

Good and Evil, Life and Death

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Abstract

Is there actual justification for moral laws? Are they only social conventions or is there some hard core involved? Is there some basic ethical principle telling what deeds are good and what deeds are bad?

Second group of questions relates to life and biological death. How should one define life? What happens in the biological death? Is self preserved in the biological death in some form? Is there something deserving to be called soul? Are reincarnations possible? Are we perhaps responsible for our deeds even after our biological death? Could the law of Karma be consistent with physics? Is liberation from the cycle of Karma possible?

In the sequel these questions are discussed from the point of view of TGD inspired theory of consciousness. The cosmology of consciousness, the concept of self having space-time sheet and causal diamond as its geometric correlates, the vision about the fundamental role of negentropic entanglement and Negentropy Maximization Principle, and the hierarchy of Planck constants identified as hierarchy of dark matters and of quantum critical systems, provide the building blocks needed to make guesses about what biological death could mean from subjective point of view.

1 Introduction

In principle the proposed conceptual framework allows already now a consideration of the basic questions relating to concepts like Good and Evil and Life and Death. Of course, too many uncertainties are involved to allow any definite conclusions, and one could also regard the speculations as outputs of the babbling period necessarily accompanying the development of the linguistic and conceptual apparatus making ultimately possible to discuss these questions more seriously.

Even the most hard boiled materialistic sceptic mentions ethics and moral when suffering personal injustice. Is there actual justification for moral laws? Are they only social conventions or is there some hard core involved? Is there some basic ethical principle telling what deeds are good and what deeds are bad?

Second group of questions relates to life and biological death. How should one define life? What happens in the biological death? Is self preserved in the biological death in some form? Is there something deserving to be called soul? Are reincarnations possible? Are we perhaps responsible for our deeds even after our biological death? Could the law of Karma be consistent with physics? Is liberation from the cycle of Karma possible?

In the sequel these questions are discussed from the point of view of TGD inspired theory of consciousness. It must be emphasized that the discussion represents various points of view rather than being a final summary. Also mutually conflicting points of view are considered. The cosmology of consciousness, the concept of self having space-time sheet and causal diamond as its correlates, the vision about the fundamental role of negentropic entanglement, and the hierarchy of Planck constants identified as hierarchy of dark matters and of quantum critical systems, provide the building blocks needed to make guesses about what biological death could mean from subjective point of view.

2 Life and Death

There are rather important steps of progress occurred during that last years (I am doing this updating 2015), which allow a more serious consideration of the notions of life and death in TGD framework.

1. NMP and the notion negentropic entanglement imply that state function reductions do not only destroy entanglement but can also create negentropic entanglement for which the density matrix is projector to a higher-dimensional

sub-space of state space. This changes completely the standard rather gloomy view about evolution as approach to maximal entropy. Also now second law holds but for the ensemble entropy which is single particle quantity whereas entanglement entropy characterizes a system with at least two particles. The stable correlation between system and complement becomes information carrier.

A possible interpretation is as an abstraction: the pairs of state in the superposition are instances of the abstraction, concept, or rule. I have christened the negentropic resources as Akashic records. In this view Universe is a gigantic library, which grows all the time. The information coded to negentropic entanglement need not be conscious as such. If interaction free measurement generalizes so that it applies to this entanglement the information about the entanglement might be read consciously. Second possibility is that negentropic entanglement is experienced as a rule or concept during state function reduction sequences at same boundary of CD.

2. TGD Universe is quantum critical. This statement has now an elegant formulation as a hierarchy of quantum criticalities assignable to a fractal hierarchy of sub-algebras of various conformal algebras associated with TGD acting as gauge symmetries, and labeled by effective Planck constants $h_{eff} = n \times h$. The levels of the hierarchy have interpretation in terms of dark matter. The most important algebra of this kind is super-symplectic algebra. The phase transitions increasing $n = h_{eff}/h$ correspond to scalings $n \rightarrow m \times n$ for some integer m and criticality is reduced so that these phase transitions should occur spontaneously. Living systems can be seen as systems trying to stay at the existing criticality. This requires metabolic energy and homeostasis serves this purpose. Eastern philosophies talk about Karma's cycle and the need to preserve ego preventing the spontaneously occurring extension of consciousness.

