

# Crop Circles and Life at Parallel Space-Time Sheets: part II

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## Abstract

There are two especially fascinating crop circle formations: Chilbolton and Crabwood. Both formations suggests very strongly the interpretation as a message from an intelligent civilization perhaps living at parallel space-time sheets in our solar system.

### 1. Genetic codes of aliens

The interpretation of the Crabwood message as a representation for the genetic codes of alien life forms is suggestive. If this interpretation is accepted, the crop circles allow to deduce a lot of information about the genetic code and other bio-codes associated with these life-forms.

a) The message suggests strongly the existence of also doublet code besides two triplet codes and this inspires a simple model for our genetic code allowing to see the code as resulting from much simpler product code by a small symmetry breaking due to the interaction between singlets and doublets. Also various alien codes results in the same manner. This has deep implications for the theories how the life at the molecular level has involved.

b) The model suggests strongly that DNA triplets have resulted as a fusion of DNA singlets and doublets defining simpler genetic codes. My bio-chemical knowledge does not allow to test this hypothesis. It turns out that one can deduce surprisingly detailed information about the alien genetic codes. In fact, almost unique codes result if one accepts the proposed model of the genetic code having symmetries obeyed also by our genetic code.

c) The Chilbolton message tells that also silicon is of fundamental importance for this life-form at DNA level. Crabwood message contains a variant of genetic code for which the simplest interpretation is that DNA doublets of form  $XA$  are effectively doubled: perhaps doublets of form  $XA_S$  besides  $XA$ , where  $A_S$  denotes a compound of A 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 one member of the 7-plet composing aminoacids 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 impossible to even imagine the level of intelligence of these creatures as compared to that of us. The silicon insertions to the DNA and amino-acids bring in mind symbiosis with a silicon-based nano-computers.

d) Chilbolton message contains two different DNA strands. This could have several interpretations. DNA could indeed be asymmetric. Alternatively, there could be two genetic codes for the same life-form: the 80 DNA-23 amino-acid code would involve silicon and could perhaps give rise to a living arithmetic processor. The third option is that there are two separate life-forms involved. 64-DNA code would be associated with the plasmoidic life-forms. The fact that the Sun, whose convective zone contains a magnetic field of order Tesla making it an ideal environment for this life-form, is described to be smaller than in Arecibo message, suggests that this life-form populates also solar magnetosphere. The plasmoidic life-forms 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 life-form. Also UFOs could be identified as plasmoidic life-forms inducing telepathic encounters with the alien life-forms. The biology of the more intelligent life-form would be based on 80 DNA-23 amino acid code, which could live even outside the solar system.

The 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 aminoacid 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-aminoacids'. After that DNA doublets and singlets fused to triplets coding for the ordinary aminoacids, which are perhaps an outcome

from the fusion of the two kinds of "pre-aminoacids".  $2 \times 10$  dichotomy might relate to the hydrophilic-hydrophobic dichotomy for the aminoacids.

2. *Where do the messages arrive from?*

The messages responsible for the crop circles should come from our solar system, perhaps from terrestrial magnetosphere or solar magnetosphere. Time mirror mechanism allows to consider also the possibility (suggested by the time interval of year and one day between the messages) that the messages arrive from a distant geometric future and tell about the genetic codes of future civilizations living in the solar system.

3. *Where do the life forms assignable to the genetic codes live?*

One can consider several identifications of the biological life forms assignable to the codes using Chilbolton message as a hint. These life forms could live in Earth, Mars, Jupiter, perhaps as intra-planetaries, say intra-terrestrials at various boundaries such as mantle-core and core-inner core boundary. Even the photosphere of Sun could be populated.

The notions inspired by the dark matter hierarchy, in particular the notion of  $N$ -molecule, allow to consider seriously the existence of biological life forms able to cope in high temperature environments, and one can build rough view about what high- $T$  life should look like. The experimental signature of  $N$ -molecules are spectral lines of corresponding ordinary molecules in environments where they are not thermally stable. In the solar photosphere the spectral lines of water and solid calcium ferrite have been indeed observed. To sum up, without exaggerating one can say that the systematic search of these spectral lines might revolutionize our world view.

## 1 Introduction

There are two especially fascinating crop circle formations: Chilbolton [57, 58] and Crabwood [59, 60] and this chapter is devoted to the ideas stimulated by the attempts to understand what these formations try to tell to us. It must be emphasized that this chapter is just a play with thoughts contributing positively to my personal intellectual well-being (and perhaps also that of reader), and not meant to irritate skeptics to the border of fit of rage. It must be however added that dark matter hierarchy changes so profoundly the world view that these light hearted and childish speculations represent something which can be only a pale image of the reality which is much more magnificent than we are able to imagine.

### 1.1 Do Chilbolton and Crabwood messages provide information about aliens?

Chilbolton and Crabwood formations suggests an 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 bio-codes associated with these life-forms.

1. The Chilbolton 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 by Leslie Orgel [55] 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.

2. The Chilbolton message tells that also silicon is of fundamental importance for this life-form 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.
3. 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 both 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 life-form: the 80 DNA-23 amino-acid code would involve silicon. This life-form could even live outside the solar system.
  - iii) There are two separate higher level life-forms perhaps living in symbiosis inside same organism (like mitochondria and cell nucleus inside our cell).
4. Plasmoid like life-forms 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 life-form, is described to be smaller than in Arecibo message, suggests that this life-form might populate also solar magnetosphere. The plasmoid like life-forms 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 life-form. Also UFOs could be identified as plasmoid like life-forms inducing telepathic encounters with the alien life-forms. Being predecessors of the recent life-forms, plasmoids would generate immune response in higher life-forms: otherwise the direct encounters would be lethal. Even multicellulars formed by nanno-bacterium like life-forms [29, 30] or by their predecessors could be in question.
5. 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".

It is possible to transform the purely formal mathematical model for the evolution of the triplet code as a fusion of singlet and doublet codes to a concrete physical model. This is done in [L4] without barely mentioning crop circles. The truth however is that I would have never discovered the model without crop circles.

## 1.2 Where do the higher life forms live?

If one forgets Crabwood and Chilbolton messages, then the magnetosphere of Earth is the most natural candidate for the intelligent conscious entity responsible for the crop circles. Even if one takes seriously these messages, it would seem that the magnetosphere of Earth, or perhaps that of Sun, is the most natural identification for the crop circle artist. The question is basically about which life forms the genetic codes can be assigned to.

Chilbolton message can be interpreted as telling that aliens live in the solar system and populate Earth, Mars, and Jupiter. Sun is depicted to be smaller than in Arecibo message. This leaves two options.

1. Higher life forms live in the recent solar system as planetary or intra-planetary (IP) life forms and the small size of the Sun tells that they receive much less solar light. One could consider even the possibility that these life-forms populate also Sun: magnetic spots as analogs of tornadoes are best candidates for self-organizing living systems.
2. Aliens could also live in a relatively distant geometric future where the radius of the Sun is considerably smaller (long range  $Z^0$  force brings new force in solar dynamics and could allow relatively large and rapid variations of the solar radius, which are indeed observed). Also this option allows intra-terrestrial life, and the civilization of the geometric future could use time mirror mechanism to build crop circles perhaps utilizing simple IT life forms as quantum messengers.

In TGD framework the idea about intra-terrestrial life or more more generally, life at high temperatures, is not so crazy as it sounds. 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 life-forms. The presence of the small glass balls and of the magnetized iron in crop formations could be interpreted as a message 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 or could be an additional essential element of life.

The basic objection against high- $T$  life is the instability of organic molecules at high temperatures and the narrow range of temperatures at which higher life forms survive. Two solutions to the problem can be considered.

### 1.2.1 The option based on effective thermal isolation of space-time sheets

The earlier scenario was based on the assumption that space-time sheets are effectively thermally isolated and can thus be at widely different temperatures. Assuming that the size of the space-time sheet corresponds to the thermal de Broglie wave length one ends up with the conclusion that  $k = 131$  space-time sheets having size of .1 Angstroms are the carriers of the liquid glass and iron whereas  $k = 137$  atomic space-time sheets could be even in room temperature. This however just

an assumption and one might argue that it is better to start from the most pessimistic scenario than one can imagine and assume that the transfer of thermal energy between space-time sheets is possible.

### 1.2.2 The option based on dark $N$ -atoms

Dark matter hierarchy provides an alternative, and it seems more convincing, solution to the temperature problem working even when space-time sheets are assumed to have same temperature. The solution is based on the notions of dark  $N$ -atom and  $N$ -molecule discussed in [L2].

The space-time sheets of inherently dark atoms would in this case define  $\lambda^k$ -fold coverings of  $M^4$ . This would hold true also in the radial degrees of freedom. For radial anyons principal quantum number  $n$  would be replaced by  $n/\lambda^k$  so that energy levels  $E_n \propto 1/\hbar^2 n^2$  would not differ considerably from those of ordinary atoms. There is  $\lambda^k$ -fold state degeneracy corresponding to  $\lambda^k$  sheets of the covering and it is possible to construct  $N$ -atoms analogous to fermionic counterparts of Bose-Einstein condensates. From Fermi statistics  $N$  can have values  $N \in \{1, \dots, \lambda^k\}$ ,  $\lambda \simeq 2^{11}$ . The transition energies of  $N$ -molecules are  $N$ -fold as compared to their normal values so that thermal stability can be achieved even in vibrational and rotational degrees of freedom.  $N$ -atoms and molecules are an essential element of also ordinary TGD inspired quantum biology [L2].

The most fascinating aspect of fermionic  $N$ -atoms is that they make possible to understand DNA replication and lock and key mechanism of bio-catalysis in terms of high probability of fermionic  $N$ - and  $\lambda^k - N$ -atoms to combine to  $\lambda^k$ -atom which must be especially stable as a full fermion shell. The emergence of symbolic representations as names of molecules based on sequences of  $N$ -atoms playing the role of letters, and the emergence of molecular sex based on names having  $N$ -atoms as letters and their conjugates having  $\lambda^k - N$  atoms as letters and combining to  $\lambda^k$  atoms in molecular marriage.

What would be required that high- $T$  life is based on  $N$ -atoms, which are thermally stable with respect to the transition energies crucial for biological functions. Hence the values  $k$  characterizing the dark matter levels involved should be higher than in bio-sphere and the life in question should be at higher evolutionary level than ours. Mathematician inside me cannot not avoid the temptation of exaggerating that dark life is simply  $\lambda^k$ -fold covering of ordinary life.

The same mechanism that makes possible high- $T$  life might explain the well-documented ability of people in trance to dance on burning charcoals. Since trance is involved, the idea about phase transition raising the dark matter level of the skin tissue is natural.

This crazy sounding hypothesis is testable. For instance, one could test the presence of  $N$ -molecules in thermal environments in which they are not stable by looking whether radiation associated with molecular transitions resulting as de-coherence of corresponding  $N$ -photons is present. For instance, there is spectroscopic evidence for water in sunspots [19]. Ordinary water molecules are not stable at temperature range 3000-4500 K so that  $N$ -water molecules could be in question. The only reasonable explanation for the spectroscopic evidence suggesting the presence of water in sunspots [19] and solid calcium ferrite surface of sun [44] is in terms of dark  $N$ -atoms stable under the temperatures prevailing in the photosphere. The same evidence extrapolated to the planetary interiors allows to consider seriously the notion of IP. An experimental program checking systematically the presence of spectral lines of molecules not stable at the temperatures of the environment would allow to test the hypothesis and perhaps map the distribution of dark matter.

One could search for IT life-forms and fossils 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 artifacts 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. This forces to ask

whether various crop circles represent various technological achievements of ITs or whoever the aliens are.

## 2 Chilbolton and Crabwood messages

In TGD universe parallel space-time sheet are an obvious candidate for the world where the life forms responsible for crop formations and Chilbolton and Crabwood messages live. For reasons already described, these life-forms could control material at a 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 magneto-terrestrials (even in the interior of the planets involved). Also plasmoid like life-forms for which magnetic field strength would be around .2 Tesla from the requirement that electronic cyclotron radiation generates micro-waves serving as the 'food' of the plasmoids, are possible. Balls of light (BOLs) of micro-wave wave length 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 favored 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.

### 2.1 Chilbolton message

The crop formation in Chilbolton which appeared in August 2001 [57, 58] 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 radio waves 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 space-time 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 micro-wave 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 [57, 58].

1. 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 (intra-terrestrials) 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 space-time sheets which are cold.

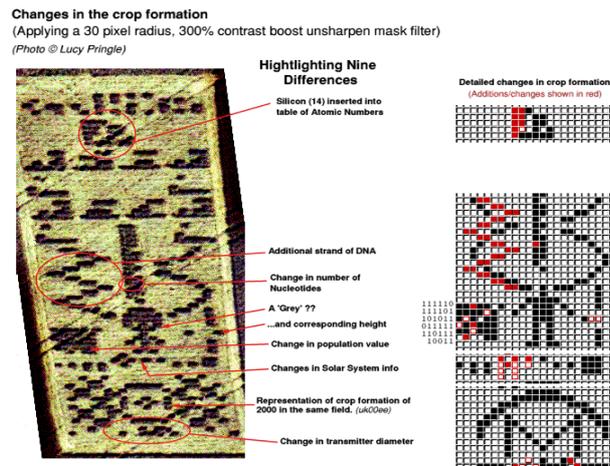


Figure 1: Chilbolton crop formation

This identification also explains why the civilization in question has been able to receive Arecibo message. Arecibo message is sent at micro-wave wave lengths, and micro-waves are amplified by quartz crystals appearing in Earth's crust and correspond to just those wave lengths which induce supra-currents between different space-time 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 magneto-immune system preventing the leakage of extra-Martial 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. Also smaller regions where magnetic field exist are possible. 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).

2. 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 message provides further support for this interpretation.
3. The strands of DNA (or more probably RNA) are depicted as different.
  - i) The arguments below suggest that the second strand could correspond to a rare variant of DNA in which two triplets of DNA correspond to a full  $2\pi$  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 RNA doublets replacing 64 RNA triplets could be associated with the plasmoid like life-forms serving as messengers.

ii) Alien RNA could indeed consist of asymmetric double strands. The physical model for the evolution of the genetic code developed in [L4] allows this option. A closer inspection of the Chilbolton message suggests that two exotic RNA nucleotides correspond to single singlet RNA nucleotide in the double strand. Therefore the translation of the RNA strands to two different pre-amino-acid sequences could occur as a single process using common pre-tRNA. A further conclusion is that singlet RNA must have been scaled-up by a factor of 2: this might be achieved if the phosphate-sugar backbone contains diphosphates instead of monophosphates. Therefore both RNAs would differ from those dominating the recent life. Pre-amino-acids would not have such an intimate relationship and would represent separate molecular life forms. The higher level life forms could correspond at molecular level to this kind of symbiosis.

The presence of diphosphates would also resolve the basic objection against IT life at mantle-core boundary due to the fact that DNA cyclotron energy ( $f_c$  is about 1 Hz at the Earth's surface) would be below the thermal threshold. The increase of the charge density of DNA per unit length would increase the cyclotron frequency above the thermal threshold.

4. The amount of DNA is somewhat higher than in human genome.
5. The population of these aliens is much higher than that of humans: 21.3 billions. The typical size of aliens, looking like "greys" in UFO mythology, is about one meter.
6. 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 intra-terrestrial 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?

### 2.1.1 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 space-time sheets in question and might be transferred to our space-time sheets when crop circles are formed. Silicon has been indeed found. Here I represent citation from biologist Dr. Levensgood:

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 Levensgood, who has pioneered the biochemical 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 biomass, 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.

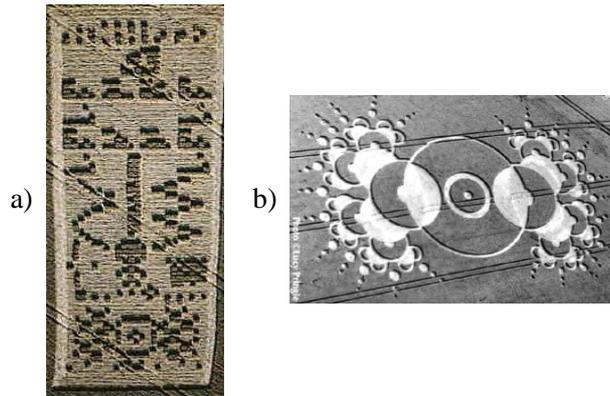


Figure 2: The counterpart of the Arecibo antenna in Chilbolton message which corresponds to earlier crop formation brings in mind Earth's magnetosphere and suggests the presence of intra-terrestrial life.

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.

### 2.1.2 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 space-time sheet carrying the magnetic field of about .2 Tesla guaranteeing that electronic cyclotron transitions generate micro-waves 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 space-time 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. According to [55], Red Setter, a research biologist, 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 biologist, 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.

### 2.1.3 Comparing the simple DNA with that of ours

While building a model for cognitive representations at molecular level I ended up to the following ideas.

1. The regular polygons constructible using only compass and ruler have number  $N$  of sides (and vertices) which is product of a power of two with product of some Fermat primes. The Fermat primes are given by  $F_n = 2^{(2^n)} + 1$ ,  $n = 0, 1, 2, 3, 4$ . One has  $F_0 = 2$ ,  $F_1 = 5$ ,  $F_2 = 17, \dots$   $F_0, F_1$  and  $F_2$  define Mersenne primes via the formula  $M_F = 2^F - 1$  and are clearly in special role.
2. Biology is full of helical structures and the hypothesis is that these structures are such that the number of basic units per period (full  $2\pi$  twist) of the helical structure corresponds to the number  $N$  of vertices for above mentioned polygons or to a Mersenne prime. The hypothesis is in principle easily testable.
3. For ordinary DNA the number of DNA base pairs per period is  $30 = 2 \times 3 \times 5$ . This corresponds to 30-gon constructible using only compass and ruler.
4. For the exotic two-base DNA the number of base pairs is  $6 = 2 \times 3$  per period so that this structure corresponds to hexagon and therefore also to a polygon constructible using only compass and triangle. Clearly, this DNA is somewhat simpler in well defined sense and could correspond to the DNA of plasmoid like life-forms for which doublets replace triplets.

## 2.2 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. I am in debt for Martin Keitel for learning about this fascinating formation

includegraphics[width=10.0cm]crabwood.eps

Figure 3: Crabwood crop formation

in a local UFO meeting and also for interesting discussions and for concrete help.

### 2.2.1 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 [59, 60] 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.EELIUVE. There is GOOD out there.We OPpose DECEPTION. Conduit CLOSING\*

Obviously there are one or two incomprehensible words involved (EELIUVE). There are also two variants of the message in the net. OPpose appears at Paul Vigay's homepage [59] and Oppose at at Martin Keitel's homepage [60]. In the following both options are considered.

One could consider the possibility that the message has much deeper layer than the somewhat oracle-like 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 RNA 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 [H8].

The first guess is that the message should be represented by some universal code. The appearance of  $3 \times 3 = 9$ -bit code words 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 RNA and the decomposition of 3 3-bit portions also suggests immediately that information about RNA 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 RNA. 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 code words are mapped to a particular amino-acid (or whatever counterpart of it) matter.

