased so that the aminoacid remained stuck to the pre-tRNA₃ up to the moment when the tRNA attached to the RNA₃ (former RNA₁). The used catalyzing aminoacids thrown were not thrown into a waste basket but began to build aminoacid sequence coded by the RNA sequence. RNA \rightarrow aminoacid + DNA translation was established. After this the symbiosis with cell nucleus able to replicate DNA and to produce RNA led to the modern translation machinery.

8.2.5 **How the structure of tRNA reflects the evolution of the genetic code?**

The structure of tRNA indeed reflects the proposed view about the evolution of the genetic code into its recent form.

1. *Cross structure of tRNA₃ as resulting from the fusion of tRNA₁ and tRNA₂*

The crossed segments of tRNA have natural identification as tRNA₁ and tRNA₂ possibly modified after the fusion.

a) The length of D and T ψ C arms is by one nucleotide pair shorter (15 nucleotides instead of 17) which suggests that these arms correspond to tRNA₁ segment.

b) The maximum number of pairs of DNA doublet and its conjugate in tRNA₁ arms is 2 since 3 pairs would mean critical number of pairs leading to the generation of doublet code. Acceptor arm indeed contains 3 pairs of doublets plus singlet which means overcriticality.

c) If one assumes that D and T ψ C arms with loops contain 4 DNA conjugate pairs, one can conclude that D and T ψ loops contain one DNA singlet having a triplet at right and its conjugate at left.

This structure is consistent with the fact that during the period of doublet-singlet symbiosis translation process produced two DNA sequences and that tRNA₁+tRNA₂ had to attach to both mRNA₁ and mRNA₂ sequences simultaneously.

2. Loops were stems during the period when both ordinary and doublet RNA were present

During the period when both DNA₁ and DNA₂ were coded, the various loops were stems. D and anticodon stems served the purpose of attaching simultaneously the coding DNA₁ and DNA₂ to mRNA₁ and mRNA₂ sequences and coded DNA₁ and DNA₂ to the growing DNA sequences.

a) D stem consisted of the coding singlet DNA plus the conjugate X_c of the DNA nucleotide X to be coded plus DNA triplet. The DNA nucleotide X was attached to X_c by base pairing. TψC stem contained Tψ C triplet and coding and coded nucleotide. The aminoacid was attached to the TψC stem before the establishment of RNA-aminoacid code.

b) Anticodon stem had a similar structure but now the stem consisted of the coding DNA doublet attaching to mRNA and the conjugate of the coded doublet to which the coded DNA was attached. The pre-amin-acyl-tRNA was attached to tRNA₂ but only for the time needed to build the DNA-tRNA complex.

3. De-activation of DNA-catching activity of tRNA by the generation of loop

One should understand mechanism de-activating tRNA₁ arm when RNA₂ lost the game, and also the mechanism de-activating RNA→DNA translation when the symbiosis between the host cell and nucleus was established.

The deactivation of the DNA-catching activity of the the predecessor of the tRNA can be understood by inspecting the structure of the anticodon loop.

a) The anticodon stem contained the coding DNA triplet and the conjugate of the coded DNA triplet XYZ)_c to which DNA triplet XYZ was attached by base pairing to be later added to the growing DNA sequence.

b) The de-activation of the tRNAs meant short circuiting, that is a permanent attachment of XYZ to (XYZ)_c and the bending of the resulting structure into a closed loop. This also led to a separation of the YZ and (YZ)_c of XYZ-(XYZ)_c complex.

c) The ability to attach to mRNA was not lost in the short circuiting if the the DNA responsible for this was directed outwards as it is in the anticodon arm.

4. De-activation of tRNA₁

A mechanism essentially identical with the de-activation mechanism of the triplet DNA coding mechanism de-activated the ability of the D-arm of the tRNA₁ segment of tRNA to catch DNA nucleotides. That the nucleotide at the end of the D loop became directed inwards, means that the coding DNA nucleotide could not anymore bind by base pairing to mRNA₁. Instead, the triplet at the anticodon stem which had replaced the doublet of the former tRNA₂ began to attach to the triplets of mRNA₁ sequence.

The short circuiting of TψC stem (which is selective with respect to the third codon of the aminoacid) to form a loop meant that the aminoacid could not anymore attach to TψC arm and was forced to attach to the acceptor stem. This led to the establishment of the RNA-aminoacid translation process since the aminoacid attached to the acceptor stem was not removed until the tRNA was attached to mRNA.

5. The ACC in the acceptor stem as the former stopping sign for RNA→DNA translation process

The acceptor stem to which the aminoacid is attached contains ACC triplet plus single DNA nucleotide. This suggests that ACC has attached to UGG mRNA triplet during some period of evolution. ACC codes for trp which is the exceptional aminoacid in the model of the genetic code in the sense that it is not coded at all during the period of the product symmetry. Thus ACC coded stopping sign during this period. Also the stability arguments below suggest that ACC has coded stopping sign but that the generation of the additional

loop to tRNA has changed its role (this is a testable prediction) and induced T-C symmetry breaking.

The interpretation is that ACC in the stem acted as a stopping codon before the generation of the RNA-aminocid translation by attaching to mRNA instead of the ACC triplet at the anticodon loop, and in this manner stopped the RNA-DNA translation. Presumably AC had the same role during the period when the doublet code still prevailed.