One can argue that this view about life as a battle against enlightenment is rather cynical. The attempt to stay at quantum criticality should have some deep positive meaning. Maybe the jumping forth and back between criticalities is what gives life its positive meaning and helps to build Akashic records by generating negentropic entanglement. Maybe living systems could be seen as kind of publishing producing systematically replicas of Akashic records could be the deep rationale behind life.

3. ZEO allows a precise identification of self as a sequence of state function reductions at the same boundary of CD. This allows also to understand how the experience about flow of time and arrow of time emerge. One can also formulate precisely the life-time of the system in geometric sense as the increase of the average distances between the tips in the superposition of CDs associated with self. The life-time in subjective sense can be identified as the number of quantum jumps at passive boundary of CD.

The first state function at the opposite boundary of CD means the death of self and rebirth of self at the opposite boundary. NMP forces this first state

function reduction and when it occurs for sub-self higher level self interprets it as an act of volition.

4. NMP has become central principle of TGD inspired theory of consciousness. Quite generally, NMP replaces quantum randomness with intentional evolution: Universe has a goal and this is to increase negentropic resources. The analogs of sleep-wake-up cycles in which self and its shadow wake up would be realized in all scales. Can one interpret also human life cycle as an example about this kind of cycles.

The basic questions seem to be following ones.

1. Is me the self defined by my biological body? In this case biological death would mean re-incarnation of me at opposite boundary of CD and life lived in opposite direction of time. Or does my biological body corresponds to my sub-self/mental image. Me could in this case correspond to my magnetic body or field body having possibly astrophysical size. The death of my biological body would be replaced the mental image about biological body with time reversed mental image.
2. A further interesting question is whether there is a continuity of conscious experience in the re-incarnation of self at opposite boundary of CD. We remember something about our dreams. Does this new self have memories about the earlier life?
3. Also NMP raises questions. Can self perform bad deeds or does NMP automatically imply possible deeds increase the negentropic resources. In thermodynamics thermodynamical fluctuations can break second law in some short enough time scales. NMP has structure very similar to second law. Could it be that bad deeds are analogous to thermodynamical fluctuations: possible but present only in short time scales?

Or is the only remaining non-predictability related to the ordinary state function reductions in which outcome is non-deterministic and random. But how can one see the deeds of Hitler as creation of negentropy? His deeds produced a lot of suffering but did they teach for humanity something very important: Do not do like Hitler?

Perhaps the only reasonable option is that NMP allows but does not force state function reduction to a density matrix which is a higher-dimensional projector. Self can select whether it performs a reduction to this or a lower-dimensional space or even to a ray of Hilbert space. This allows also bad deeds and the optimistic view would be that these bad deeds are analogous to thermodynamical fluctuations.

2.1 What is Death

One can interpret ageing in two senses. The ageing with respect to geometric time and the ageing with respect to the subjective time. Before discussing ageing in the sense of geometric time one must specify what one means with geometric time and what one believes its relationship to subjective time to be.

1. There are two geometric times corresponding to the times assignable to space-time surface and imbedding space and by general coordinate each of these times can be identified in various number of ways.
2. Geometric time increases in discrete steps and corresponds to sub-sequent scalings of CD size defined by the distance between its tips by integer. One could call this geometric time associated with particle CD/self personal geometric time. Each self/CD defines its own imbedding space time and the increase of the proper time distance between the tips of CD is the natural choice for the definition of the age of self. There is also time associated with space-time surfaces. Both time coordinates can be chosen in many manners but symmetry conditions favor certain choices.
3. Subjective time corresponds to the number of the state function reductions already occurred at the passive boundary since the first one. The ratio of subjective age to geometric age measures the number of conscious experiences per geometric time and the larger this number is the longer of the subjectively experience time is.
4. Ageing itself with the biological and spiritual aspects that we know could be seen in two manners. Biological ageing which corresponds to $h_{eff}/h = 1$ sector consisting of ordinary visible matter and second law which follows also from TGD. Variants of second law are expected also for other values of h_{eff}/h corresponding to dark matter and be a manifestation of the non-determinism of state function reduction at ensemble level. Spiritual ageing would correspond to the gradual increase h_{eff}/h and quite literally leading to the increase of the scope of consciousness. The increase would be due to giving up in the fight against spontaneous increase of criticality to keep h_{eff}/h unchanged and allowing the transition to criticality at longer length scales. Eastern thinking would translate this to ego attachment.