### 2.2.2 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.

1. The first possibility is that  $k = 151$  tells that the DNA and amino-acids of the life-forms 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 life-forms are ITs. This would also mean that  $k = 151$  refers to the space-time sheet at which super-conductivity is broken. For our life it would be  $k = 137$  space-time sheet.

2. 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 (.1 Angstroms) are also present and correspond to the hot space-time sheets. Alien DNA and amino-acids 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 wave length for the typical particles involved, is consistent with this assumption, as will be found later.

Option 2) 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 [K5] 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 life-forms 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 life-forms have cell membranes and all that is made possible by the presence of  $k = 151$  space-time sheet.

## 2.3 ASCII code interpretation of the Crabwood message

The basic hypothesis is that the message uses only the most general aspects of the ASCII code. The very fact that ASCII code and English language is utilized for the construction of the surface message, tells that the civilization is at a higher level than us and knows a lot about us. The one or two incomprehensible code words in EELIUVE are purposefully added to help to realize that there is a deeper level involved. For OPpose option the illogical use of capital letters could be also seen as a hint that the numbers of the capital and small letters are more important than the grammar.

The hypothesis is that there are at least two codes involved and these codes are represented by capital letters, small letters + special signs. Of course, also combinations of these are possible and it seems that small letters and special symbols indeed appear in a combination.

### 2.3.1 Why ASCII code?

ASCII code table consists of seven 16-element columns. The first two columns correspond to various control signs; the next two columns to various special symbols like ! and & and decimal numbers; the next two columns to capital letters and special signs; the last two columns contain small letters and special signs. The ASCII number runs along the first column to 15, continues along second column from 16 to 31, etc.... The ASCII numbers of the alphabet run in the alphabetical order and A corresponds to 65 and Z to 90. The ASCII numbers of small letters are obtained by adding number 32 to those of the capital letters and a given small letter is in the same row as the corresponding capital letter and shifted by two columns.

	0	@	P	'	p
<b>32</b>	48	64	<b>80</b>	96	<b>112</b>
!	1	A	Q	a	q
<b>33</b>	49	<b>65</b>	81	<b>97</b>	113
"	2	B	R	b	r
34	50	<b>66</b>	<b>82</b>	<b>98</b>	<b>114</b>
#	3	C	S	c	s
35	51	<b>67</b>	<b>83</b>	<b>99</b>	<b>115</b>
\$	4	D	T	d	t
36	52	<b>68</b>	<b>84</b>	<b>100</b>	<b>116</b>
%	5	E	U	e	u
37	53	<b>69</b>	<b>85</b>	<b>101</b>	<b>117</b>
&	6	F	V	f	v
<b>38</b>	54	<b>70</b>	<b>86</b>	<b>102</b>	118
'	7	G	W	g	w
39	55	<b>71</b>	<b>87</b>	<b>103</b>	<b>119</b>
(	8	H	X	h	x
40	56	72	88	<b>104</b>	120
)	9	I	Y	i	y
41	57	<b>73</b>	89	<b>105</b>	121
*	;	J	Z	j	z
42	58	74	90	106	122
+	;	K	[	k	{
43	59	<b>75</b>	91	107	123
,	<	L	\	l	
44	60	<b>76</b>	<b>92</b>	<b>108</b>	124
-	=	M	]	m	}
45	61	<b>77</b>	93	<b>109</b>	125
.	>	N	^	n	
<b>46</b>	62	<b>78</b>	94	<b>110</b>	126
/	?	O	_	o	
46	63	<b>79</b>	94	<b>111</b>	127

Table 1: The table gives the 3 to 8 columns of ASCII table (the first two columns for control commands have not been included). The ASCII numbers for the symbols appearing in the message are in boldface.

1. *What senders can tell using ASCII message?*

There are several good reasons for using the general features of ASCII code to send the message.

1. 8-bit code is favored because 9th bit must be used as a separator for practical reasons. In fact, all 8-bit code words involved have 0 as the last digit so that if 9:th digit is 1 then this digit combination acts as a natural separator for the code words.
2. The use of the ASCII code allows to tell implicitly that the senders of the message live near to us, and that they have quite a lot of information about us. The presence of the surface message tells that they can even cope with English language. The totally incomprehensible EELIUVE can be seen as an ingenious manner to signal that there is a deeper layer involved.

The presence of the surface message also tells that the ordering of the letters is very probably not important.

3. If only very general features of ASCII code are involved, enormous flexibility results. For instance, the ordering of the code words in the message does not matter, and there is invariance with respect to the permutations of capital letters and 4 special symbols: only the blanco must map to itself under these symmetries. The permutation group is  $S_{20} \times S_{19}$ . This means a huge freedom to construct the surface message. It is hard to believe that average crop circlist could have this kind of skills.

2. *Hints that the message is about genetic code and cannot be random lyric burst*

One can ask whether the selection of the amino-acid-letter correspondence could have been used to convey additional hints telling that the codes are involved.

1. When one replaces the ASCII numbers  $n$  of the various symbols with the symbols which correspond to the number  $n_1 = n \bmod 32$ , one obtains control symbols in the first two columns of the ASCII code table. This operation corresponds to simply the shifting of the column pair to the left so that it replaces the first two columns. Since all capital *resp.* small letters are contained in the column pairs starting from ASCII symbol 64 *resp.* 92 this operation does not mean a loss of information. Same applies to the special symbols appearing in the message. That capital and small letters are mapped to the same control symbols, suggests as a first guess that they might denote the same amino-acid also in the code: this guess turns out to be wrong and is not actually used in the analysis. Control symbols are denoted by two- and three-letter symbols which brings in mind the three letter notation for amino-acids and also the function of amino-acids as bio-controllers, whereas DNA corresponds to the symbolic representations like ordinary letters of the language. It is also interesting that there are  $26=21+5$  capital letters: this brings in mind 20 amino-acids, stopping sign, 4 pairs of micro-wave polarizations, and corresponding stopping sign.
2. Especially intriguing is the appearance of special symbols. There are 20 capital letters and 19 small letters plus the special sign \ which also has ASCII number larger than 64: does this signal for 20 amino-acids also in the case of the small letters? Or is meant to tell that both small letters and special symbols denote for amino-acids? The remaining three special symbols have ASCII numbers in the third column of the ASCII table.
3. The alphabet runs vertically along 16 element columns of ASCII table and A corresponds to 65. The letters H, X, Y, Z, J and @ symbol which corresponds to ASCII number 64 in capital letter column of ASCII table, do not appear as symbols of amino-acids. The symbols H,X,Y,Z and J (ASCII numbers modulo 32 equal to 8, 24, 25, 26, 10) form a *connected* symmetric region in ASCII table (H (J) is connected horizontally to X (Z) at the upper (lower) end of the vertical bar formed by XYZ). Since a random choice of letters would give disjoint set of letters, there seems to be a clear systematics in the selection of the letters used to denote amino-acids. Furthermore, there are 7 letters A, B, C, D, E, F, G above H and 5 letters below K: these are the primes characterizing  $M_5$  and  $M_7$  codes.
4. It is perhaps worth of noticing that the strange word UVE in EELI!UVE corresponds to a connected region of ASCII table and the sum of ASCII numbers modulo 32 is  $7^2$  which is 9 modulo 8 and 17 modulo 32. Also the sum of the ASCII numbers modulo 32 associated with EELI equals to  $7^2$ . The total sum of the ASCII numbers modulo 32 is 99 which equals to 3 in modulo 32 arithmetics.

5. The ASCII numbers of the special characters modulo 32 correspond to 0 (blanco), 1, 6, 14, 28. The numbers 6 and 28 are perfect numbers associated with Mersenne primes  $M_2 = 3$  and  $M_3 = 7$  defining genetic code. All these numbers define Fermat polygons. The column of ASCII table containing blanco, !, & and period contains 7+5 other characters, seven characters between & and period. There are four characters between ! and &, whereas the remaining character is below period at the bottom of the column of ASCII table: this brings into mind 4 micro-wave pairs plus stopping sign identification.

### 3. Ideas about how to dis-entangle the message

A fascinating possibility is that the structure of the ASCII table could give further hints about the systematics of the genetic code.

1. Professional biologists might make guesses about what amino-acids the various letters correspond by comparing the code with our genetic code. For instance, the highly degenerate amino-acids might be same for both genomes.
2. The symmetries of the genetic code, in particular the exact A-G symmetry for the last codon might help to deduce the DNA-amino-acid corresponds using the information of message as hint. There are also other approximate symmetries which give strong constraints on the amino-acid-capital letter identification if one assumes that they hold true also for capital letter code. For instance, the amino-acids corresponding to left-right pairs of capital letters have almost as a rule same number of DNAs coding them. By looking what might the corresponding symmetry for our DNA, one could end up with strong constraints for amino-acid-capital letter correspondence. Unfortunately, this approach does not seem to provide much information.
3. The most important hint came from the realization inspired by the message that both our and alien genetic code are in a good approximation products of simpler doublet and singlet codes. This realization might have emerged also from simple number theoretical considerations. One can imagine two possibilities.
  - i) If one counts only real aminaocids  $20 = 10 \times 2$  decomposition suggest a decomposition to doublet could mapping 16 DNA pairs to 10 elements and 4 DNA bases to 2 elements, kind of 'pre-amino-acids' serving as formal building blocks of real amino-acids. Exact  $A \leftrightarrow G$  symmetry and only slightly broken  $T \leftrightarrow C$  symmetry for the last base of DNA triplets supports the  $10 \times 2$  product decomposition.
  - ii) If one counts also stopping sign formally as an amino-acid,  $21 = 3 \times 7$  decomposition suggests a decomposition to doublet code mapping 16 DNA base pairs to 7 elements and 4 DNA bases to 3 elements.

This idea also leads to a vision about life being evolved through a development of doublet and singlet codes which then formed a symbiosis.

4. A further guideline comes from the basic idea of Combinatorial Hierarchy model of the genetic code [L1, L2]. The discrete 21-element set of amino-acids and stopping sign can be imbedded to the discrete space of 64 DNA triplets so that there is a unique DNA for each amino-acid serving as kind of a coordinate for it in the space of DNAs. This leads to a geometric view about the genetic code. Most important prediction is that the the DNAs associated with amino-acids a predicted to code for these amino-acids in any genetic code.
5. Finally, the general structure of the ASCII table in capital letter columns together and the general features of the message give important hints about the identification of the amino-acid-capital/small letter correspondence. It however turned out that the model of the genetic code is almost enough for the deduction of the codes.

### 2.3.2 The degeneracies associated with the 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(3)	2	4	2	1	1	1

Table 2: Numbers of capital letters appearing in the Crabwood message. The number of P:s is 4 for OPpose option and 3 for Oppose option. The number of blancos is correspondingly 10 or 11.

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 3: 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 for OPpose option and by 8 codons for Oppose option! In fact, the model for our genetic code discussed in [L1, L2] predicts that the number should not be larger than six.

It would seem that the alien genetic code is not so entropic than ours in the sense that the number of DNAs per amino-acid varies much more. The measure for the redundancy is given by the entropy per amino-acid given by  $s = S/N = \sum_n N(n)\log(n)/(N\log(2))$ ,  $N = 20$ : here bit is used as a unit. The entropy achieves maximum, when the degeneracies of all amino-acids are same. The entropy per amino-acid is  $s = 1.42$  bits for our genetic code and  $s = 1.20$  bits for the alien genetic code in case of Oppose option. When stopping sign is regarded as amino-acid, one has  $s = 1.49$  and  $s = 1.28$  for our *resp.* alien genetic code.

### 2.3.3 The degeneracies of codes associated with small letters and small letters plus special signs

The numbers of the small letters, of blancos besides those associated with the capital letter code, of backslashes (\) (ASCII number is larger than 64) in the message are represented by first four rows of the table 4 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(2)	6	5	9	4	1	11	1	
!	&	.								
1	1	5								

Table 4: The numbers  $n$  of small letters and special signs appearing in Crabwood message. The number of  $p:s$  is 1 for OPpose option and 2 for Oppose option.

In the case of small letters the identification of the code is not unique. There are three different interpretations depending on whether one

1. includes only small letters giving 18 amino-acids with  $h$  playing the role of stopping sign (this is possible for Oppose option only),
2. whether also the \ appearing in the capital letter column is included giving  $19+1=20$  amino-acids, or
3. whether one includes also special symbols, which gives 23 different aminoacids.

#### 1. Are only small letters included?

There are 19 different small letters in the message. For Oppose option the total number of small letters is  $68 = 4 \times 17 > 64$  so that a variant of the ordinary genetic code cannot be in question. For cognitive codes based on the regular plane polygons constructible using compass and ruler, the number of code words is power of 2 times a product of some Fermat primes. The code word number  $N = 4 \times 17$  obviously corresponds to this kind of code.  $M_{17}$  is also Mersenne prime and in [H8]) it was speculated that  $M_{17}$  Mersenne codes are realized at DNA level. In the case of OPpose option the number of letters is 67 and this kind of interpretation is not possible.

There are two possible interpretations for this code making sense only for the Oppose option.

1. The first identification for the small letter code is as a modification of the genetic code obtained by doubling of one DNA doublet which turns out to be AA. Chibolton messages tells that also silicon is fundamental for the alien life at DNA level. This suggests that the modification  $(AA)_S$  of AA involving silicon increases the number doublets to 17 and the number of triplets to 68. This modification obviously increases the information content of the genome.
2. The appearance of the number 4 suggests that the four DNA bases send 17 different signals such that a given signal affects only single amino-acid. The code could tell how many signals affect a given amino-acid. One can deduce the number of the stopping sign signals and can also identify the two amino-acids which are not affected by the signals if one assumes that capital and small forms of a given letter code for the same amino-acid. Interestingly, all

the code words involved have ASCII number larger than 64 and smaller than 127, which fits nicely with the assumption that DNA triplets are involved and  $M_7 = 127$  genetic code is involved. Note that the 'stopping sign' of this new code might be simply one particular signal rather than actual stopping sign.

If one assumes that small letters label amino-acids and capital and small letters code for the same amino-acid, one can conclude that the letter  $h$  must code for the counterpart of the stopping sign, and the letters  $K$  and  $V$  whose small counterparts are not present in the small letter code correspond to amino-acids not involved with the code in question. Thus only 18 amino-acids would be coded and the expressive power of the genome would be reduced. The number  $N(n)$  of amino-acids coded by  $n$  DNAs is represented in the following table:

n	1	2	4	5	6	9	13
N	6	5	2	2	2	1	1

Table 5: The numbers  $N(n)$  of amino-acids coded by  $n$  DNAs for pure small letter code for Oppose option.

Stopping sign corresponds to degeneracy  $n = 5$ . The above defined entropy of the code is  $s = 1.22$  bits per amino-acid ( $s = 1.43$  for our code) using the formula above and assuming that stopping sign does not contribute. If stopping sign contributes, one has  $s = 1.39$  ( $s = 1.49$  for our code).

2. *Are also blancos and \ included into small letter code?*

If one includes also the 10 (11 for Oppose) blancos left when 7 (8 for Oppose) is reserved for the capital letter code, one has 20 different small letters and their total number is 79. This number is not divisible by 4 as doublet-singlet product form for any code involving DNA triplets would suggest. Also one amino-acid is lacking. There is however the symbol  $\backslash$ , which appears in the columns containing capital letters unlike other special symbols with ASCII number smaller than 64. If one includes it the number of different symbols becomes 21 and their total number is  $20 \times 4 = 80$ . In this case blanco has a natural interpretation as a stopping sign and the letters  $h$  and  $\backslash$  could represent amino-acids different from those coded by our DNA. As a matter fact, it is known that there are more than 20 amino-acids and the 2 additional ones are coded by the DNA of some terrestrial life-forms. One can however wonder what it means that the  $\backslash$  does not belong to the small letter columns but to the second capital letter column. Perhaps this amino-acid, or whatever it is, has a very special role.

The interpretation would be following. The code is obtained by adding 16 new codons to the old ones. If the code results from a product of doublet and singlet codes, this is achieved if the number of doublets increases by four. This could result from the doubling of the base T by silicon modification in case that it appears as (say) the first base of the codon. This would mean that one has also four codons of form  $T_SXY$ .

If one assumes that small letters label amino-acids and capital and small letters code for the same amino-acid, one can conclude that the letter  $h$  and  $\backslash$  code for amino-acids by replacing the amino-acids represented by the letters  $K$  and  $V$ . 20 amino-acids would be coded by the modified DNA. By looking what amino-acids have been replaced with these new ones one could perhaps deduce what amino-acids the letters  $K$  and  $V$  denote.

The number  $N(n)$  of amino-acids coded by  $n$  DNAs is represented in the following table:

n	1	2	4	5	6	9	10 (11)	13
N	8(7)	5	2	2	2	1	1 (1)	1

Table 6: The numbers  $N(n)$  of amino-acids (with stopping sign included) coded by  $n$  generalized DNAs for small letter + \ code with 80 generalized DNAs and 20 amino-acids. Numbers in brackets refer to Oppose option.

Stopping sign corresponds to degeneracy  $n = 10$  ( $n = 11$ ). The above defined entropy of the code is  $s = 1.28$  bits per amino-acid ( $s = 1.42$  for our code) for Oppose option assuming that stopping sign does not contribute. The small value of entropy is due to the large numbers of code words coding for stopping sign and one amino-acid. With stopping sign included the entropy is  $s = 1.39$  bits per amino-acid ( $s = 1.49$  for our code). One can criticize this code for the fact that the large number of DNAs coding stopping sign reduces the information content of the code.

One might think that same amino-acids correspond to a large number of DNA code words in both capital letter and small letter codes. The table below allows to compare capital and small letter codes. The first and third rows denoted by x correspond to small letter code and second and fourth rows denoted by X to the capital letter code.

	a	b	c	d	e	f	g	h	i	k	l
x	2	2	1	1	13	2	1	5	6	0	2
X	2	2	3	2	8	1	2	0	5	1	3
	m	n	o	p	r	s	t	u	v	w	\
x	1	1	4	1(2)	6	5	9	4	0	1	1
X	2	4	7	4(3)	2	4	2	1	1	1	0

Table 7: Comparison of numbers of DNAs coding for same amino-acid in small letter code and capital letter code assuming that small letters and capital letters denote the same amino-acid.

There indeed seems to be this kind of correlation up to amino-acid coded by p: amino-acids e and i and o correspond to maxima of  $N(n)$ . They could correspond to leucine, arginine and serine which are maximally coded also in our genome. It turns out that the assumption that small and capital letters correspond to each other is not needed in the construction of the small letter code. The assumption of this correspondence would obviously pose serious limitations on the content of the surface message.

3. *Do both small letters and special symbols define counterparts of amino-acids for the small letter code?*

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.