6. *How the doublet code was transformed to triplet code at tRNA level?*

The transformation of the doublet and singlet codes to a triplet code involved the addition of a DNA nucleotide to both the coding DNA doublet and the conjugate of the coded DNA doublet in the anticodon stem. It is known that the arms of tRNA are bent so that they are near to each other. Moreover, the coding DNA nucleotide at the extremity of D arm does not contain the coded DNA nucleotide and its conjugate at its both sides as one might have expected. Same applies to T ψ C arm.

These observations make sense if the transformation to the triplet code was a topological process in which the coded DNA from D stem and coding DNA from T ψ stem (or vice versa) were transferred to the anticodon arm and glued to the coding and coded DNA doublets respectively to give triplets. This would mean that the longer *resp.* shorter halves of the D arm and T ψ arm without stem were 7 *resp.* 4 nucleotides long. For acceptor arm the shorter half had a length of 7 > 6 nucleotides in accordance with the criticality idea.

8.3 Could nannobacteria correspond singlet and/or doublet lifeforms?

Already Miller's classical experiments imitating the primordial sea demonstrate the emergence of the exotic RNA for which doublet effectively replaces the triplet. The so called nannobacteria represent a mystery at the borderline between living and non-living matter. The web article of Robert L. Folk [11], who is one of the pioneers in the field besides Y. Morita [31] and E. O. Kajander [12], provides a brief summary about nannobacteria and contains also references.

8.3.1 Basic facts about nannobacteria

Nannobacteria (often called also nanobacteria) are considerably smaller than ordinary bacteria. The sizes of the nannobacteria vary from about 20 nm to .2 micrometers. Thus the smallest nannobacteria have size scale not much above $L(151)$ so that optical microscope does not allow to study them. Indeed, geologists discovered nannobacteria by using scanning electron microscope.

Nannobacteria can originate a precipitation in calcite and argonite crystals by providing the seed of the crystal. Nannobacteria act also as catalysts by attracting cations to their negatively charged cell walls. They appear as dense clumps in various minerals and rocks such as limestones, dolomites, native sulphur crystals, and metallic sulfide minerals[11]. Nannobacteria produce complex silicates such as clays, where their sizes can be as small as 30 nanometers. They are involved even with the construction of birds' eggs! Nannobacteria of size about .1 micrometers were found in the Martian meteorite ALH84001 [32], and there is evidence that carbonaceous chondrite meteorite Allende [11] contains them. According to Folk, the nannobacteria might be the biological counterpart of the dark matter perhaps dominating over the ordinary biomatter in the entire universe. An interesting question is how deep in the rock nannobacteria based life forms can survive. The hypothesis about intraterrestrial life suggests that there is no limit here!

Although nannobacteria have been demonstrated to replicate [11], the prevailing belief has been that nannobacteria cannot be real life forms since by their small size they cannot contain the usual DNA replication apparatus. A Finnish

biologist Kajander and his collaborators have done a lot of self-funded pioneering work in the study of the nannobacteria [12]. It has not been demonstrated that nannobacteria possess DNA-mRNA-aminoacid translation machinery, the existence of which is often taken almost as a definition for what it is to be a living system (a size larger than .2 micrometers has been the second prevailing definition of a living system!). This failure can be understood if only the RNA-to-DNA translation machinery exists. Due to the hard cell wall of nannobacteria, the study of DNA is very difficult but according to the Kajander's private communication to Folk [11], the nannobacterial DNA exists and consists of very short strands.

8.3.2 Predictions

Nannobacteria could express both singlet and doublet codes. Singlet RNA would express itself as DNA sequences containing only A and T nucleotides. For doublet code 16 exotic RNA doublets are predicted to code for 10 DNA doublets. The precise realization of the genetic code involves aminoacids and their sequences only in the role of catalysts being not coded by DNA. The tRNAs used by the nannobacteria should appear as fossile remnants in ordinary tRNA.

In the case of a singlet lifeform the layer could correspond to the length scale $L(139)$ and be formed by doublet atomic layer corresponding to the twin pair of p-adic length scales formed by $L(k)$, $k = 137, 139$. Since $L(151)$ corresponds to the thickness of the cell membrane, the doublet lifeforms should not be isolated from the environment by a double layered cell membrane. One can imagine two options.

a) The tertiary p-adic length scale $L(3, 7^2)$ = " $L(147)$ and $L(149)$ form a twin pair and thus double layered structure with a total thickness of the lipid layer of cell membrane might be possible. The reported hard cell wall could correspond to this double layered structure. A cell wall consisting of minerals (nannobacteria induce also the precipitation of mineral crystals) might be most appropriate for lifeforms living in the pores of rock, and possibly utilizing tectonic energy in some form to satisfy their metabolic needs.

b) The lipid layers of the cell membrane correspond to $k = 149$ so that in the case of a doublet lifeform the primordial cell membrane might consist of a single lipid layer containing owater inside it whereas outside would be dry. In this case the hard cell wall would be only an outer shield protecting the lipid membrane bound nannobacterium and analogous to the shell of bird's egg generated by nannobacteria.

The generation of the triplet code would have been accompanied by the generation of double lipid layers and possibly a transition to water environment. The most natural location for the primitive RNA-DNA translation machinery is at the inner surface of a lipid membrane if present inside nannobacteria.

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