There must of course be some point in fighting against the spontaneous increase of h_{eff} and there is. The longer the lifetime of self is, the wiser the sub-selves representing mental images can become by repeated re-incarnations. Ageing means getting wiser! By favoring the generation of negentropic mental images, self can live longer.

5. The challenge is to understand in more detail how biological death as the first state function reduction at the opposite boundary of CD is forced by NMP. This relates to the growth of entropy at the lowest and also other levels by the challenge is to understand the details. The increase of the total negentropy of CD by generation of negentropic mental images can postpone the biological death.

Could it be that a cascade of state function reductions proceeding down to shorter scales from the level of CD cannot anymore produce negentropic entanglement and after that NMP forces the biological death. Since h_{eff} can increase in the first reduction to the opposite boundary of CD, NMP forces this reduction to eventually occur. An interesting question already posed is

whether the integer multiples of the original size of CD correspond to especially critical moments for the biological death.

There is present an entropy growth due to the randomness of state function reduction leading to a thermalization or the ensemble of mental images. This would correspond to second law, which still hold true for ensemble entropy. NMP predicts that the negentropy of conscious experience tends to increase and the biological death is only a transformation to some new form of existence. The dark matter hierarchy with levels labeled by the values of Planck constants has become a key element of TGD inspired theory of consciousness and one can imagine that during ageing these levels of existence begin gradually dominate consciousness.

What interests us mostly is obviously the subjective ageing and biological death. What dying person might experience? Is there a continuity of subjective experience or does suffering end with a loss of consciousness. What follows after biological death? How our deeds affect what happens in biological death and to the experiences after the biological death? Here are some possible answers.

1. If biological body corresponds only a mental images of the magnetic body, the only thing that happens in biological death could be that the contribution of biological body to the contents of consciousness disappears so that other contributions usually masked to a high degree by sensory input and motor activities become into full light of consciousness. In fact biological body and magnetic body are 4-dimensional and there are good reasons to expect that it continues to contribute to the consciousness of some self- not necessarily the self which possessed the body. The question is however about what this particular self that I have experiences in biological death and after it.
2. The notion of negentropic entanglement (see fig. <http://www.tgdtheory.fi/appfigures/cat.jpg> or fig. 21 in the appendix of this book) allows to consider an answer to what might happen in biological death from the point of subjective time. Depending on the choices of self which has the dying person as sub-self, dying person generates bound state entropic entanglement with a loss of consciousness or negentropic entanglement accompanied by an expansion of consciousness. What option the higher level self chooses depends on the probability of the size of the contribution of the state with negentropic entanglement.
3. If the dying person has a strong negentropic entanglement with external world, it tends to be preserved in quantum jumps and only a small entropic contribution is present and there is only a small probability to lose consciousness. Another manner to see this is that a sub-self having very entropic sub-selves (mental images) is experienced by self as something unpleasant and by generalized NMP self might want to get rid of this kind of mental image. This would reduce the chances of experiencing an expansion of consciousness. Perhaps death could be seen as the price for sins.
4. One could also argue that although consciousness might be lost it might be not be in any manner different from sleep. It could be gained back in wake-up but

as something different from ordinary wake-up consciousness and determined by the 4-D biological and magnetic bodies and the deceased could remember his former life by still existing 4-D body. The notion of electromagnetic body, when combined with the view about psychological time, allows to consider a general answer to these questions. Magnetic body probably survives the biological death, and since it serves as the sensory canvas, there are all reasons to expect that subjective consciousness continues after the biological death. The contents of consciousness would be determined by the 4-dimensional physical and electromagnetic bodies and the dominating contribution creating the illusion about reality as a time=constant snapshot would be absent. Kind of timeless consciousness would be in question in accordance with the life review experiences associated with NDEs.