The observation that the total number of small letters plus special signs is  $24 = 8 \times 3$  and divisible by 3 suggests that the genetic code involves both small letters and special signs and that the code is obtained by a modification of ordinary genetic code by adding 3 new 'amino-acids' and yielding the additional expressive power. In fact, the possibly existing decomposition  $3 \times 7$  for amino-acids (perhaps as composites of simpler molecules or in more general sense) might have expanded to  $3 \times (7 + 1)$ , where one new building block of amino-acid involving silicon has appeared and that the 3 special symbols !, &, . with ASCII number smaller than 32 denote these molecules. Alternatively, and actually more convincingly,  $2 \times 10$  decomposition for real amino-acids could have expanded to  $2 \times (10 + 2)$  for generalized amino-acids with stopping sign included now. From the degeneracies for special symbols, the entropy is  $s = 1.22$  bits per 'amino-acid' for this kind of code. If one includes also stopping sign one has  $s = 1.30$ .

### 2.3.4 Comparison of the information contents of various codes

In [H8] an information measure to the genetic code was associated. This information gain was defined as a difference of two entropies. The first entropy corresponds to situation when there is no correspondence between amino-acids and DNA. This entropy is given by

$$S_{max} = \log(N_{dna}!N_a!) .$$

Here  $N_{dna} = 64$  and  $N_{aa} = 20$  refer to the numbers of DNA triplets and amino-acids. The second entropy is entropy due to the permutation symmetry of codons coding the same amino-acid and defined as

$$S = \log\left(\prod_n n!^{N(n)}\right) ,$$

where  $n$  runs over amino-acids but does not include stopping sign. The information gain associated with the establishment of the genetic code is defined as

$$I = S_{max} - S .$$

The following table gives the entropies and information gains for various codes.

Code	$(N_{dna}, N_{aa})$	entropy	I
ours:	(64,20)	45.5	202.1
capital:	(64,20)	40.5	207.0
small:	$(4 \times 17, 20)$	63.1	201.2
small:	(16+64,20)	67.9	248.1
small:	(16+24,23)	75.9	240.5

Table 8: The table gives entropies and information gains for various codes. For the notation see the text above. Oppose option is used for calculation.

### 2.3.5 Is there a DNA doublet code present?

It is not obvious whether the codon of the possible exotic genetic code corresponds to 3 bases. If the exotic RNA corresponds to passive RNA as the message suggests, the counterparts of the amino-acids need not be molecules but could be some electromagnetic signals, perhaps topological light rays characterized by polarization direction. The work of Gariaev [45] and TGD based interpretation for it suggest that four pairs of radio waves with orthogonal polarizations provide the counterparts of the amino-acids. If plasmoid like life-forms are in question, micro-waves are indeed crucial for the metabolic cycle, and one expects that there is genetic control of micro-waves involved. Of course, doublet code could also be realized chemically: nothing precludes the simultaneous presence of both chemical and micro-wave codes.

If a base pair indeed represents single codon, one has  $M_5$  code, and 16 codons must be represented. In case of the ordinary genetic code the number  $M_7 - 1 = 126 = 6 \times 21$  is related to DNA-amino-acid coding with  $N = 21$  representing the number of different amino-acids which stopping sign counted as 'amino-acid'. In present case  $M_5 - 1 = 30 = 6 \times 5$  would suggest that 5 appears as a factor in the number  $N + 1$  of 'amino-acids' with stopping sign counted effectively as 'amino-acid'. There are three possibilities.

1. The fact that doublets code for 10 different 'pre-amino-acids' in case of the product code suggests that the number of 'pre-amino-acids' plus stopping sign is  $N + 1 = 10$ . This option is consistent with the idea that triplet code has emerged as a fusion of doublet and singlet codes

with 10 and 2 'pre-amino-acids' respectively. The degeneracies of various 'pre-amino-acids' are in this case dictated by the product model for the capital letter code.

2. The effective number for the counterparts of amino-acids is  $N + 1 = 15$ , this would give code for which 16 base doublets map to 14 counterparts of amino-acids and stopping sign. Two base doublets would map to the stopping sign or some amino-acid and the rest faithfully to amino-acids. The code would be maximally non-degenerate and such a low redundancy does not seem to be plausible.
3. There are  $5 - 1 = 4$  different 'pre-amino-acids' plus stopping sign. The ratio of number of DNA doublets to the number of 'pre-amino-acids' would be  $16/5 = 3 + 1/5$  and is rather near to the corresponding ratio  $64/21 = 3 + 1/21$  for the ordinary genetic code. The interpretation in terms of pairs of orthogonal polarizations for micro-waves might make sense. This code might be realized even at the level of ordinary DNA with pairs of bases forming basic units instead of triplets and it might be possible to test whether the translation of DNA to these 'pre-amino-acids' occurs.

### 2.3.6 Several codes might be associated with special signs and blancos

There are four special signs !, &, \, period, and blanco and the numbers of special signs in the message are given by the following table.

!	.	&	\	blanco
1	5	1	1	19

Table 9: The degeneracies of special signs for Crabwood message.

The interpretation of the last code word as \ raises some worries since the ASCII number of \ is larger than 64 whereas the ASCII numbers of other special symbols are smaller than 48. The total number of the special signs in the message is 8, period appears five times. The number of blancos is 19, this makes 27 signs altogether.

In ASCII code blanco is not counted as a symbol, or more precisely, any non-vanishing number of blancos has the same meaning. If the situation is the same now, it is possible to add arbitrary number of blancos to adjust the number of the code words such that it tells the prime  $k$  characterizing the life-form in question. This prime could characterize one of the Gaussian Mersennes  $k = 151, 157, 163, 167$  characterizing various kinds of biologies just as ordinary Mersennes and Gaussian Mersennes characterize various physics below atomic length scale.

There are several candidates for the code involved with the special signs. To discuss them first some background information about Mersenne codes is needed.

#### 1. Mersenne codes

In TGD [H8] an important class of cognitive codes correspond to Mersenne primes  $M_n = 2^n - 1$  and the number of the code words is  $M_n$  power of  $M_n$  instead of  $2^n$ . This can be understood as follows. In an external  $Z^0$  magnetic field neutrinos suffer spontaneous magnetization and spins become all parallel. This generates a conscious experience. For the configuration in which spins are parallel to  $Z^0$  magnetic field no phase transition occurs and no experience results. Hence this bit sequence is not consciously representable. The mechanism is actually much more general: any spontaneous magnetization or spontaneous electret formation process gives rise to similar representation. This reduces the number of code words to  $2^n - 1$ .

There is a beautiful connection with finite geometries. The finite geometry associated with  $M_n$  has  $M_n$  points whereas projective geometry with the point at infinity added has  $2^n$  points.

The point at infinity corresponds to the code word not consciously representable as spontaneous magnetization phase transition.

There is a hierarchy  $M_3 = 7, M_5 = 31, M_7 = 127$  of codes based on Mersenne primes. The number of code words for  $M_n$  is  $2^n - 1$  and corresponds to the number of statements about  $n$  basic statements with the statement which is not representable as a phase transition thrown away. The number of statements consistent with a given atomic statement is  $2^{n-1}$  and is 4, 16, 64 for the three cases  $n = 3, 5, 7$  respectively and corresponds to the number of singlets, doublets, and triplets of DNA bases.

1.  $M_3 = 7$  which appears in the 9-bit code is more primitive than genetic code: the number of DNAs for this code would be 4. The number of the counterpart of amino-acids for this code would be factor of  $M_3 - 1 = 6 = 2 \times 3$  and is 3 most naturally. Single base might could be the counterpart of the DNA triplet.
2. The number of statements consistent with a given atomic statement for  $M_5 = 31$  code is 16 and genetic codons correspond to two pairs of DNA bases. The number of counterparts of amino-acids plus stopping sign is factor of  $M_5 - 1 = 30 = 6 \times 5$  and is 5 most naturally.
3.  $M_7 = 127$  gives rise to 64 statements consistent with atomic statement of 128-element Boolean algebra coded to DNA triplets of the ordinary genetic code. The number of amino-acids plus stopping sign is factor of  $M_7 - 1 = 126 = 21 \times 6$  and is 21.

## 2. $Z_5$ code

The special signs correspond naturally to the four micro-wave counterparts for amino-acids in case of  $M_5$  code. The 16 RNA base doublets would replace RNA triplets as code words in case of the exotic RNA. Of course, this might make also in case of the ordinary RNA. The senders assume that the receiver knows or discovers the number of codons so that there is no need to code the number of codons mapped to the stopping sign. For this option blancos cannot have any meaning.

To get some ideas about what kind of codes are possible notice that in TGD based model of DNA-amino-acid correspondence is induced by an identification of the set  $X$  64 statements of 128-element Boolean algebra consistent with given atomic statement (single bit in bit sequence fixed).  $M_7 - 1 = 126 = 6 \times 21$ -element group  $Z_{126}$  is identified as a subset of the 128-element Boolean algebra. This identification induces automatically a map to the coset space  $Z_{126}/Z_6 = Z_{21}$  representing amino-acids and stopping sign, and the prediction is that the number of DNAs coding given amino-acid cannot be larger than 6. There are 7 different identifications of the set  $X$  so that the identification of DNAs is not unique.

In the case of the special sign code one as  $M_5 - 1 = 30 = 2 \times 3 \times 5$ -element group and code could be determined by similar map. There is quite a number of possible codes the possible factorizations of the number 30:  $Z_2$ -dcode,  $Z_3$ -code,  $Z_5$  code,  $Z_6$  code,  $Z_{10}$ , and  $Z_{15}$  code. Only  $Z_5$   $Z_3$  codes are possible now.

$Z_5$ -code would predict that the number of DNAs coded to same element is not larger than 6. Since the total number of special symbols other than blanco is 8, and the number of DNA doublets is 16, 8 elements are mapped to the 'stopping sign'. The  $Z_5$  code decomposes the 16 DNA doublets to two classes representing 8 statements consistent with a given statement and the Boolean complement of this set. Second class is mapped to 'stopping sign' and the rest 8 are mapped to 8 special symbols appearing in the message. For instance, if one of the bits in the four-bit code of DNA base vanishes, this would act as a stopping sign. One can say, that lie stops the action. The entropy of the code is  $s = \log(5)/4\log(2) = .6$  bits per polarized micro-wave pair.

$Z_5$  code has 16 code words and would be naturally associated with the exotic RNA. The code would assign to each DNA base doublet a pair of polarized micro-waves, 4 states altogether. If one takes seriously the suggestion of the Chilton message that passive RNA strand consists

of doublets and 2 RNA triplets define a unit for which twist is full  $2\pi$ , one could consider the possibility that this code is associated with the exotic RNA. On the other hand, the approximate decomposition of the triplet code to a product of doublet and singlet codes suggests that this code could be also associated with the doublets formed by the first to RNA bases of the triplets and realized also in life as we know it.

### 3. $Z_3$ code as dual of $Z_5$ code

For the proposed  $Z_5$  code the second half of DNA doublets are totally passive, and one could argue that this cannot make sense: there must be some code involved also with these DNA doublets.  $Z_3$  code is obviously what comes first in mind. TGD version for this code would predict that the number of elements mapped to a given element is not larger than 10 and is therefore possible. Now only !, & and period are counterparts of amino-acids and if stopping sign like action is at all involved it could correspond to period.  $Z_3$  code requires that \ does not represent a counterpart of amino-acid for  $Z_3$  code. That \ has ASCII number larger than 64 unlike the other three special symbols could be regarded as a signal for this.

The total number of elements mapped to  $Z_3$  by  $Z_3$  code would be 7 rather than 16. This is consistent with the idea that the DNA doublets which are passive with respect to  $Z_5$  code are active with respect to  $Z_3$  code, and that the DNA doublet which corresponds to a bit sequence 0000 is passive with respect to both codes. This conforms with the general ideas about how codes are realized consciously. In the realization based on phase transition the bit sequences consisting of say zeros only is not consciously representable and now it would correspond to the DNA doublet corresponding to 0000 sequence. In the proposed correspondence between DNAs and bit sequences this would correspond to GG.

A possible realization of these codes is in terms of pairs of micro-wave polarizations. Gariaev has found empirical support for the presence of this kind of code of this kind (radiation of laser beam with polarized coherent light generates polarized radio waves [45]) and I have proposed how this kind of codes might be possibly realized [H8]. The physical action of the micro-waves would be induction of bridges between magnetic flux tubes and  $k = 151$  space-time sheets making leakage of super-conducting ions possible and generating thus kind of dynamical piece of wire in many-sheeted current circuitry responsible for homeostasis. In [N1] various aspects of the micro-wave mechanism are discussed.

For  $Z_5$  code all polarization pairs would be active. For the  $Z_3$  code micro-wave pair would induce conscious effect only if at least one polarization is in a selected direction. Logical operation OR for the two bits represented by micro-wave polarizations would be in question

### 4. $Z_3^3$ code for DNA triplets

The interpretation of the 19 blancos as representing stopping sign would imply that the number of code words is  $19 + 8 = 27 = 3^3$ , which brings in mind the number of bits of the code word of the message. This interpretation does not require the assumption that we already have discovered the micro-wave code. In this case one could consider of assigning  $M_2 = 3$  code to each DNA of DNA triplet. The 3 statements would correspond to all DNAs except the one represented by 00, G is good candidate for this DNA.

The 2 statements consistent with a given statement of each four-element Boolean algebra associated with  $M_2 = 3$  would define  $2 \times 2 \times 2 = 8$  statements mapped to the four signals and the remaining 19 statements would be mapped to stopping sign. Translation process would stop to a lie! The code could be associated with the checking whether each base of triplet belongs to the set of two allowed ones, say A or G.

For the proposed identification  $A = 10$ ,  $T = 01$ ,  $C = 11$ ,  $G = 00$ , the appearance of G(uanine) in the triplet would mean that triplet is mapped to the counterpart of stopping sign (does not generate micro-wave pair at all perhaps) This code would be naturally associated with the ordinary

DNA. I have proposed family of codes based on Mersenne primes and associated with DNA in [H8]. This interpretation would bring in  $M_2^3$  code,  $M_3^3$  code with  $7^3$  code words inspired by the 9-bit code words would have 64 DNA triplets in the role of amino-acids.

### 3 What can one conclude about aliens?

In the sequel "aliens" refers to the life forms whose genetic code Crabwood message is assumed to represent. The basic question concerns the identity of aliens.

#### 3.1 Intra- or futuro-terrestrials?

The fact that the Chilbolton message has appeared so soon after the sending of Arecibo message could mean two things.

##### 3.1.1 Intra-planetaries...

If the constructors of crop circles have received Arecibo message telling about us the, the civilization in question can be at most at a distance of few light decades. Even more, 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 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 micro-wave range. One should not forget the spectroscopic evidence for water at solar spots [19] and for solid calcium-ferrite surface at photosphere [44] having interpretation in terms of dark  $N$ -matter. Notice also the fact both calcium and iron ions are fundamental for the terrestrial life.

The question is where in the Earth's magnetosphere (with dark flux sheets included) the biological bodies of aliens could be hiding (magnetic bodies of aliens could differ from those of ours in any essential manner). 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.

##### 3.1.2 ... or futuro-terrestrials?

If the crop circles are generated by communications involving negative energy photons (phase conjugate light) as the model for the realization of intentional actions indeed implies, then the signals responsible for the formation of crop circles arrive from the geometric future. In this case the civilization could be arbitrary far away from Earth and the temporal distance would determine the dark matter level to which it corresponds (in particular, the span of its long term memories). Chilbolton message however leaves only the possibility that the civilization is some other civilization or ourselves of the geometric future after the colonization of Mars and Jupiter.

This civilization must have invented the technology making it possible to apply time mirror mechanism to induce magnetic self-organization patterns leading to the generation of plasmoids serving as mediums for telepathic communications and able to perform simple tasks like construction of crop circles. The smaller size of Sun could indeed mean smaller size of Sun: standard model predicts that the radius increases very slowly so that this interpretation seems to be wrong in standard physics context.

Notice that the idea about intra-planetary life need not be in conflict with the idea that Crabwood and Chilbolton messages come from a distant geometric future. Indeed, intra-terrestrial life, possibly as some variant more primitive than terrestrial life, is supported by the TGD inspired model for pre-biotic evolution [L4].

### 3.1.3 The basic options for the interpretation of Chilbolton and Crabwood messages

One can imagine several options depending on what interpretation of Chilbolton and Crabwood messages one adopts.

1. The minimal assumption is that only plasmoid like life forms survive at the high temperatures of the Earth and planetary interiors. In this case the three codes could be assigned with the life forms assignable to Sun, Mars, and Jupiter. These three codes could also correspond to those of futuro-solars, -martians, and -jovians).
2. Inherently dark bio-molecules and  $N$ -molecules could make possible also life at hot temperatures of Earth's interior. This option will be discussed in the sequel. Even in the case that IT life forms with genetic code are possible, the simplest assumption is that their genetic codes are same as those of ordinary terrestrials so that three codes would result as suggested by the Crabwood message.

## 3.2 Two guesses for the temporal distance of futuro-terrestrials

In the following two guesses for the temporal distance of futuro-terrestrials are discussed.

### 3.2.1 First guess

There are highly controversial claims that Sun is shrinking with the rate of .1 per cent per century [20]:  $d\log(R)/dt = 10^{-3}/\tau$ ,  $\tau = 100$  years. The analysis of [21] however led to a conclusion that only oscillations with a period of 76 years are in question. If the shrinking occurred for the entire Sun rather than only surface layers, the claimed rate for shrinking would mean that gravitational energy would be liberated with a rate  $P = GM_{Sun}^2/R \times d\log(R)/dt$ , which would give  $P \sim 10^{29}$  Watts, which is much higher than the power  $P \sim 4 \times 10^{26}$  Watts radiated by Sun by known mechanisms. The presence of the classical  $Z^0$  force could make possible considerable deviations from the standard stellar evolution and might be also needed to explain the oscillations of the solar radius. The increase of the gravitational binding energy could be compensated by the increase of the repulsive  $Z^0$  Coulombic energy so that the catastrophic conclusion could be avoided. One could say that gravitational and  $Z^0$  force serve opposite tendencies compensating each other in the "solar homeostasis".

If the shrinking were real and would continue with the rate claimed in [20], one would have  $R/R_{now} = \exp(-10^{-3}t/\tau)$ . If the radius in Chilbolton message is by a factor  $k < 1$  smaller than in Arecibo message, the proposed interpretation implies that the message must have been sent from at temporal distance  $t \simeq \log(1/k) \times 10^3\tau \sim 10^5$  years in the geometric future. A more realistic estimate would probably increase the value of  $t$  by some powers of 10. If this extremely light hearted argument were taken seriously, a breakthrough in time mirror technology is not to be expected during my lifetime!

In the model for a fractal hierarchy of EEGs predicting correctly the band structure and narrow resonance bands of ordinary EEG the characteristic time scale of life forms at  $k$ :th level of hierarchy corresponds to the Josephson period of the Josephson junction defined by the scaled up version of cell membrane and scales as  $\lambda^k$ .  $k = 7$  level of dark matter hierarchy corresponds to a time scale of  $\sim 50$  years. The ability to communicate with geometric past in a time scale of  $10^5$  years, which corresponds to the next  $k = 8$  level of the dark matter hierarchy, means that this is also the characteristic time scale for the long term memories of futuro-terrestrials.

### 3.2.2 Second guess

One can imagine also a second manner to guess the temporal distance of futuro-terrestrials. Rather curiously, Crabwood formation appeared year and one day later than Chilbolton formation. A

possible interpretation is as a message telling that it takes one day more for Earth to rotate around Sun in the geometric future so that year is by one day longer.

The mass loss of Sun causes the gradual weakening of the gravitational force of Sun causing the increase of the radii of planetary orbits and thus also of orbital periods. The rate for the increase of the orbital period is  $d\log(T)/dt \equiv 1/\tau = -1/4 \times d\log(M_{Sun})/dt$ . The rate of the solar mass loss is believed to be mostly due to the energy liberated in fusion, and one has in a good approximation  $d\log(M)/dt = 10^{-13}/\text{year}$ . This gives  $T(t)/T(\text{now}) = \exp(t/\tau)$ . The lengthening of year by one day requires a time  $t \simeq \tau/365 \sim 10^{11}$  years, which is about one percent of the rough estimate for the lifetime of Sun, and of the same order of magnitude as the estimates for the time parameter called the recent age of the Universe. In fact, Sun is estimated to become a red giant within 7.5 billion years making life as we understand it impossible at Earth.

This would mean that futuro-terrestrials would correspond to  $k = 10$  level of dark matter hierarchy which almost cosmological time span of long term memories.

This estimate is based on the neglect of perturbations caused by planets to each other's orbits. The multiple gravitational resonances between planets resulting, when the ratios of rotation or precession periods are integer valued, are a route to chaos (in the sense of complexity rather than randomness) in the planetary system. Since also  $Z^0$  force is  $1/r^2$  force, this holds true also when classical  $Z^0$  force is taken into account. These resonances can affect dramatically orbital parameters. Numerical simulations lead to the conclusion that the Lyapunov time of planetary system is 5-10 million years [22]. If this holds true also in TGD Universe, then the parameter  $t$  for the future civilization for which year is one day longer than for us, could be as small as million years and of same order of magnitude as the first estimate giving  $k = 8$  for the level of dark matter hierarchy characterizing futuro-terrestrials.

### 3.3 Conditions on high- $T$ life

In the following some conditions on life at high temperatures are discussed on basis of the general vision about magnetic bodies as controllers of biological bodies discussed in the first part of the chapter [N2].

#### 3.3.1 Inherently dark atoms might allow the survival of chemical life at high temperatures

The model for crop formations was developed few years before the emergence of dark matter hierarchy and involved the notion of intra-terrestrial life.

Certainly the high- $T$  life in form of plasmoids could exist but if one interprets Chilton and Crabwood messages as information about IT life or high- $T$  life in Sun, Mars, and Jupiter, also chemical life should be possible and should resemble ours to a high degree.

##### 1. First option

The only way out in the framework of the ordinary quantum mechanics is that the space-time sheets are virtually thermally isolated so that even in the interior of Earth space-time sheets with room temperature are possible. Also space-time sheets for which ELF frequencies correspond to energies above thermal threshold must be present to explain the correlation of EEG with consciousness. A further hypothesis was that the typical size of the space-time sheet corresponds to the de Broglie thermal wavelength  $\lambda_{dB}(\hbar, T) = \sqrt{3}\hbar/\sqrt{2mT}$  for the typical particles involved. This would allow room temperature space-time sheets also in harsh environments like the interior of Earth. If thermal isolation fails then situation changes and space-time sheets with size larger than  $\lambda_{dB}(\hbar, T)$  are not possible.

##### 2. Second option

The discovery of dark matter hierarchy allows to give up the hypothesis about thermal isolation. If inherently dark atoms as  $\lambda^k$ -fold  $M^4$ -coverings of ordinary atoms and having essentially same energy spectrum are possible at  $k^{\text{th}}$  level of dark matter hierarchy ( $\hbar(k) = \lambda^k \hbar_0$ ), then also  $N$ -atoms and  $N$ -molecules become possible as discussed in the first part of this chapter [N2]. Note that the formula for  $\lambda_{dB}(\hbar, T)$  generalizes and predicts a dark hierarchy of thermal de-Broglie wavelengths.

There is also an additional constraint on the temperature. Quantum criticality plays a key role in TGD inspired quantum biology and since the energies of photons resulting in the transitions of  $N$ -particles are scaled up by  $N$ , one might argue that also the critical temperature at which intelligent life is possible (about 36-37 °C for ordinary life and understandable in terms of high  $T_c$  superconductivity [J1, J2]) is simply scaled up by  $N$  in the first approximation. Certainly  $N$ -water would be required as well as  $N$ -DNA and  $N$ -aminoacids plus other biologically relevant  $N$ -molecules satisfying  $N > T/T_{\text{room}}$ . These molecules could perhaps give rise to a dark variant of ordinary life surviving at temperatures encountered in the Earth's interior.

Also ordinary life could involve  $N$ -DNA and  $N$ -aminoacids but in the interior of Earth the range of thermally stable values of  $N$  would be narrower unless the value of  $\lambda^k$  is higher. The model for the replication of DNA and lock and key mechanism of bio-catalysis suggests that dark  $N$ -hydrogen atoms are most probably associated with hydrogen bonds.

### 3.3.2 How the integers characterizing $N$ -bio-molecules in the Earth's interior should depend on the temperature?

Ordinary life is possible only in a very narrow temperature range around 37 K and as explained quantum criticality explains this [J1, J2]. Dark matter inspired option for high- $T$  life is based on replacement of Earthly bio-molecules with their  $N$ -variants with larger  $N$  so that one would have  $N$ -H<sub>2</sub>O,  $N$ -DNA,  $N$ -proteins, etc. with  $N/N_{\text{room}} > T/T_{\text{room}}$ .

The critical temperature  $T_c$  around which life is possible would be scaled up to  $T_c \rightarrow NT_c$  and the minimal value of  $N$  as a function of temperature would be given by  $N_0 = [T/T_{\text{room}}]_+$ , where  $[x]_+$  is the smallest integer larger than  $x$ . In particular, this formula would determine the dependence of  $N_0$  as a function of depth as one goes to interior of Earth. The space-time sheets of  $N$ -atoms would be  $\lambda^k \geq N$ -fold coverings of ordinary space-time sheets.

$T$  increases by an order of magnitude from  $T_0 = 300$  K to  $T = 1300$  K at crust-mantle boundary to  $T = 4000$  K at the mantle-core boundary, and to  $T = 4600$  K at core-inner core boundary. This means that also  $N$  does so that one would have  $N/N_{\text{room}} = 40/3 \sim 13$  at the mantle-core boundary and  $N/N_{\text{room}} \sim 15$  at core-inner core boundary. In principle, for  $k = 1$  and  $\lambda = 2^{11}$  even temperatures up to  $T = (2^{11}/N_{\text{room}}) \times 300$  K would be possible.

There is evidence for solid structures in the mantle-core boundary [23] where most solids are thermally unstable. Due to the high pressure the interpretations in terms of standard physics are of course possible but one can also ask whether this evidence could be seen as evidence for dark matter structures consisting of  $N$ -molecules with  $N > T/T_c$ , where  $T_c$  is the melting temperature of ordinary molecule.

### 3.3.3 Conditions from the thermal stability of EEG

EEG and its scaled up variants are in a fundamental role in the control of biological body by magnetic body and this should hold true also for ITs. According to the model of EEG resulting as a special case of the model for the fractal hierarchy of EEGs and its generalizations [M3], EEG involves two components. The first component corresponds to the harmonics of cyclotron frequencies of biologically important ions: most of them belong to the alpha band. Dark ions reside at magnetic flux sheets traversing DNA and cyclotron radiation affects directly DNA. Cyclotron frequencies are associated with motor control affecting directly DNA and inducing gene expression

among other things. The models leads naturally to the introduction of the notions of super DNA and hyper DNA [M3].

Josephson junctions associated with cell membrane and its scaled up dark variants define second contribution to EEG as frequencies associated with coherent state of photons emitted by Josephson current. The frequencies are expressible as  $f_{n,\pm} = nf_c \pm f_J$  and alpha band and its harmonics split into counterparts of beta and theta band.

The essential condition is that cyclotron energy scale is above the thermal energy. This fixes the minimal value of the integer  $k_{em}$  characterizing the level of dark matter hierarchy involved. For EEG frequencies the minimal value of  $k_{em}$  is  $k_{em} = 4$ . DNA cyclotron frequencies assuming that the charge of DNA is solely due to the phosphate groups  $\text{PO}_4^{2-}$  is around 1 Hz and just above the thermal threshold. The thermal stability of DNA cyclotron frequencies is satisfied if the ratio of the cyclotron energy to thermal energy is not smaller than one. Hence the ratio  $B/T$  cannot be smaller than at the surface of Earth unless  $k_{em} = 5$  is assumed.

Second condition is that Josephson energy determined by cell membrane voltage and assumed to be same for all scaled up variants of cell membrane is above thermal energy. The minimum condition is that membrane voltage scales up as  $V/V_{room} = T/T_{room}$ . It is not clear whether physiological constraints allow to increase the strength of the membrane electric field keeping. A more promising option is the scaling of cell membrane thickness by a factor  $T/T_{room}$  and keeping electric field strength unchanged.

Josephson frequency  $f_J$  would scale as

$$f_J = \frac{T}{T_{room}} \times f_{J,room} ,$$

where  $f_{J,room} \simeq 5$  Hz holds true. Alpha band and its harmonics and also the widths of theta and beta bands would scale like  $B$ . The positions of theta and beta bands would scale like temperature, and one would have the formula

$$f_{n,\pm} = \frac{B}{B_E} nf_c \pm \frac{T}{T_{room}} f_J$$

for the frequencies in the generalized beta and theta bands, when  $k_{em} = 4$  holds true also in the high- $T$  environment.

It is illustrative to consider some examples.

### 1. Mantle-core boundary

The temperature is  $T = 4000$  K  $\sim 13T_{room}$  at the mantle-core boundary. This temperature allows simple ordinary molecules like Carbon monoxide and water (due to the high pressure). This temperature would favor the scaling factor  $\simeq 16$  for the cell membrane thickness and scaled up lipid layers would correspond to the p-adic length scale  $L(157) = 8$  nm and cell membrane to  $L(3, 53) = L(159)$ .

IT life at mantle-core boundary might fail because DNA cyclotron frequencies are not thermally stable if there are 2 units of charge per nucleotide (phosphate ion) and the membrane voltage cannot be increased. As already noticed, Crabwood message suggests that the DNA of aliens involves di-phosphate ions instead of mono-phosphates so that the charge per unit length would increase by a factor of 2 and thermal stability would result since the ratio  $E_c/T$  would be essentially the same as at the surface of Earth.

### 2. Sunspots

The average temperature of the solar photosphere is about 5800 K whereas the minimum temperature is  $T_{min} = 4000$  K and same as the temperature at mantle-core boundary. The favored value for cell membrane thickness would be same as in case of mantle-core boundary. Inside

sunspots the temperature varies in the range 3000-4800 K and sunspots, which are analogous to tornadoes, would be good candidates for the seats of solar life forms. Spectral analysis demonstrates the presence of water inside sunspots [19]: the de-coherence of  $N$ -photons emitted by thermally stable  $N$ -water molecules with  $N > 10$  would explain this finding as well as the evidence for solid calcium ferrite surface at photosphere [44].

The value of the sunspot magnetic field is between 1600-2500 Gauss and thus cyclotron frequency is about 3200 – 5000 times higher than at the surface of Earth. Also in this case  $k_{em} = 4$  level would correspond to thermally stable EEG photons. Whether the fast time scale of solar EEG is consistent with the dynamics of DNA translation which corresponds to EEG time scale in case of ordinary biology, is not clear. If the conformational dynamics of  $N$ -DNA is what poses the basic restrictions on the rate of translation, this is not a problem.

### 3.3.4 De-Broglie temperature and the p-adic length scale of the space-time sheet

A rough estimate for the typical size of the space-time sheet for a system consisting of  $N$ -particles of mass  $m = Am_p$ ,  $A$  mass number, at temperature  $T$  is obtained as the thermal de Broglie wave length  $\lambda = \sqrt{3}\hbar_0/\sqrt{2Am_pT}$ . Note that the estimate does not depend on  $N$  or  $\hbar(k)$  for inherently dark atoms and is same as for ordinary atoms. This follows from the  $\lambda^k$ -covering property alone of  $N$ -particles.

1. The hypothesis about the thermal de-Broglie wave length as a typical size of a stable space-time sheet would suggest that the ordinary hot matter (liquid quartz or iron) resides at the  $k = 131$  space-time sheets.
2. For water with  $A = A_w = 18$  at room temperature  $T = 330$  K one has  $\lambda \simeq .7$  Angstroms so that  $k = 137$  is a reasonable identification for the p-adic prime characterizing the atomic space-time sheet in this case (note however that  $L(137) = .78$  Angstroms is slightly above  $\lambda$ ).

The p-adic length scale associated with  $\lambda$  changes at certain critical temperatures  $T$  coming as powers of 2 using a suitable unit and characteristic for a given atom. The critical values of temperature could define physically detectable boundary layers. The p-adic length scale  $L(\lambda)$  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  $L(131)/L(137) = 1/8$  at the layer where  $k = 131 \rightarrow k = 137$  transition occurs. For  $A(Si) = 32$  *resp.*  $A(Fe) = 56$   $k = 137 \rightarrow 131$  transition should occur at  $T = 1524$  K below crust *resp.*  $T = 871$  K inside crust.

The presence of  $k = 131$  space-time sheets at the mantle-core boundary (and inside sunspots) would add to the metabolic repertoire strong metabolic energy quanta corresponding to the dropping of protons and electrons to larger space-time sheets from  $k = 131$  space-time sheets. The quanta would be about 32 eV for protons and 64 keV for electrons. The hot environment would be an ideal provider of metabolic energy for high- $T$  life-forms.

## 3.4 What IT life could look like?

Taking into account the almost identical properties of  $N$ -atoms and ordinary atoms, it might be better to transform the question "What IT life could look like?" can be replaced by "How IT life differs from the life in biosphere?".

### 3.4.1 Some arguments supporting IT life

The following arguments favor IT hypothesis.

1. 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. Recall also that  $N$ -DNA and  $N$ -aminoacids would be possible for  $N > T/T_{room}$  by the previous argument.
2. 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 micro-meters are found from crop circles, and these elements must have been solidified from molten state in situ. The additional message of molten state for quartz and iron, besides providing information about plasmoids themselves, could be that it is planetary interiors, where the biological bodies of the life-forms responsible for the crop circles 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 life-forms receive much less solar radiation than us.
3. 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 dark photons situation changes, and the transparency of liquid glass might be due the fact that some fraction of photons propagate as dark photons through it. Hence quartz is transparent in liquid state, and thus an optimal candidate for a medium whose behavior is quantum controlled from larger space-time sheets.

### 3.4.2 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.

1. Earth's interior decomposes into a relatively thin crust of thickness 30-60 km; a plastic mantle consisting mainly of Si, O, Mg, Fe, and Al mostly in form of silicates  $FeO-SiO_2$  and  $MgO-SiO_2$ ; a 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 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.
2. 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 [23]. 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 possibly consisting of thermally stable  $N$ -atoms and -molecules. 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.

3. Quite recently it has been announced that Earth contains a previously unidentified core region with size of 300 km [17]. 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 wave length 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 [24]. 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 at 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 or its dark variant 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 bio-control from magnetic flux tubes would operate on the local direction of magnetization of the magnetized regions in the boundary region. Crabwood message could contain also a third genetic code consisting say 5+1+1+1 special symbols alone and coding 16 DNA doublets to 8 amino-acid. This simpler life-form might reside at the most inner boundary and be associated with the plasmoid like life forms.

### 3.4.3 What could the EEG and sensory representations of ITs look like?

If the sensory representations of IT life-forms are realized at the personal magnetic canvas and at magnetosphere in the same manner as ours, the cyclotron transitions at the distance of about

$$r_1(A) = (A/A_1)^{1/3} \times r_0 \ ,$$

giving

$$y(A, A_1) = (A/A_1)^{1/3} \times x \ .$$

Here  $r_0 = xR$  is the radius associated with the life-form, and  $r_1 = yR$  is the distance at which the sensory representation is realized.  $R$  denotes the radius of Earth and  $A$  the mass of the ion at

$r_0$  associated with IT cyclotron transition and  $A_1$  the mass of the ion at  $r_1$  defining the cyclotron transitions associated with the sensory representation.

If the most important frequencies of alien EEG correspond to cyclotron frequencies, if aliens live at the mantle-core and core-inner core boundaries, and if the magnetic field inside Earth behaves as dipole field in a reasonable approximation, one can deduce the EEG frequency range of aliens by scaling the human frequency range by the ratio

$$x^{-3} = \left(\frac{R}{r}\right)^3 = \left[\frac{f_S(r)}{f_S(R)}\right]^3 ,$$

where  $r$  is the distance of the boundary region from the center of the Earth. The constraint that representation is realized in inner magnetosphere gives the bound  $y \leq 6$  and the constraint that it is realized in ionosphere gives  $y \simeq 1$ .

### 1. Biosphere

In this case the basic equation is obtained by putting  $x = 1$  in the general equation so that one has

$$y = \left(\frac{A}{A_1}\right)^{1/3} .$$

For protonic representations with  $A_1 = 1$  possible in entire inner magnetosphere the constraint  $y \leq 6$  allows all possible values of  $A$ .

### 2. Mantle-core boundary

For mantle-core boundary the ratio is roughly  $x^{-3} = 7.1$  so that the EEG frequency range 1.5 – 90 Hz scales up to 107 – 639 Hz. Sensory representations can in this case be realized as ionic transitions in atmosphere. The basic equation is

$$y = \left(\frac{A}{A_1}\right)^{1/3} x ,$$

where  $A$  is the mass number of the ion in mantle-core boundary and  $A_1$  is the mass number of representative ion. For protonic representation one has

$$y = 1.92A^{1/3} .$$

The condition  $y \leq 6$  guarantees that representation is realized in the inner magnetosphere and gives  $A \leq 27$ . This corresponds in ordinary EEG to frequencies  $f \geq 11$  Hz. For  $A_1 > 1$  also scaled up variants of alpha and theta frequencies are representable: note however that the densities of these ions are probably much smaller than in ionosphere.

One can consider also ionospheric ion representations satisfying  $y \simeq 1$  for mantle-core boundary. Now the mass numbers of the ions involved are related by

$$\frac{A}{A_1} \simeq x^{-3} \simeq 7.1 .$$

The biologically most interesting ions have  $A > 7$  and are representable. One manner to realize this sensory representation is using cells or brains of various organisms and one might consider the possibility that we actually are life-forms which have developed as magnetospheric sensory representations of the life-forms at the mantle-core boundary.

### 3. Core-inner core boundary

For core-inner core boundary the ratio is roughly  $x^{-3} = 263$  for  $f_S(r) = 50$  Hz and  $x^{-3} = 135$  for  $f_S(r) = 40$  Hz. In this case only electronic sensory representations are possible and one has

$$y = \left(\frac{Am_p}{m_e}\right)^{1/3} x ,$$

1. For  $x^{-3} = 263$  this gives

$$y \simeq 1.98 \times A^{1/3} .$$

The range [1, 6] for  $y$  corresponds to the inner magnetosphere and the upper bound  $A \leq 27$  and to scaled up variants of cyclotron frequencies above 11 Hz in ordinary EEG. Only beta and gamma bands would be represented.