5. One can also ask what might be the physical correlate of self after the biological death. The self associated with the biological body should re-incarnated at the opposite boundary of CD associated with it and defined kind of “shadow me”. The 4-D space-time sheet representing self very probably does not disappear in biological death and the 4-D character of the perceptive field suggests that this 4-D body continues to exist as a conscious entity and the sub-CDs of the geometric past representing mental images still exist. Only at the future boundary of CD the flow of 4-D biological body ceases but the sub-CDs representing existing mental images float to the direction of geometric past in the river of time and remain consciousness.

2.2 Ageing from the point of view of second law

In standard quantum theory framework not allowing negentropic entanglement self could be regarded as a statistical ensemble of mental images defined by the unentangled final states of the quantum jumps. Since the size of this ensemble increases quantum jump by quantum jump, the approach of this ensemble to thermal equilibrium is unavoidable although living matter has probably invented manners to fight against the second law of thermodynamics. Thus ageing of self means dissipation.

The hierarchy of Planck constants and negentropic entanglement mean deviations from this picture.

1. For higher levels of dark matter hierarchy the dissipation rate is expected to be slower: the naive expectation is that the rate is inversely proportional to Planck constant.
2. Negentropic entanglement means second exception to the rule and for given CD second law can be broken in time scales shorter than the time scale characterizing CD [K3].

Each p-adic length scale defines its characteristic dissipation rates. In case of a self decomposing into sub-selves the rate of dissipation is sum over the real dissipation rates associated with the nested system formed by the self, its sub-selves, their sub-selves, etc.... The dissipation associated with states of whole-body consciousness can be anomalously small since only negentropic mental images are absent and

if there is only one such mental image (or no mental images at all) there is no generation of ensemble entropy. A possible test for this is the study of total rate of metabolism during meditation.

Dissipation causes the ageing of self: getting old at least at the level of biological body would be the price for having self. More concretely, the entropies associated with various distributions of quantum number and zero mode increments increase during ageing so that mental images are gradually blurred. Note that also our self which defines a mental image of a higher level self is blurred. Also biological death, or at least death experience, seems to be unavoidable fate of self.

2.3 Ageing and death from the point of NMP

The possibility of negentropic entanglement allows to see ageing from different point of view if NMP is taken as the analog of second law holding in the realm of subjective existence.

1. Ageing as an entropic process could be seen also as a process analogous to the process of getting drowsy and falling asleep but in much longer time scales. Bodily sub-self would not remember anything about these periods in the case that the entanglement was entropic. Also sleep could represent a similar conscious state without bodily mental image and the impossibility to remember anything about this period of consciousness might be simply due to the fact that one can remember something about sleep state only in sleep state. The periods during which negentropic entanglement prevails would be experienced as enlightenment like experiences. During ageing bodily sub-self would spend more and more time near the critical line at which this kind of phase transition occurs.
2. Ageing could be seen as a process of personal growth generating negentropic entanglement. The negentropic entanglements generated with larger selves would give rise to larger selves and the metaphor “awakening” would thus be much more than a metaphor. Time-like negentropic entanglement would mean longer time span of attention. Person would spend more and more time in extended state of consciousness and in death finally leave the confines of the biological body. Note that person need not, and probably doesn't, remember anything about the periods of entanglement in which the local topology of self changes. This would make possible the evolution of selves continuing after death to higher levels of conscious existence.

This picture is rather optimistic: one must also consider the possibility that the evolution of self is not always a continuous personal growth! The fact that the individual development of most people seems to be a process of continual abstraction suggests that biological death is only one step in the process of abstractions and that our self consciously experiences the final transition to higher level of existence in biological death.

2.4 Why childhood memories are recalled so intensely?

The first manner to see ageing is as a subjective experience: as ageing with respect to subjective time. Our self contains sub-selves representing our memories, sensory input from the geometric now and future plans. At the old age it often happens that childhood memories begin to dominate whereas the recall of more recent memories is gradually lost. Of course, the contribution of future plans becomes also gradually negligible. This suggests that the contents of consciousness for our self can suffer a gradual transformation such that the childhood begins to dominate: of course, this need not happen always. That the childhood dominates is not easy to understand if the memories of the past are stored in the geometric now as assumed in the standard brain science. In TGD framework the very fact that the childhood consciousness is very intense and un-conceptual, explains the dominance of the episodal memories of childhood.