2. For  $x^{-3} = 135$

$$y \simeq 2.48 \times A^{1/3}$$

The upper bound for  $A$  is  $A \leq 14$  and to the scaled up variants of cyclotron frequencies above  $\sim 20$  Hz in ordinary EEG.

#### 4. Inner core-most inner core boundary

The boundary of the most inner core of radius 300 km could also be carrier of life-forms, perhaps plasmoid like life-forms. The simplest hypothesis is that the magnetic field associated with the plasmoids is the Earth's magnetic field in the core region of Earth, which would be constant and of order .2 Tesla below this distance if dipole approximation makes sense.

If important EEG frequencies correspond to cyclotron frequencies, part of the EEG would be scaled up by a factor  $2^{169-157} = 2^{12} \simeq 4000$  so that EEG frequency range .25 – 90 Hz would be mapped to 1 – 360 kHz. Ionic cyclotron frequencies would be in the MHz range with proton cyclotron frequency equal to 1.2 MHz. The cavity resonance frequency analogous to the lowest Schumann frequency for a structure with radius 300 km is 159 Hz.

If the sensory representations of IT life-forms possibly existing at at  $r_0 = 300$  kilometers are realized as electronic cyclotron transitions one has

$$y \simeq .59 \times A^{1/3} .$$

Ions with  $A \geq 6$  would be represented above Earth's surface. All ionic representations would be realized in Earth's interior.

### 3.4.4 What are the metabolic energy quanta of ITs?

ITs would share with us the basic quanta of metabolic energy which are .5 eV *resp.* 1 keV corresponding to the dropping of proton *resp.* electron from  $k=137$  space-time sheet to the magnetic flux tube of the Earth's magnetic field.

If  $k = 131$  corresponds to the hot space-time sheets at which liquid iron and quartz reside, the dropping of proton from the hot  $k = 131$  space-time sheet would correspond to a much higher energy of about 32 eV able to ionize hydrogen atom. For electron the corresponding energy would be 64 keV. 32 eV energy quantum might play a role in the intelligent control of the hot iron or quartz from larger space-time sheets. Even some kind of liquid iron or quartz metabolism could be imagined.

Also heavier atomic nuclei can drop to larger space-time sheets from  $k = 131$  space-time sheet. The zero point kinetic energy for a particle of mass number  $A$  at  $k = 131$  space-time sheet is obtained from proton's zero point kinetic energy  $E_p(137) \simeq .5$  eV by scaling  $E_A(131) =$

$2^6 * E_p(137) \simeq 32/A$  eV. For mass numbers  $A = 12, 14, 16, 32$  associated with  $N, C, O$  and  $Si$  which, according to Chilton message, appear in the DNA of aliens, this gives energies 2.7, 2.3, 2.0, 1.0 eV. These energies cover the wave length range for visible light. Obviously the dropping of ions from  $k = 131$  space-time sheet to larger space-time sheets could explain the visible light generated by plasmoids and the generation of light at these frequencies might provide a possibility to get a contact with plasmoids. These energies would be in exactly the same role as the proton's zero point kinetic energy in the ordinary metabolism, which suggests that IT and also plasmoid metabolism involves also the energies besides those associated with our metabolism. Entire fractal hierarchy of energy currencies would be thus involved. If the sizes of  $k = 131$  space-time sheets can vary so that the spectrum becomes effectively continuous, one can even consider the possibility that bio-photons are generated by the dropping of atoms from  $k = 131$  space-time sheets. The question is whether the propagation of a plasmoid like excitation at a temperature of order 3700 K along DNA double strand could generate bio-photons.

Dark micro-waves amplified by quartz crystals might be crucial for the metabolism of plasmoid life-forms and replace visible light serving as the "food" of the terrestrial life forms. Tectonic activity might be as important for these life-forms as solar radiation is for us. The crust and mantle could serve as amplifiers of em waves in a wide wave length range and make possible communications between IT and us.

### 3.5 Where did those 223 genes pop up?

The reports of the Public Consortium about human genome in Nature, Feb 15, 2001 [27] and of Celera Genomics in Science of Feb 16th, 2001, [28] contained two big surprises.

#### 3.5.1 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 amino-acid 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. 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.

### 3.5.2 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.

### 3.5.3 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.

1. 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?
2. 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.
3. 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.

### 3.5.4 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.

### **3.5.5 Who performed the (memetic and) genetic engineering?**

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

1. 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 life-forms, which were technologically much more advanced. These myths would relate to the last step in the sequence of engineering activities.
2. The second guess, intra-terrestrials (ITs), is natural if one accepts the TGD based identification of the life-forms responsible for the art of crop formations as ITs. The term intra-planetary (IPs) is actually more appropriate: the Chibolton crop formation, which obeyed the same format as the Arecibo message sent to the outer space and telling about our species, suggests that the life-forms 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.
3. The third guess, is that genetic engineering is due to a highly advanced civilization of a remote geometric future populating Earth, Mars, and Jupiter, and applying highly advanced technology based on time mirror mechanism and possibly utilizing simpler intra-terrestrial life forms, perhaps plasmoids, as their couriers. Abduction experiences might relate to genetic manipulations using plasmoids to do the hard job. In this case encounters with aliens would be based on sharing of mental images.
4. The fourth guess is that genetic engineering is self engineering. The work of Yu. Chen Kangeng gives evidence that the transfer of the genetic information by electromagnetic means is possible [46]. According to [47], where the method is summarized, the successful transfer of the genetic information from a donor bio-system to an acceptor system was achieved via high-frequency electromagnetic fields feed repeatedly through the optically-active donor bio-system and then delivered over a long period of time to the receiving bio-system in its early

developmental stages. The hybrids created through the irradiation of eggs and seeds with such "genetically loaded" fields are claimed to show very specific mixed characteristics that were transferred to the next generation without need for further irradiation.

It would seem that the donor genome or parts of it are imprinted to the electromagnetic field pattern in the process and that this field pattern is able to modify the target genome.

Nothing precludes the possibility that genes/supergenes/hyper genes at some level of dark matter hierarchy can also code for genetic self engineering since these activities are after all very similar to other genetically coded bio-chemical activities. The computer analogy would be programs writing programs. The engineering genes would be activated by *W* MEs inducing plasma oscillation patterns. The claimed effects could be understood if the interaction with genetically imprinted electromagnetic field pattern activates genes inducing genetic self engineering yielding the genetic modifications consistent with the pattern represented by the em radiation.

Magnetic body would receive information about the desired outcome as electromagnetic field patterns emitted by other organisms, most naturally members of the same species. If these modifications are successful, the magnetic body is exposed to this information for long enough time to react and activate *W* MEs inducing the genetic program inducing the genetic program leading to the suggested genetic modification.

Hyper-genes integrating groups of organisms to larger wholes would be naturally involved with the mechanism. This mechanism would guarantee a rapid propagation of successful genetic modifications to the entire population and would be much more effective than the slowly occurring selection of random mutations. The possibly existing genes responsible for the genetic self engineering could be also introns and express themselves by activating nuclear RNA and process like reverse transcription.

A further quite recent mystery discussed in [L1] is that corals seem to possess genes responsible for higher level psychological functions in mammals [34]: it is very difficult to understand this as an outcome of selective pressures combined with random mutations. The proposed mechanism might explain these genes as a result of genetic engineering.

During the early developmental stages the genome might be plastic enough to allow genetic self engineering. The genetic modification during this period also the most rational option since this gives the best guarantee that the modifications are transferred to the offspring.

### 3.5.6 Is genetic/memetic engineering an ongoing process?

Irrespective of whether IPs are the active genetic engineers or only realized the intentions of the civilization of geometric future, 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.

1. 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.
2. 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 life-forms 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.

3. 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 possible 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 highly life forms and us would probably be a catastrophic event. The reason is that the immune system of both ours and of higher life forms 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 their is even a report about ball of light caught in an act of constructing a crop formation.

### 3.6 Do Ts and ITs live in symbiosis?

IT hypothesis conforms with the age old beliefs about shamanic state as a travel to the interior of Earth. Shamanic state would involve quantum entanglement with IT life forms and sharing of their mental images. One can even imagine that magnetic bodies control several biological bodies, say ordinary biological body and IT body giving rise to a kind of superego-ego-id trinity. In the sequel some aspects of this hypothesis are discussed.

#### 3.6.1 How Ts and ITs could communicate?

Ts and ITs could interact via several mechanisms.

1. Communication via sensory representations would mean that for instance our magnetic bodies receive generalized EEG emanating from the biological bodies of ITs and in this manner experiences what it is to be IT. Reception would mean generation of cyclotron transitions. A model for the sensory representations of ITs have been already discussed. Since the cyclotron frequency scales and Josephson frequencies of ITs would differ from ours, positions and widths of EEG bands would be different and if the signal is received it is received by different portions of our magnetic body. For instance, for mantle-core ITs positions and widths of alpha band and its harmonics would be scaled up by  $B/B_E \sim 7$  and positions of beta and theta band relative to alpha band would be scaled up by  $T/T_{room} \sim 13$ .
2. Telepathic communications involving sharing of mental images of ITs by us could be considered. This would mean that our magnetic body entangles with the "brain" of IT or vice versa by  $W$  MEs. This mechanism would allow also to realize remote motor control of IT (our) biological body by generating dark plasma wave patterns by exotic ionization. If ITs correspond to  $N$ -atoms with different value of  $N$  there are restrictions on this communication mode.

One can imagine several mechanisms of telepathic communications between Ts and ITs.

1. The first mechanism is based on pairs of dark ELF MEs and micro-wave MEs such that microwave MEs propagate like particles inside ELF MEs acting as wave guides and define patterned pulses of duration not much longer than  $T = 1/f$ . For these representations the amplification of micro-wave MEs by piezo-electric quartz crystals in crust and mantle could be involved. Piezo-electricity is basic characteristic of also ordinary life. Microwave hearing for which a concrete model is discussed in [K5], provides a concrete example about this kind of communication: in this case microwave carrier frequency is modulated by audible

frequencies. The discrete version of the modulation would be the presence of microwave ME of varying duration or its absence.

2. The second communication mechanism would use pairs of radio wave MEs and MEs at the frequency range of visible light.
3. IT sensory representations generated by ionic cyclotron transition at mantle-core boundary can be realized using lighter ions at the surface of Earth: these ions could belong to our body or brain. Light ions in core-inner core boundary correspond to the frequencies of electronic cyclotron transitions at MHz range at the surface of Earth and provide a mechanism of communications based on active generation of mental images at our end of the communication line.

Microwaves modulated by MHz frequencies are involved with Priore's machine [63] and the findings of Sue Benford about intentional generation of dots and tracks on photographic emulsions [64]: the models are discussed in [K5]. Egyptian pyramids have a size scale which corresponds to MHz frequency scale: one can wonder whether these pyramids could have served as amplifiers making possible communications between humans and ITs or between humans and future civilization?

#### *1. ELF-micro-wave communications*

ELF-micro-wave communications could involve ELF MEs containing micro-wave MEs and coupling to Schumann resonances. Micro-wave MEs would in turn be amplified by quartz crystals.

Quartz crystals are piezo-electrics and ideal for transforming em waves to lattice oscillations and vice versa, and thus also for amplifying em waves. The frequency range of lattice oscillations has the cutoff frequency  $f_c = v/a$ ,  $v$  the velocity of sound in crystal and  $a$  the lattice constant. For  $v = x$  km/s this gives  $f_c = 10^4 \times x$  GHz, which corresponds to infrared photon wave length  $10/x$  micro-meters, so that micro-waves belong to the amplified range. The sizes of connected quartz crystals are bound from below and for the size of order 5 micro-meters, the frequency is about  $.2 \times x$  GHz, so that the length scale range between  $.3 \times x - 5 \times x$  micro-meters covers the frequency range  $.2 - 3$  GHz involved with the micro-wave hearing. At room temperature the values of the longitudinal and transversal velocities of sound in quartz correspond to  $x_L \simeq 2.7$  and  $x_T \simeq 2.0$  for the density for which  $SiO_2$  molecule corresponds to lattice cell with side .1 nm.

Micro-waves are the key controllers of the homeostasis, and quartz crystals could serve as amplifying mediums making possible remote self-organization induced by friendly ITs in the bodies of Ts and based on micro-wave MEs amplified by quartz crystals and propagating along ELF MEs. Shamanic healing could involve this kind of remote self-organization. Thus the old belief that quartz crystals have positive effects on health could have justification.

The correlation between tectonic activity and Schumann resonances on one hand and various altered states of consciousness on the other hand, in particular UFO and ET experiences, could be seen as an evidence for communications with ITs. That micro-waves generated by protein/DNA conformational transitions and rotational transitions of water molecules and their clusters seem to be so important for biological life, might relate to several facts: that quartz crystals in the size scale range defined by cell size amplify them, that they might serve as the "food" of the IT life forms and induce self-organization of T life forms, and that they are involved with the communications between IT and T life forms.

#### *2. Radio waves and visible light*

Interestingly, kHz frequency, which is the fundamental frequency of terrestrial life (frequency of neuronal synchrony, the time scale of nerve pulse, frequency involved with Kirlian imaging), correspond to a length scale  $r = 3 \times 10^5$  meters. Interestingly, this is nothing but the radius of recently found new core region of Earth, at which Earth's magnetic field corresponds to .2 Tesla

important for the plasmoid like life forms. This might be a pure accident but might have some deeper meaning too.

For quartz crystals kHz frequency would require a structure of size  $x$  meters using the parametrization  $v = x$  km/s for the velocity of sound in quartz.  $x = 3.2$  would mean a reasonable size. The thickness of the mantle-core boundary layer is measured in meters so that this layer might contain the needed large quartz crystals. Note that the velocity of sound is inversely proportional to the square root of density so that  $x$  is smaller near the mantle-core boundary and thus also the size of the required structures. For 2 cm sized quartz crystal the frequency would be near electron cyclotron frequency in  $B_{end} = 2B_E/5$  (this is the magnetic field explaining the effects of ELF em radiation in vertebrate brains and might be identified as a dark companion of the Earth's magnetic field).

According to the general model of remote mental interactions ("remote" is actually a very relativistic notion), these radio wave MEs should contain visible light MEs propagating like massless particles inside them and induce self-organization at the receiving end. The question is whether Ts routinely communicate with ITs using kHz radio wave MEs, and whether the neuronal synchrony is a signature of this communication. One can also ask whether terrestrial life could in this manner serve as a source of visible light for IT life in absence of a direct solar radiation. If so, there could be a symbiosis between these life forms and we would be only be at the verge of becoming conscious about this symbiosis.

### 3. Observations about resonance frequencies

One can imagine several resonances possibly relevant for T-IT communications and interactions.

1. The space-time sheet associated with the 20-70 km thick layer defined by the Earth's crust allows cavity resonances just as the 100 km thick layer between the Earth's surface and the lower edge of ionosphere does.
  - i) For the first type of resonances the wave is essentially constant in the radial direction and effectively 2-dimensional: these radial resonances are different from Schumann resonances. For ionosphere the lowest resonance frequency of this kind would be  $\simeq 10$  Hz. For the crust space-time sheet the lowest frequency would vary in the range 16.7 – 33.4 Hz.
  - ii) There are also radial resonances analogous to waves in box in the radial direction. For these resonances the varying thickness  $d = 20 - 70$  km of the crust would correspond to range of frequencies  $f = c/d = 4 - 15$  kHz for radial resonances. The strange 5 kHz sound reported near the crop formations corresponds to the thickness 60 km for the thickness of the crust, and one can wonder whether it also serves as a hint. What is interesting is that the time taken for this kind of radial wave to travel the distance 90+90+60 km from Earth's surface to the ionosphere and back down to the lower boundary of crust corresponds to a time interval which is quite near to the duration  $T = 1/1260$  of the bit of the memetic codon.
2. A further interesting finding is that for  $d = 2900$  km corresponding to the thickness of the mantle, the frequency of the radial waves is  $f_{max} = c/d \simeq 103$  Hz. Hence EEG frequencies correspond to distances larger than the vertical distance to the mantle-core boundary. Of course, the waves need not be purely vertical and this means that waves propagating to the mantle span the range  $f_{max} \times [1/\sqrt{1 + 2R/d}, 1]$ . The lower bound corresponds to 44.4 Hz slightly above the thalamocortical resonance band.
3. Interestingly, the so called taos hum [65] (which I also personally experience now and then) discussed in detail in [N1] has its fundamental frequency around 80 Hz. Taos hum begins at the sunset and ends at the sunrise, and correlates strongly with the micro-wave static which on basis of its complexity is believed to have a biological origin although to my best but unprofessional knowledge no detailed identification of the source of the static has been

suggested. Could it be that the micro-wave static arrives along vertical MEs connecting Earth's surface with the mantle-core boundary? Micro-wave radiation would be naturally modulated by the 80 Hz resonance frequency and its harmonics and would generate taos hum by the same mechanism as in the case of micro-wave hearing [43].

Could taos hum be generated by IT life-forms and is it meant to compensate for the loss of the micro-wave radiation coming during daytime from Sun? This would conform with the idea of fractal metabolism involving in an essential manner also micro-wave photons at special frequencies inducing ion flows between space-time sheets, say micro-wave photons at wave length of about 25 cm (6 cm) kicking protons from the magnetic flux tubes of the  $B_{end} = .2$  Gauss to  $k = 151$  ( $k = 149$ ) space-time sheets.

### 3.6.2 Paramagnetic rocks, bio-photons, and ITs

Dr. Phil Callahan has made fundamental contributions to the understanding of insect olfaction as infrared vision, and his findings have been of great help in developing quantum model for sensory receptors and sensory organs. The work of Callahan relating to paramagnetic rocks might have non-trivial connection with IT hypothesis.

#### 1. Callahan's findings about paramagnetism

Dr. Phil Callahan has found that the presence of paramagnetic rocks (say granite and basalt: quartz crystals basically) in a combination with a compost and micro-bes facilitate dramatically the growth of plants [42]. Why paramagnetic rocks are important is that their magnetic field is not fixed as in case of ferromagnets but varies with the external magnetic field and amplifies it. For instance, Schumann contribution to the magnetic field could be amplified. The flux tubes of the amplified magnetic field could also originate from the interior of Earth. Paramagnetically optimal rocks contain magma from volcanic eruptions and thus originating from the region where IT life forms are predicted to exist. Could it be that this material quantum entangles the plants via volcanic material with the ITs and makes communications possible?

Paramagnetism seems to be important for humans too. Callahan has carried out extensive measurements of the level of paramagnetism (presumably defined by the value of magnetic field in the soil) all around the world, and found that the soil in sacred places tends to be more paramagnetic than elsewhere. On basis of his measurements Callahan also reports that the intensity of the oscillating Schumann resonance part of the Earth's magnetic field correlates with the paramagnetic level of the soil. This looks natural since paramagnets amplify the oscillations of the Earth's magnetic field and possibly also those of its dark variant.

Furthermore, on basis of his measurements carried out around Earth Callahan concludes that the Schumann contribution to the Earth's magnetic field is abnormally weak in places where a lot of violence occurs. This kind of correlation is not surprising if magnetosphere, in particular its dark counterpart  $B_{end} = 2B_E/5$  is a living system interacting strongly with biosphere. In TGD framework Schumann resonances mediate horizontal communications between personal magnetic bodies, whose magnetic tubes might reside inside magnetic flux tubes of the Earth's magnetic field or its dark companion  $B_{end}$ . Thus abnormally low intensity of Schumann contribution would weaken the horizontal communications and in turn lead to a weakening of the collective consciousness. Sacred places would in turn be places where horizontal communications are strongest due to the strong Schumann resonance contribution.

#### 2. Bio-photons and paramagnetism: could IT see with phase conjugate laser light?

Callahan has also found that paramagnetic rocks generate bio-photons received by the roots of plants which he believes to act as wave guides. Bio-photons could serve communication purpose. Perhaps ITs communicate using memetic code realized as modulations of the bio-photon beam.

This would be consistent with the earlier suggestion that visible MEs propagating along MEs corresponding to frequencies of order kHz are key element of IT-biosphere communication. Quartz crystals with size slightly below micro-meter (cell size) would be ideal for generating the bio-photons. The depth of the cavity below ionosphere is about  $d = 80 - 100$  km whereas the thickness of the space-time sheet associated with the Earth's crust is  $d = 30 - 60$  km. The time taken by a photon to traverse 100 km distance forth and back is .67 ms very near to the duration of the bit of the memetic codon. Memetic codewords represented as sequences of bits represented by the presence of absence of this kind of back-forth reflected ray might be transformed by quartz crystals to signals propagating to the interior of Earth.

Also negative energy bio-photons analogous to phase conjugate laser beams could be involved. Feinberg has demonstrated that phase conjugate laser beams allow to see the target through say chicken [25]. The reason is that negative energy photons have energies with magnitude larger than thermal energy, and cannot not be "absorbed" (in this case absorber drops to lower energy state) except resonantly, say when they induce droppings of ions of living matter to larger space-time sheets. This makes this communication mode extremely selective.

Negative energy bio-photons would quite literally allow the ITs to see through the rock. Either ITs could provide energy for biosphere (as suggested by Callahan's findings) or biosphere could feed ITs. The high temperature of the Earth's interior would suggest that it we who receive the energy, and ITs who receive the sensory information about the world above Earth's biosphere!

### 3.6.3 DNA, hallucinogens, shamans, Freud, and myths of Christianity

Peter Gariaev [45] has found that the irradiation of DNA by laser light generates radio waves below kHz, and Fritz Popp [48] has discovered that DNA emits bio-photons with wave lengths in the visible wave length range. Both findings fit with the hypothesis that these telepathic communications occur at DNA level.

In his book "Cosmic Serpent" Jeremy Narby [35] takes seriously the stories of the shamans about travels under Earth during trance, and the myth that spirits have taught to the people of forests their surprisingly profound wisdom about medicinal plants and skills like weaving and spinning. Narby proposes that snake and double snake encountered universally in the shamanic mythology is a symbol for DNA. He even suggests that DNA and also visible light and radio waves are somehow involved with the telepathic communications during the shamanic trance but does not make guesses about the other participant of these communications.

Besides its extreme complexity and "reality", the objectivity of the experience supports the view that these experiences are much more than reactions to neuro-physiological disorders caused by drugs. Random input from the brains stem defining a starting point pattern completed by cortex to a sensible experience, was also the earlier view about the origin of dreams but has been given up now. Narby tells about collective experiences in which several participants had same experience, one participant continuing to tell about what he saw, when other participant ceased. The creatures encountered in shamanic experiences, in particular snakes, are same in all cultures. Snakes are seen by shamans even in areas, where snakes are not encountered.

If the communications are based on entanglement at DNA level, one has hopes of understanding the role of various hallucinogens in generating this kind of experiences. Perhaps some neurotransmitters and information molecules, while binding to the neuronal receptors, become molecular mediums entangling us with ITs. Hallucinogens could have more or less permanent entanglement with the IT life forms. Hallucinogens reduce inhibition in brain and this suggests that the role of the inhibition is to de-entangle and thus give rise to modern subjective consciousness in which the sharing of mental images is minimized and the organism behaves highly individually.

Shamans tell that the spirits have very human weaknesses: for instance, they like tobacco more than anything else. Nicotin affects like a neurotransmitter, and also our brains like tobacco. If the

ITs share the experiences produced by tobacco smoking, it is easy to understand how spirits can become remote tobacco addicts.

"The mother of a tobacco is a snake" is the title of a chapter in the book of Narby. Collective consciousness associated with the DNA in biosphere and below it could be the mother of tobacco and also the cosmic serpent believed to be the creator of all life-forms. The genetic codes of aliens, to be deduced later from the Crabwood message, encourage to think that ITs are at a higher evolutionary level than us. The myths according to which these spirits created also the life as we see it support the same conclusion. Perhaps IT life forms have actively guided the evolution of life-forms at the surface of Earth, and are doing it right now, and are in this sense creators of life-forms in biosphere. An active genetic manipulation of crops might be occurring in the crop formation areas. Remarkably, some women who have had abduction experiences claim that a cross breeding with aliens is involved with the fetus somehow taken away after some time.

On basis of his lifelong experimentation with certain hallucinogens Terence McKenna [36], one of the initiators of quantum consciousness movement at eighties, states that there are myriads of exotic life-forms just here, there is no need to travel to the outer space. In a description of tryptamine induced experiences McKenna says "First of all (and why, I don't know) you have the impression that you are underground - far underground - you can't say why, but there's just this feeling of immense weight above you but you're in a large space, a vaulted dome...".

Freud has given a modern formulation for ancient myths in terms of the trinity of super-ego, ego, and id. Magnetic body and higher magnetospheric levels of consciousness would represent the super-ego, physical body the ego, and id would correspond to the IT life-forms, all in a continual telepathic communication with each other. Also the shamanic tradition includes the spirits in the sky to their word order. In Finnish language 'Manala', the place were the dead continue to live and where also shamans visit, means 'under ground'. Perhaps the tradition of burying the dead relates to the intuitive idea that dead in some sense continue to live under ground. The Christian myths of holy trinity, of heaven-earthly life-hell trinity, and of ultimate salvation could also reflect the trinity of consciousness and anticipate the inevitable breakthrough of consciousness in which these three levels of self hierarchy become fully conscious of each other.

### **3.6.4 Model for the sensory representations and magnetospheric id-ego-super ego trinity**

The model for the sensory representations requires a comprehensive view about the structure of the personal magnetic body and its relationship to the Earth's magnetosphere. One can make only tentative guesses in this respect but quite general arguments lead to a picture supporting the magnetospheric id-ego-super ego trinity.

1. The personal magnetic body interacts with the external world, in particular, with the Earth's magnetic field and its dark variant and with the solar wind carried by the solar magnetic field. Hence the idea about personal magnetic body as a structure analogous to the Earth's magnetosphere is worth of testing. Personal magnetosphere could decompose into a part moving with the physical body and analogous to the inner magnetosphere, and a stationary, highly stretched, part analogous to the outer magnetosphere at the night side of Earth. Earth's magnetosphere-solar magnetic field interaction would be replaced by personal magnetosphere-Earth's magnetosphere interaction.

There are reasons to believe that one must distinguish between dark magnetic magnetic fields and ordinary ones and that dark magnetic fields are those which are most relevant ones for living systems.  $B_{end} = 2B_E/5$  would be the basic example of a dark magnetic field playing a key role in living matter. What dark space-time sheets with Planck constant not equal to the normal could really be is discussed in detail in [C7].

2. Solar wind would enclose the personal magnetic body inside the Earth's magnetosphere, whereas the interaction with the flux tubes of the Earth's magnetic field could force the flux tubes of the personal magnetic body to be more or less parallel to them. Incoherent summation of the personal and terrestrial magnetic fields, fractality, plus the fact that the field strengths associated with the flux tubes of the personal magnetic body should decrease much slower with the distance from Earth's surface than those of the Earth's magnetic field, are consistent the possibility that the flux tubes of the personal magnetic body reside inside the magnetic flux tubes of the Earth's magnetic field in far-away regions.
3. The highly self-organizing plasma sheet at the equatorial plane at the night side of the Earth's outer magnetosphere is an especially interesting structure as far as personal and magnetospheric sensory representations are considered. For the fractal option the plasma sheet of the Earth's magnetosphere would contain plasma sheets inside plasma sheets, in particular the plasma sheets associated with the personal magnetic bodies. Personal and magnetospheric sensory representations would correspond to different levels of the same fractal structure.
4. Also the intra-terrestrial part of the Earth's magnetosphere is important for the magnetospheric sensory representations and, if the fractality hypothesis holds true, also for the personal ones. The strange co-incidences of important cavity resonance frequencies of intra-terrestrial structures with EEG resonance frequencies, and the fractal correspondence between the architectures of brain and magnetosphere (discussed in [N1]) support the view that personal magnetic body extends also to the interior of Earth. The flux tubes of the Earth's magnetic field (with field strength increasing faster than for the flux tubes of the personal magnetic body) would be however contained *inside* those of the personal magnetic body in this region. The intra-terrestrial consciousness would therefore represent sub-...-selves of ours, something analogous to Id whereas magnetospheric sensory representations would correspond to the super ego. This interpretation conforms with the proposal that intra-terrestrial life forms are possible in the many-sheeted space-time, and that crop circle formations could be interpreted as attempts of ITs to communicate about their existence.
5. Probably it makes sense to speak about  $Z^0$  magnetosphere (both solar and terrestrial).  $Z^0$  magnetic flux tube structures are crucial for the model of long term memories [H6], and the sizes of the flux tube structures associated with the personal  $Z^0$  magnetic body should be measured in light years. This suggests that also much weaker personal magnetic and  $Z^0$  magnetic fields with the lengths of the closed flux tubes measured in light years are relevant.

### 3.6.5 Connection with the general view about life cycle of self

By the fractality of consciousness the anatomy of quantum jump represents the general structure of the life cycle of any self. First totally entangled multi-verse is generated, then state function reduction and preparation by self measurements occur and the end result is a maximally un-entangled state. This is what analysis following the birth of an intuitive idea is. By the fractality of consciousness same process occurs also in longer time scales since the sequences of quantum jumps effectively integrate to single quantum jump and the sequences of these effective quantum jumps have similar structure.

What is tragic is that the evolution of self at any level is also a decay process leading to alienation and loneliness at the level of conscious experience of sub-selves. What is consoling is that selves can lose consciousness and wake-up into new childhood. One can say that a healing sleep after a hard day is possible at all levels of self hierarchy.

Also ancient myths inspire to think that this vision applies to the evolution of modern subjective consciousness from more collective consciousness. Jaynes has proposed a vision about how

bicameral consciousness [37], in which the voices of Gods talking to people were talking to everyone, gradually transformed to the modern subjective consciousness. TGD based articulation of Jaynes's views based on the notion of semi-trance is discussed in the last chapters of this book written much before these lines were written.

The basic theme of this evolution is the gradual de-entanglement. The ancient world has survived in fairy tales. In this world remote mental interactions like telepathy, remote healing, and witchcraft were every-day life. Incredible-to-us physical feats like building of pyramids might have been made possible by the liberation of energy and coherent momentum in the formation of collective bound state entanglement. The rhythmic work songs helping to generate body synchrony are a remnant from this period, but are not sung in modern IT companies. Also the strange intra-terrestrial creatures and spirits of magnetosphere; fairies, trolls, eagle-headed humans, dreadful snakes,..., populated this world. Shamans tell completely seriously to the anthropologists about these creatures without any doubt about their reality. The human sacrifices for Gods, which look extremely cruel to us, were not experienced as such since these people were not individuals with ambitious plans for a lifelong career.

This development has a parallel at the level of personal life. Fairy tales are told to children, who themselves are living the period of oneness. Then these children grow, become more and more rational and analytic. They lose their ability to make choices and there is not much to choose anymore, and become often also lonely and separated. Gradual physical decay adds its own flavor to this process.

The entire evolution can be seen as wake-ups or re-births, bursts of potentialities from which only few are selected during gradual de-entanglement accompanying self-organization, with dissipation serving as the Darwinian selector. Huxley's view about brain as a filter makes sense: our brains minimize the sharing of mental images, which does not aid controlled behavior and survival, and thus make us modern individuals.

Inhibition by various neurotransmitters is a good candidate for a measure for the degree of de-entanglement. Inhibition acts as the filter, which de-entangles the brain from other brains and the body from the bodies of other life forms. During hallucinatory experiences, generated by say drugs, inhibition "fails". The degree of inhibition indeed increases, as one climbs along evolutionary tree and in human brain most of the neural activity is inhibition, a rather strange finding difficult to understand in the framework of the ordinary neuroscience.

In accordance with ontogeny recapitulates phylogeny principle, this evolution is seen as an increasing dominance of inhibition during the development of individual leading from spontaneous children to well-behaved and highly controlled adults. Only in some periods of life inhibition fails: during puberty, in physical death and in great turning points of life. Indeed, puberty and physical death are sometimes accompanied by poltergeist phenomena. Physical death also by telepathic phenomena. I experienced telepathic contacts and remote sensory experiences during my great experience. The anthropologist reporting his experience induced by ayahuasca in the book of Narby [35] tells that the strange creatures that he met told him that usually they are seen only by people who are dying.

This speculative picture could be tested. One could find whether some drugs could enhance telepathic and psycho-kinetic abilities. The "blessed are the meek since they quantum entangle" prediction could be also tested. Indeed, one of the most dramatic experiments supporting psychokinesis was done using chicken which imprinted to a robot [38]. The robot, whose behavior was programmed earlier by random number generator, tended to stay near the chicken, as if chicken had induced a quantum jumps changing the geometric past in macro-temporal time scales. Also the mysterious ability of birds and fishes to migrate back to their birth places might actually involve quantum entanglement.

Also magnetospheric selves have their own life cycle. As a matter fact, we should be living highly interesting times now. There is a compelling evidence suggesting that pole reversal has already

started and occurs during next millenia [40]. This would perhaps mean a period of sleep for the magnetospheric self followed by a wake-up to a new magnetospheric day. If the proposed general vision is correct, this could have enormous consequences for the character of the magnetospheric collective consciousness. We might be approaching the end of the period of individualization and the decay of the collective consciousness and have hopes about a new collective period.

The myth of salvation might be interpreted as this kind of wake-up of magnetospheric selves after un-conscious period. Note that also magnetospheric selves have geometries memories from the earlier wake-up periods so that dramatic loss of information about past would not be involved. The Omega Point of Teilhardt de Chardin is different articulation of the salvation myth. The rebirth of the magnetospheric selves would presumably mean a conscious sharing of mental images between the various layers of self-hierarchy including ITs, ourselves and magnetospheric selves. At least we have some hopes that the modern "global" market economy is not the final outcome of the human evolution.

### 3.7 Some questions

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

#### 3.7.1 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 ([41], see also [H9]). 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 life-forms 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 [36] 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 higher life forms 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.

1. 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.
2. 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 artifact like silica crystals suggest the presence of a conscious IT intelligence. Various silicates such as MgO/FeO-SiO<sub>2</sub> dominate in the mantle of the Earth. As will be found in the next chapter devoted to the pre-biotic evolution, crop circles could be also interpreted as giving information about the evolution of life at Earth. Earth consists mostly of ancient meteorites known as chondrites, and carbonaceous chondrites are known

to contain organic molecules. Thus IT life might have developed from these molecules in the womb of Mother Gaia and messages might try to tell also about this. Continuing the fractal metaphor, the bio-molecules in meteorites from outer space would take the role of the sperm as in panspermia theory.

3. The micro-wave induced explosions in growth nodes are a further manner to tell the serious researcher that hoax cannot be in question and that micro-waves are crucial aspect for the communications.
4. 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.

### 3.7.2 Why not earlier?

There are many reasons for why not earlier.

1. 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 life-forms 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.

2. 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 [16] 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  $4.4 \times 10^4$  year duration for the magnetospheric sleep-wake cycle.  $10^4$  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 irregular 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 [40] 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.

3. 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 [40]. 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.

### 3.7.3 How to communicate with ITs?

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

1. If the higher life forms behind Chilbolton message are indeed ITs, they have received and understood the Arecibo message so that we could continue communicating using this microwave wave length using the same frequency modulation based binary code. If ITs are only simple quantum couriers for the civilization of the geometric future, then direct communications with ITs are not so simple. In this case we could however try to establish conscious-to-us communication directly with the civilization of the future: very probably unconscious-to-us communications would be probably occurring all the time. It might be a good idea to try to develop communications based on topological light rays using light at p-adic frequencies

utilizing binary cognitive codes [L1]. We could also try to demonstrate the existence of the future civilization by using population inverted lasers at p-adic frequencies to receive negative energy signals from future.

2.  $k = 151$  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 micro-wave 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.
3. 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.
4. Situation might be even simpler than this: the Crabwood message suggests that the higher life forms 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.

### 3.7.4 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 cyano-bacterial 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 [31]. 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 space-time 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 wave lengths correspond to p-adic length scales between cell membrane thickness and cell size defined by four Gaussian Mersennes  $\lambda_h(k) = L(k) = 2^{(k-151)/2} \times 10$  nm,  $k = 151, 157, 163, 167$ . The photon energies are (126, 15.68, 1.96, .49) eV and correspond to the wave lengths (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.

### 3.7.5 Are ITs really at higher evolutionary level than us?

The metaphor about Earth's interior as the womb of Mother Gaia suggests that the life at the surface of Earth's is in the same relation as adult to a child. Therefore it seems strange that the genome of ITs would be more complex than that of ours. Also the Freudian IT=Id identification suggest that IT life is more primitive than T life. One can also wonder how a highly advanced intra-terrestrial civilization would see the trouble to and even could hide from us.

This forces to consider the possibility that the senders of the Arecibo message are in the geometric future. This would explain the smaller size of the Sun, that also Mars and Jupiter are populated, and the more complex genome, in particular the presence of silicon in the DNA. This does not mean that one should give up the IT hypothesis. ITs could be simple plasmoid like life forms used by the civilization of the geometric future to carry out simple tasks like building crop circles and even activities related to genetic engineering. This requires that the civilization of geometric future has a highly developed time mirror technology.

### 3.7.6 What is the message of the sacred geometry of crop circles?

Astronomer Gerald Hawkins has found that the areas for the circles associated with the crop formations are in diatonic ratios, that is simple rational numbers characterizing the ratios of frequencies for the basic musical scales. According to the theorem deduce by Hawkins, the ratios are simple rational numbers for the areas for circles which are tangential to the sides of any triangle having its vertices at the circumference of a circle [61]. Surprisingly, no reference to this theorem appears in the works of Euclid or in any book that he has consulted. Crop circle geometries express also simple algebraic numbers such as square roots of small numbers, in particular Golden Mean  $\Phi = (\sqrt{5} - 1)/2$  but also the transcendental number  $\pi$  represented by the the circumference of circle.

The use of sacred geometry could try to express some deep message. The most general message would be that rational numbers and more generally, sacred numbers, play a fundamental role in the world order not understood yet by us. The number theoretic formulation of quantum TGD unifying real and p-adic quantum physics to single coherent whole leads to a discovery of number theoretic information measures definable using p-adic norms for rational valued probabilities [K1]. If entanglement probabilities are rational numbers, and more generally finitely extended rational numbers, one can assign to them a negative entanglement entropy, and thus positive information measure, whereas ordinary continuum entanglement entropy is positive in all number fields. This kind of entanglement represents bound state entanglement stable under state function reduction and preparation and is the physical correlate for the experience of understanding. One can say that rational numbers and finitely extended rational numbers represent islands of order in the real and p-adic continua.

The number theoretic formulation of TGD inspires some interesting conjectures. In particular, the ratios of  $\pi$ ,  $e$ ,  $\log(p)$ ,  $p$  any prime, and  $\log(\Phi)$ , where  $\Phi$  is Golden Mean, should be rational numbers.  $\pi$  indeed appears in the sacred geometry besides simple algebraic numbers. Thus the message might be that finite-dimensional extensions of p-adic numbers involving algebraic numbers and some selected transcendentals are fundamental for cognitive consciousness as indeed predicted by TGD.

A less general interpretation, which deserves to be noticed, relates to the p-adic length scale hypothesis, which states that p-adic length scales come as square roots of primes. This implies that ratios for areas of p-adically fractally scaled variants of a given structure are ratios of primes.

## 4 Number theoretical models 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 notion  $N$ -particle leads to a model how  $N$ -hydrogen atoms define names for molecules and how molecules with conjugate names form especially stable bound states and how the same mechanism explains lock and key mechanism of bio-catalysis. The lock and key mechanism depends only weakly on chemistry and it is quite possible that several genetic codes are realized.

Hence the tRNA molecules mediating DNA-amino-acid correspondence could be different for various life-forms. The stability of various possible tRNA type molecules determining the code would be determined by the electromagnetic environment. Therefore one must take genetic code as a result of selection. The findings about the alien codes, if taken seriously, suggest also 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 raises the question whether the factorization occurs also at the level of amino-acids. Could DNAs triplets have resulted as a symbiosis of singlets and doublets whereas amino-acids might have been developed via a symbiosis of 2 (3) molecules coded by 4 DNA singlets and 10 (7) molecules coded by 16 DNA doublets?

### 4.1 Three kinds of number theoretical models for the genetic code

TGD has led to three different number theoretic approaches concerning the understanding of the genetic code.

1. In [L1] the model of the genetic code based on the notion of Combinatorial Hierarchy is discussed. This approaches predicts at least one additional code that I have christened memetic code.
2. In [L3] a universal number theoretical code giving genetic code as a special case and based on the maximization of a number theoretic information measure was developed.
3. The model based on the assumption that genetic code has evolved from a product code is the one to be discussed in this chapter (see also the discussion in [L4]).

#### 4.1.1 Genetic codes as deformations of product codes

In this section number theoretical models based on the approximate factorization of the genetic code into product code formed by doublet and singlet codes are discussed. 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  $4 \times 4$  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.

#### 4.1.2 Genetic codes based on the maximization of number theoretic information measure

In the chapter [L3] an alternative number theoretic model for the ordinary genetic code and its variants is discussed. This model is based on very general number theoretic notions, in particular, number theoretical generalization of Shannon entropy, and must be regarded as the most convincing

one of the three number theoretic models constructed hitherto. This model allows to identify ordinary genetic code and its variants as codes maximizing a unique number theoretic information measure. The model is also consistent with the idea that genetic code has evolved from a product of singlet and doublet codes.

The model predicts the number for "aminoacids" once the number  $n$  of "DNAs" is known as  $N(n) + 2$ , where  $N(n)$  is the number of primes not larger than  $n$ . For 80 DNA triplets the prediction would be  $24 = 3 \times 8$  rather than 23 aminoacids. Hence the two models for the genetic code would not be consistent.

Before making any hasty conclusions one should recall that the interpretation of the Crabwood circle as ASCII text involves considerable uncertainties. A modification of single special symbol or small letter to a symbol not appearing in the proposed interpretation of the Crabwood message would give 24 "amino-acids". For instance, the ASCII symbols for dot *resp.* comma are 00110100 *resp.* 01110100 and differ only by a single bit so that misinterpretation cannot be excluded.

This model of genetic code emerged much later than the model for alien genetic codes and is not discussed in this chapter.

## 4.2 Does amino-acid structure reflect the product structure of the code?

The exact A-G symmetry and the almost exact T-C symmetry of our genetic code supports approximate  $2 \times 10$  structure such that 16 DNA doublets and 4 DNA singlets code for 10 *resp.* 2 "pre-amino-acids" which combine to form the real amino-acids. The  $3 \times 7$  decomposition of the number 21 of amino-acids plus stopping sign suggests  $3 \times 7$  decomposition of the genetic code. This decomposition is however not favored by the symmetries of the genetic code.

The coding of amino-acids involves tRNA binding with amino-acids and this means that the structure of amino-acids need not reflect the product structure of the genetic code and it might be that only the structure of tRNA reflects the product structure. Indeed, the identification of pre-amino-acids as DNA singlets or doublets dictated by RNA-DNA translation mechanism is strongly favored by the physical model for the evolution of the genetic code. With this identification triplet pre-amino-acids (DNA triplets) are simply composites of doublet and singlet pre-amino-acids (DNA doublets and singlets).

Despite this interpretation, the study of the amino-acid geometric structure is in order. It does not reveal any obvious structural  $3 \times 7$ -ness or  $2 \times 10$ -ness. One can however wonder whether this kind of structures might be present at more abstract level and present only in the interactions of tRNA and amino-acids.

### 1. $2 \times 10$ product structure at amino-acid level

$2 \times 10$  decomposition for real amino-acids might approximately correspond to hydrophobic-hydrophilic dichotomy which plays a key role in the amino-acid chemistry. This correspondence cannot be very precise since the number of the hydrophobic (-phobic) amino-acids is 8 (12) rather than 10 (10). Of course, this is what one expects since the product symmetry is broken.

### 2. $3 \times 7$ product structure at amino-acid level

Aminoacids can be classified into three groups. The first class contains 8 hydrophobic non-polar amino-acids: ala, val, leu, ile, pro, met, phe, trp, Second class consists of 7 hydrophilic polar amino-acids gly, ser, thr, cys, asp, glu, tyr. The third class consists of polar hydrophilic acidic amino-acids asp, glu and hydrophilic basic amino-acids lys, arg, his: 5 altogether.

Could these three classes correspond to the  $3 \times 7$ -ness?

1. First of all, the non-varying group contains almost(!) as a rule both the acidic carboxy group  $COOH$  which tends to ionize to  $COO^-$  and basic aminegroup  $NH_3$  which tends to ionize to  $NH_3^+$ . When carboxy or amine group is associated with the side group, the  $2+3=5$  acidic

or basic polar amino-acids result. Thus the three-ness in standard sense corresponds to the difference for the total numbers of acidic and basic groups of the side chains: amino-acid side chain is either neutral and non-polar, neutral and polar, or charged. This leads to 8+7+5 decomposition and a slight breaking of three-ness.

2. One could however consider a modified definition in which one counts the numbers  $N_+$  of basic and  $N_-$  of acidic groups of the *entire* amino-acid and uses the difference  $N_+ - N_-$  to tell the net charge of the amino-acid. If this criterion is used, the first group contains one alien, proline. Proline differs from all other amino-acids in that the neutral group  $H_3N^+ - COO^- - C - H$  group is replaced by a charged  $HN - COO^- - C - H$  group. But this means nothing but replacing the basic group  $NH_3^+$  with a non-basic NH. This implies also a net charge for proline. If net charge is taken as the characterizing property of the third group of amino-acids, proline belongs to it. Therefore first and second would group contain 7 amino-acids and the third group would contain 3 positively charged and 3 negatively charged amino-acids.
3. If one thinks that stopping sign formally corresponds to one additional amino-acid in the third group, one indeed has 7+7+7 decomposition. For some rare life-forms to be discussed later stopping sign codon ATC can code for both stopping sign and non-standard amino-acid pyrrolysine depending on context [33]. Pyrrolysine, being a derivative of lysine, is basic so that in this case one would have 7+7+7 decomposition even without counting stopping sign formally as an amino-acid.

The 7-ness index labelling the amino-acids with the three groups should be some abstract property and it is impossible to make any conclusions on basis of the chemical formulae alone.

### 3. *Is the product structure at the level of amino-acids really needed?*

It has become clear that the product structure for amino-acids is not necessary.

1. The number theoretic model of the genetic code discussed in [L3] neither predicts nor requires the product structure for amino-acids but is consistent with the approximate product structure for codons.
2. In [L4] a model for the evolution of the genetic code from a product code mapping RNAs to a subset of RNAs is studied. In this model the product structure at the level of coded RNAs is natural but there is no reason for it at the level of amino-acids which, according to the model, originally only catalyzed  $RNA \rightarrow RNA$  mapping but later replaced the coded RNAs in a kind of palace revolution.

## 4.3 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.

### 4.3.1 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.

This should be reflected in its structure. There are two options.

1. 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.
2. The decomposition  $21 = 3 \times 7$  for amino-acids plus stopping sign suggests that singlet code maps four bases to 3 'pre-amino-acids' and 16 doublets to 7 'pre-amino-acids'. In the first approximation the triplet code would decompose to a product of doublet code and singlet code in the sense that 4 singlets are mapped to  $Z_3$  and 16 doublets are mapped to  $Z_7$  so that 21 different product states result. The decomposition of the statements consistent with some atomic statements suggests itself strongly. In the first approximation the triplet code would decompose to a product of doublet code and singlet code in the sense that 4 singlets are mapped to  $Z_3$  and 16 doublets are mapped to  $Z_7$  so that 21 different product states result. The problem of this option is that it predicts complete breaking of T-C symmetry and the breaking of the product symmetry should produce T-C symmetry. This looks two complicated.

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  $2 \times 10$  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.

In  $3 \times 7$  case singlet code would have following interpretation.  $Z_3$  is identified as negations of 4 selected statements with 00 excluded. Statement and its negation are projected to this  $Z_3$  representing negations with 00 excluded so that 11 must be projected to some other statement. The degeneracies of the code are unique: 2, 1,1 since any change of the code changing this degeneracy spectrum implies that one degeneracy vanishes.

Same applies to  $Z_7$  and 16 DNA doublets. Now 1111 is mapped to some statement in the set of negations. In this case the simplest coding is obtained by mapping 7 statements to their conjugates and the two remaining statements to different conjugate statements in the set of 7 statements. The resulting degeneracy structure is 2222233 and entropy is maximal for this code.

#### 4.3.2 Our genetic code as result of symmetry breaking for $2 \times 10$ product code

As found, there are two cases to be considered:  $3 \times 7$  T-C asymmetric and  $2 \times 10$  T-C symmetric product code. The approximate T-C symmetry favors strongly  $2 \times 10$  option and  $3 \times 7$  will be considered only briefly in a separate subsection. On basis of degeneracies alone it is not possible to distinguish between these codes and  $3 \times 7$  code was in fact the first guess for the product code.

In case of  $2 \times 10$  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 10: The numbers  $N(n)$  of amino-acids coded by  $n$  DNAs for unperturbed  $2 \times 10$  product code and for the real genetic code for  $2 \times 10$  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. Alternatively three amino-acids are transformed to stopping signs.

It is easy to find the deformation yielding correct degeneracies by removing DNAs from the DNA-boxes defined by various values of degeneracies to other boxes and adding them to other boxes. The rule is simple: taking  $m$  DNAs from a box containing  $n$  DNAs creates a box with  $n - m$  DNAs and annihilates one  $n$ -box:

$$N(n) \rightarrow N(n) - 1 \quad , \quad \text{and} \quad N(n - m) \rightarrow N(n - m) + 1 \quad .$$

If one adds  $k$  of these DNAs to  $r$ -box one has

$$N(r) \rightarrow N(r) - 1 \quad , \quad N(r + k) \rightarrow N(r + k) + 1 \quad .$$

The operation which is not allowed is taking the entire content of a DNA box defined by amino-acid and adding it to other boxes since this would mean that the amino-acid in question would not be coded by any DNA. Thus the number of boxes can only grow in this process.

Realistic degeneracies are obtained by a rather simple operation.

1. Take from one 6-plet two amino-acid and move the first of them to 2-plet to get  $N(6) = 3$ ,  $N(4) = 5$ ,  $N(3) = 1 < 2$ ,  $N(2) = 11 > 9$  and move the second one to hitherto non-existing singlet to get  $N(1) = 1$ .
2. Move one DNA from some doublet to second doublet to get triplet and singlet to get  $N(1) = 2$ ,  $N(2) = 9$  and  $N(3) = 2$ . This operation gives correct degeneracies only and it turns out that correct symmetry structure requires additional operations.

#### 4.3.3 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.

1. 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  $3 \times 7$  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  $2 \times 10$  code the prediction is that all 4-columns should have  $AABB$  structure and this prediction breaks down only for  $AAAA$  type 4-columns.

2. For  $3 \times 7$  code a given amino-acid should be coded by DNA pairs of form  $(XYA, XYG)$ , or DNA of form  $XYC$  or  $XYT$ . For  $2 \times 10$  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  $4 \times 4$  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.
3. For  $3 \times 7$  each 2n-plet formed by degenerate  $(XYA, XYG)$ -pairs is accompanied by n-plets of type  $XYT$  and  $XYC$ . In case of  $2 \times 10$  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  $4 \times 4$  code table but that one cannot regard stripes longer than 4 elements as connected structures. The  $2 \times 10$  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  $16 \times 4$  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  $4 \times 4$  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.

The table 11c) summarizes our genetic code. It is convenient to denote the rows consisting of A-G resp. T-C doublets by  $X_1$  and  $X_2$ . For instance,  $A_1$  corresponds to the highest row phe-phe, ser-ser, tr-tyr, cys-cys and  $G_2$  to the row leu-leu, pro-pro, gln-gln, arg-arg.

1. The simplest hypothesis is  $2 \times 10$  option is realized and that the flow permutes entire rows of the code table consisting of A-G and T-C doublets. From the table below it is clear that there is a G-C symmetry with respect to the first nucleotide broken only in the third row. This kind of primordial self-conjugacy symmetry would not be totally surprising since first and third nucleotides are in a somewhat similar position.
2. 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.

3. 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. The exchange of  $AG_2$  (ser doublet) and  $TG_1$  (trh-doublet) represents this kind of permutation.

The tables below summarize the three stages of the construction.

1. *Table 11a): 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	stop	thr	T
	leu	thr	stop	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	asn	ser	A
	ile	ser	asn	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 11b): 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 11c): 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.

1. thr 6-plet is transformed to 4-plet by replacing thr-thr in  $AC_2$  by bla-trp. trp is the missing amino-acid.
2.  $TA_2$  met-doublet is transformed to ile-met so that the realistic genetic code results.

One might argue that symmetry breaking permutations  $G_1 - C_2$  and  $AG_2 - TG_1$  should permute amino-acids with a similar chemical character. A similar constraint applies to T-C symmetry breaking. By studying the chemical structure of the amino-acids, one finds that this is satisfied to a high degree.

1. The permutations val-leu and ala-pro exchange aminocids with non-polar (hydrophobic) sidegroups. The permutations glu-his and gly-arg exchange polar (hydrophilic) amino-acid with a polar amino-acid which is also basic. Ser and thr are both non-polar amino-acids.
2. ile and met are both non-polar so that ile  $\rightarrow$  met replacement satisfies the condition.
3. The objection is that the side group for trp is non-polar but polar for thr. Interestingly, the code table decomposes to two connected regions corresponding to non-polar/polar side groups at the left/right such that the non-polar trp located inside the polar region is the only black sheep whereas thr naturally belongs to the polar region. As will be found trp is also otherwise singular case.

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.

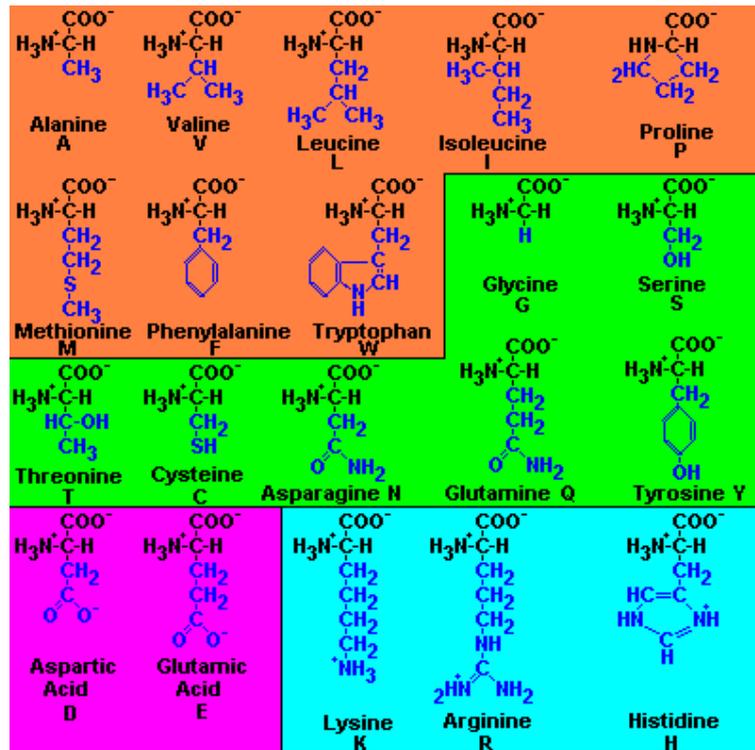


Figure 4: The chemical structure of amino-acids. The first group (ala, ... ) corresponds to non-polar amino-acid side groups, the remaining amino-acids to polar side groups. The two lowest groups correspond to acidic (asp, glu) and basic side groups.

#### 4.3.4 The information maximization principle determining the "volume preserving flow"

The interaction between the DNA singlets and doublets is the physical explanation for the breaking of the product symmetry. This interaction involves two parts: the flow and T-C symmetry breaking. The flow is analogous to the formation of connected vertical stripes of amino-acids in DNA space: kind of condensation process in which different phases represented by amino-acids tend to condense to form regions consisting of at most 4-units of type  $XYU$ ,  $U = A, G, T, C$ . Obviously this means continuity and thus also symmetry analogous to that emerging when (amino-acid) gases condense to a liquid state: the breaking of the product symmetry is the price paid for this additional symmetry. It turns out to be possible to formulate a variational principle consistent with the proposed flow in the direction of the columns of the code table and defining the dynamics of the condensation.

What this means that one can assign an information measure to the code table such that the volume preserving flow in question maximizes this information measure.

1. Information measure is assumed to be local in the sense that it decomposes into a sum of information measures associated with the elements  $C_{AB}$ ,  $A, B \in \{A, G, T, C\}$ , of the  $4 \times 4$  code table (elements are 4-element columns). In the physical analogy this means that the condensed droplets of various amino-acids can have at most the size of single 4-element column.
2. Consider the element  $C_{AB}$ . Let the multiplet associated with the amino-acid  $a_k$  contain  $n(k, AB)$  amino-acids and let  $i(k, AB)$  tell the number of the disjoint parts to which the amino-acids  $a_k$  in the 4-plet  $AB$  split. The number of these disjoint multiplets can be 0, 1, 2.

Let the  $i$ :th region contain  $n(k, AB, i)$  amino-acids  $a_k$ . The meaning of the equations

$$\begin{aligned} \sum_{i=1}^{i(k, AB)} n(a_k, AB, i) &= n_k(AB) \ , \\ \sum_{AB} n_k(AB) &= n_k \ , \\ \sum_k n_k &= 64 \end{aligned}$$

is obvious.

Assign to the  $i$ :th connected region containing  $n(k, i, AB)$  identical amino-acids  $a_k$  probability

$$p(k, i, AB) = \frac{n(k, i, AB)}{64} \ ,$$

to the element  $AB$  the total probability

$$p(k, AB) = \sum_{i=1}^{i(k, AB)} p(k, i, AB) \ ,$$

and to the entire table the probability

$$p_k = \sum_{AB} p(k, AB) = \frac{n(k, AB)}{64} \ .$$

The sum of the probabilities associated with various amino-acids satisfies

$$\sum_k p_k = 1 .$$

The information measure associated with amino-acid  $a_k$  element AB is defined as

$$I(k, AB) = \sum_{i=1}^{i(k,A,B)} p(k, i, AB) \times \log[p(k, i, AB)] ,$$

Note that this number is non-positive always. The total information associated with the amino-acid  $a_k$  in code table is defined as

$$I(k) = \sum_{AB} I(k, AB) .$$

The total information of the code table is defined as the sum of the information measures associated with various amino-acids:

$$I = \sum_k I(k) .$$

This information measure is maximized (which means the minimization of the absolute value of the measure since one can speak of the minimization of entropy) by the vertical flow satisfying the previous constraints, and thus satisfying the constraints that the numbers  $a_k$  of various amino-acids are fixed and  $A \leftrightarrow G$  and  $T \leftrightarrow C$  symmetries are respected. There is a direct analogy with thermodynamical equilibrium with fixed particle numbers and symmetry. The equilibrium is characterized by the chemical potentials associated with the amino-acids. There is no temperature type parameter now.

The variational principle indeed favors the formation of vertically connected regions consisting of  $n = 2, 3$  or 4 amino-acids. By construction the variational principle does not tell anything about larger regions. In particular, it is more favorable for 4 amino-acids in a given column (say ser in the second column of the table) to be contained by single element than by 2 elements since the information measure would be  $-1/16 \log(1/16)$  for two disjoint doublets and  $-1/16 \log(1/8)$  for singlet 4-plet in same element and thus smaller in absolute value. In the similar manner the AAAB decomposition of singlet element instead of say AABA is favored.

#### 4.3.5 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 [33] 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 [33] provide valuable hints when one tries to deduce information about the alien codes.

1. 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.
2. 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.
3. 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.

#### 4.4 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  $2 \times 10$  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  $2 \times 10$  representation differs from our genetic code in that 111112233 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(8) excludes this option.

The 111111234 decomposition 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)	3(2)	1	0	2(1)	1(2)

Table 12. The numbers  $N(n)$  of amino-acids coded by  $n$  DNAs as predicted by the  $2 \times 10$  product model for the capital letter code in comparison with the degeneracies deduced from the Crabwood message:  $2 \times 10$  option.

The following process gives the degeneracies of the OPpose code.

1. 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  $N(6) = 1 > 0$ .
2. 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.
3. 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.

1. *Table 13a): Capital letter code table before the flow*

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

2. Table 13b): Capital letter code table after the flow

	A	G	T	C	
A	phe	ser	tyr	cys	A
	phe	ser	tyr	cys	G
	leu	ser	stop	stop	T
	leu	ser	stop	stop	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
	met	thr	lys	arg	T
	met	thr	lys	arg	C
C	val	ser	asp	gly	A
	val	ser	asp	gly	G
	val	ala	glu	gly	T
	val	ala	glu	gly	C

3. Table 13c): 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

T-C symmetry breaking can be understood as follows.

1. Take one DNA from second 8-plet (ser or thr and add it to 6-plet representing stopping sign to get two 7-plets so that one has  $N(7) = 2$  and  $N(6) = 1 > 0$ . Thr is chosen in the sequel for definiteness and corresponds to TGC.
2. Change one DNA in thr 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. stop at ACT is transformed to trp as so that trp is in the same position as in our genetic code.
3. What one must do is to transform 7 2-plets into 2 3-plets, 4-plet and 4 singlets. This is achieved in the following manner.
  - i) Take from two T-C doublets one DNA and move them to a third doublet to get  $N(1) = 3 < 5$ ,  $N(2) = 11 > 7$ , and  $N(4) = 3$ . For instance, this is achieved by transforming glu and ala to asp. The value of information measure decreases by  $\log(64/27)$  in this process. There are also many other manners to do this.
  - ii) 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  $N(3) = 2$ . More concretely  $(AA)_2$  leu doublet is transformed to phe-leu, and  $(TA)_2$  met-doublet is transformed to ile-met so that correct degeneracies result and the information measure increases in these processes by  $2 \times \log(27/16)$  which is larger than  $\log(64/27)$  so that the net increase of the information measure is positive in the entire process.

The process is not obviously completely unique but the proposed choice is favored because the small letter+special sign code can be obtained as a small deformation of this code.

#### 4.5 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.

1. The  $4 \times 17$  code with 18 amino-acids involving only small letters with  $h$  interpreted as stopping sign: this code makes sense for Oppose option only and since the expressive power is not maximal, it will not be discussed in the sequel.
2.  $4 \times (16 + 4)$  code with 23 generalized amino-acids ( $\backslash$ ,  $h$ , and special symbols  $!$ ,  $\&$ ,  $.$  are interpreted as belonging to the extended family of amino-acids).
3. 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 candidates 2) and 3) appear as Oppose and OPpose options.

#### 4.5.1 The nature of silicon modification

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  $(4 + 16) \times 4$  code four additional doublets must be present. If some base of DNA suffers a modification, it suffers the modification also if it appears in RNA triplet at the same position, and this in turn implies that also the conjugate of the DNA base suffers modification so that 32 additional triplets are generated. Thus the modified base of DNA cannot appear in RNA and vice versa. DNA bases (A,G,T,C) correspond to RNA bases (U,C,A,G). Since the T of DNA corresponds to the U of RNA, there is only one possibility. The modified base is T for DNA and U for RNA, and the  $T_S$  of DNA must correspond to  $U_S$  of RNA rather than  $A_S$ . The simplest possibility is that the doublets of form XT have doubled by the silicon modification of the second T to  $XT_S$ . Also  $T_SX$  type modification is in principle possible but the construction of the code favors the  $XT_S$  option (in this case code the table gets a fifth column whereas for  $T_SX$  gives rise to a fifth row).

#### 4.5.2 $2 \times 12$ product model for the small letter plus special symbol code with 80 generalized DNAs and 23 amino-acids

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  $2 \times 12$  option.  $2 \times 12$  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 discussion below is restricted to OPpose option.

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(9)	4(5)	0	3	2(3)	3(2)	0	1	0	0	1

Table 14: The numbers  $N(n)$  of amino-acids coded by  $n$  DNAs for code containing small letters and special symbols for  $2 \times 12$  option. Both OPpose and Oppose options are included.

The breaking of the product symmetry looks large but it turns out that the code can be obtained as a relatively small deformation and extension of the capital letter code.

The first things to observe about the code are following.

1. Comparing the decomposition 11111112235 with the corresponding decomposition 111111234 for the capital letter code, one can guess that the small letter code is obtained from the capital letter code by the following process in the set of 4 exotic RNA-doublets. Decompose the four exotic RNAs to  $(2 \oplus 1 \oplus 1) \times (2 \oplus 2)$  such that  $2 \times (2 \oplus 2)$  codes for exotic and ordinary amino-acid quartet. Since trp is lacking from capital letter code before symmetry breaking, one can assume that trp is the ordinary amino-acid. Since the exotic amino-acid "period" appears five times, the second 4-plet must code for "period". The two doublets must code for exotic doublets & and ! which reduce to singlets after symmetry breaking. Two exotic doublets fuse with the two octets of the capital letter code to code for two decouplets and must therefore code for the ordinary amino-acids ser and thr. Thus the code table without symmetry breaking looks very much like capital letter code table.
2. The modification  $XT \rightarrow XT_S$  implies that code table gets fifth column. Only this option allows to generalize in non-trivial manner the flow and allows to see trp 4-plets as being consistent with product code.
3. Terrestrial codes contain two exotic amino-acids scys and plys. The fact that the small letter + special sign code contains the symbols  $h$  and  $\backslash$  with ASCII number larger than 64 not appearing in the capital letter code is taken as a suggestion that the corresponding amino-acids are exotic. A natural working hypothesis is cys is replaced with scys and lys with plys. Needless to add, this hypothesis must be taken with a grain of salt.

#### 1. Product code before flow

The code table before the action of the flow and T-C symmetry breaking looks like follows. The code table obviously resembles capital letter code table to a very high degree and satisfies all the constraints resulting from the A-G and T-C symmetries and product structure of the code.

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

Table 15a: Small letter special sign product code before flow and T-C symmetry breaking.

2. *The action of the flow*

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

Table 15b: Small-letter special sign genetic code after the flow and before T-C symmetry breaking.

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.

1. One must transform the two 10s (thr and ser) to 13 and 9. The clue to the symmetry breaking mechanism comes from the finding that one must be able to generate as many as 10 singlets. Hard trial and error work teaches that one cannot get these singlets unless one allows  $10 + 4 \rightarrow 13 + 1$  mechanism for producing one of the singlets. The transformation of val-val-val-val to ser-ser-ser-val is the only candidate for this transformation and gives  $N(4) = 3$  (scys, period, trp) and  $N(1) = 1$ .

The thr is the second 10-plet and the transformation of TTC-thr to stop is the only possibility if the universality of the G column in alien sector is assumed. The transformation of  $(AC)_2$  stop-stop column to trp-trp implies maximal resemblance with our genetic code, and one obtains  $N(13) = N(9) = 1$  (thr,ser),  $N(6) = 2$  (arg,trp),  $N(5) = 1 < 5$  (stop) and  $N(4) = 2 < 3$  (scys,period).

2. The remaining transformations must produce  $N(1) = 10 > 1$ ,  $N(2) = 4$ ,  $N(4) = 3 > 2$ ,  $N(5) = 2 > 1$ ,  $N(6) = 3 > 2$  by acting on the T-C type doublets only and thus generating a breaking of T-C symmetry. The first step is to replace & in the  $(TT_S)_2$  by "period" to get  $N(5) = 2$ ,  $N(4) = 1$ ,  $N(1) = 2$ . What one must create by the splitting all the remaining T-C doublets so that 2 4-plets and 1 6-plet as extension of A-G type doublets results. The choice of the A-G type doublets is not unique but the requirement that the code table resembles maximally the code table of the capital letter code fixes the choice of A-G type doublets extended to 4-plets to be  $AA_1$  (phe),  $(TT)_1$  (ile) and the A-G type doublet extend to 6-plet to be  $CT_1$  (asp). The table below summarizes one possible code table satisfying these constraints. For comparison also the table for capital letter code is given.

	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 15c: 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.

### 4.5.3 Product model for the small letter code with 20 amino-acids and 80 generalized DNAs

The number theoretical model generalizes for the codes defined by 64 ordinary DNAs + 16 DNAs of form  $XT_S Y$  and assuming that besides 20 amino-acids there are 3 additional modified amino-acids. A small letter-special symbol code with 80 DNAs and 20 amino-acids is obtained from 23-amino-acid code by assuming that the exotic DNAs coding for special signs !, & and period code for stopping sign and the previous construction for  $2 \times 12$  code works as such. Oppose option with 64 DNAs (special signs being not interpreted as belonging to the code) and 18 amino-acids is in conflict with the requirement of a maximal expressive power. My personal conviction is that this option can be safely forgotten.

### 4.5.4 Why the numbers 64 and 80?

The dark matter hierarchy based on the hierarchy of increasing values of Planck constant predicts that the entire universe is a macroscopic quantum system and elementary particles have a hierarchy of zoomed up variants with arbitrarily large Compton length (proportional to  $\hbar$ ) [C7]. Dark matter should be especially important for living matter and life should therefore involve fundamental physics in an essential manner rather than emerge at some very high level of complexity. Hence one can ask whether the numbers 64 and 80 for the codons of the two codes could reflect basic facts about fundamental physics in TGD Universe. The following numerological argument based on detailed counting of particle states at the end of [C3] encourages to take this idea half-seriously at least.

1. Gravitons and more general stringy states are not counted since they correspond to bound states of fermions and bosons connected by flux tubes. Color is counted neither since it corresponds to  $CP_2$  partial wave and is not spin like degree of freedom in TGD framework. Family replication phenomenon has a topological explanation and is counted neither. This leaves only spinorial degrees of freedom which according to TGD inspired theory of consciousness are responsible for Boolean representations using fermionic Fock states. The natural guess is that these fermionic degrees of freedom might relate to the genetic code or genetic code might represent them.
2. TGD predicts in purely spinorial degrees of freedom 8 lepton states (lepton and anti-lepton both having 4 states due to spin and electro-weak isospin). Also phase conjugates of these states are predicted so that  $8+8=16$  states are obtained. The number of spinor states is same in the quark sector. This gives  $16+16=32$  states altogether.
3. Bosons are identifiable as tiny wormhole contacts carrying fermion and anti-fermion numbers at the light-like wormhole throats. Essentially lepto-antilepton and quark-antiquark pairs or their superpositions are in question (see the end of [C3]).  $(2+1) \times (3+1) = 12$  leptonic and 12 quark like bosons with spin and electro-weak isospin equal to 1 or 0 (only two massless spin states are possible). Together with phase conjugates this makes  $24+24=48$  states. 24 of them correspond to ordinary electro-weak gauge bosons and Higgs and the remaining 24 are exotic bosons with charge matrices orthogonal to the charge matrices of electro-weak gauge bosons. For exotic counterparts of  $W$  bosons and Higgs the sign of the coupling to quarks is opposite. For photon and  $Z^0$  also the relative magnitudes of the couplings to quarks much change. The total number of bosonic states is 48 and the number of all particle states in this sense is  $48+16+16=80$ . If quarks are dropped from consideration the number is 64.
4. The numerological question is whether the 64 ordinary genetic codons are in some deeper sense in one-one correspondence with 48 color singlet gauge bosons and 16 lepton states and

the 80 codons of the extended code in one-one correspondence with all states constructed in this manner.

#### 4.6 Imbedding of the amino-acid space into DNA space and the universal part of the genetic code

The concrete geometric formulation for the symmetries is based on the imbedding of 20+1 generalized amino-acids to the space of 64 DNAs. Obviously, the amino-acids are coded by the DNAs to which they are mapped by this imbedding. There is indeed an imbedding of 20 amino-acids plus stopping sign with  $2 \times 10$  structure to the set of 64 DNA triplets which have  $4 \times 16$  structure. 2 is imbedded into 4 which corresponds to the 4 last bases of DNA and 10 into 16 which corresponds to 16 pairs of first two bases of DNA. The lacking amino-acid is embedded as a kind of outsider for 64 DNA codes. In case of 80 DNA-24 generalized amino-acid code this imbedding is replaced with the imbedding of 2 amino-acids to 4 and 12 to  $16 + 2$  structure.

This kind of imbedding would be regarded in the language of mathematician as a discrete bundle structure which is also singular in the sense that the fiber above a given base point does not always have the same number of points. The  $10 \times 2$  and  $16 \times 4$  compositions suggest the interpretation as the imbedding of the space formed by 10 points of 2-D space-time to the space formed by 16 points of 4-D space-time. Analogous interpretation applies also in the case of the extended codes.

The interpretation conforms with the general idea that DNA represents a plan and involves intentionality and time dimension somehow. The amino-acids coded by several DNAs correspond to surfaces for several time values correspond to the same spatial point represented by amino-acid. The set of DNAs coding single amino-acid brings in mind the notion of 'association sequence' defined as a disjoint union of space-like 3-surfaces with time-like separations and possible by the classical non-determinism of the Kähler action absolutely crucial for understanding consciousness in TGD framework [H1]. The number of DNAs coding the amino-acid would measure the degree of intentionality involved with it: each DNA associated with the amino-acid would symbolize one step in a plan. Some of alien amino-acids would be highly intentional: the degeneracies can be as high as 13 to be compared to the maximal degeneracy of 6 for our code!

Consider now in more detail this structure.

1. Exact A-G gauge symmetry implies that the pairs (XYA,XYG) form fibers and one can choose freely XYA or XYG to represent the amino-acid. In case of T-C symmetry symmetry breaking can select either XYT or XYC uniquely as a representative of the amino-acid.
2. For amino-acid coded by two DNAs only the identification of the amino-acid is unique apart from the possible gauge symmetry. For  $n > 2$ -plets the identification involves non-uniqueness.
3. The requirement that the imbedding of amino-acids to DNA space is universal allows to fix identification uniquely in case of  $n > 2$ -plets. It turns out that one can assume universal imbedding to make sense for both terrestrial and alien codes (if the replacements  $cys \rightarrow scys$  and  $lys \rightarrow plys$  possibly occurring for the small letter + special sign code are appropriately interpreted). This assumption fixes the imbedding highly uniquely and the only uncertainties relate to the T-C symmetry breaking. The possibility to choose the universal part of the code table to be the same for all codes, suggests that the proposed model catches something essential. It is also difficult to imagine that a randomly generated ASCII message could allow interpretation in terms of genetic codes having so high symmetry properties and common construction principles. The table below summarizes the universal part of the genetic code resulting from the imbedding of the amino-acid space to DNA space. Also small letter code is included.

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

Table 16: A possible imbedding of the amino-acid space to the DNA space. The gauge choice XYA allowed by A-G gauge invariance of the last codon is made. The identification is same for both our code, capital letter code, and small letter plus special sign code. There is some uncertainty related to the T-C symmetry breaking.

## 4.7 Summary

To sum up, both the terrestrial and hypothetic 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  $2 \times 10$  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 OPpose option for the small letter code with 80 DNAs and 23 amino-acids is the most plausible alternative.

### Acknowledgements

I want to express my gratitude for several persons. In particular, for Tapani Koivula for encouraging me to take seriously UFOs and ETs and for interesting suggestions (in particular, for stimulating the idea that tectonic energy could serve as a 'food' of plasmoid like life forms), Martin Keitel for helping me to realize that crop circles are real and telling about the Chilbolton and Crabwood crop circles as well as for concrete help, and for Toni Siira for providing material related to UFOs and for interesting email exchanges. I want also to thank for Jukka Kinnunen for two champagne bottles (the first one for the capital letter code and the second one for the small

letter code): I hope that I will sooner or later invent the means of establishing communications with aliens (the third bottle of champagne). I would also want to thank the ITs responsible for these charming Chilbolton and Crabwood crop formations. If I only knew their names! As an underground intellectual myself, I hope that amplitude modulated micro-waves or whatever from my computer could mediate my deep gratitude and warm greetings to this underground intelligentsia.

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