Who is the subjective experiencer in this kind of situation? Is it the old person with vivid memories or a child with some very diffuse ideas about future? The view about psychological time would suggest that the general experience gradually becomes some kind of a 4-dimensional life review such that the very intense childhood memories dominate but that the person in the psychological now is still the only one who can transform intentions to actions effectively whereas the 4-D body of the past is more or less frozen.

2.5 Death as disappearance of the mental image representing the biological body?

If one takes seriously the following two assumptions behind the TGD based model of quantum control and coordinate based on the symbiosis of MEs, magnetic flux tube structures, and matter at the atomic space-time sheets, one ends up with rather concrete view about what happens after the biological death. The ultimate sensory representations are realized on the sensory canvas provided by magnetic flux tube structures of similar size, so that we have magnetic body providing sensory representation of the biological body and external world [K5]. Our magnetic self very probably survives in the biological death by the conservation of the magnetic flux.

In this picture the body of after-life body would consists of the magnetic body plus MEs possibly surviving the death of the biological body. The only difference as compared to the life before death would be that the sensory and cognitive mental images representing the biological body (sub-selves) would disappear and the attention of our self would be directed to something else. Possibly to the entire time span of 4-D biological body since sensory input and motor actions at the upper boundary of personal CD are absent. Near death experiences indeed support this view [K1]. In this picture re-incarnation is possible and even plausible and means only that the magnetic flux tube structure representing our bodily self turns its attention to some other biological body and uses it as a sensory and motor organ. This new biological body could be plant, animal, human, or perhaps something else. In this picture the metaphor about biological body as a cloth becomes very concrete.

Since self has an extension with respect to geometric time, it has memories

about its earlier history and one could perhaps identify the continuation of self after the death as that self which has the memories of self with respect to geometric time before death. In this extended state of consciousness self could experience the subjective past of the space-time sheet of self and associate it with self's recent mind-like space-time sheet.

2.6 Near death experiences

Near death experiences provide a testing ground for the general ideas about what might happen in the physical death. Experiences resembling near death experiences can be produced now in controlled manner in laboratory circumstances for people well and alive and irrespective of their belief structure subject persons tell about light tunnels and meeting of deceased relatives [J1] . These experiences have been found to be therapeutic and are indeed used as therapy to cure severe psychic traumas. Therefore the materialistic explanation as a hallucination associated with dying brain seems to be excluded. Near death experiences involve experiences like being in light tunnel, seeing beautiful and rich landscapes and meeting dead relatives. Also out-of-body experiences are involved. The model of NDEs are discussed in detail in [K4] and here only some brief comments are represented.

The proposed picture about physical death allows a lot of room to interpret these experiences. For instance, OBEs allow two explanations.

1. The first explanation is based on the fact that in TGD based model of sensory representations the magnetic sensory canvas far outside body basically sees the brain in ELF light. This light usually comes from brain and provides a sensory representation for the external world. TGD predicts also a mechanism producing background ELF radiation from the entire body at magnetic transition frequencies and this background would make possible to see the body 3-dimensionally from outside when the sensory input is absent and does not mask this weak contribution. NDE OBEs might correspond to this kind of vision reported also by yogis.
2. The experience looking one's body from outside could mean that some higher level self corresponding to slow EEG waves and higher em selves formed physically by the personnel of hospital in the hospital room begins to dominate. This self could perhaps see patient's body with the combined eyes of the hospital personnel. Indeed, since the sensory input from the biological body ceases, the illusory identification of "me" with the biological body ceases and attention can be directed to this higher level sensory input.

Geometrically the em bodies of our dead relatives would exist in the geometric past and now, perhaps already in a re-incarnated form. This allows several explanation for the experience of meeting dead or living relatives. A very concrete model would be based on electromagnetic bridges formed by magnetic mirrors and connecting us with our relatives and friends. This would make possible for us to see them in ELF light just like we would see ourselves.

The experience about meeting deceased relatives could be also understood as a special kind of geometric memory. Generation of the long term memory means

classically looking to a magnetic mirror at classical level and seeing the me of the past in the mirror. It is however possible to see someone else in the mirror since the magnetic flux tube from the mirror could continue to the body of the deceased relative of friend instead of my body. In the usual states of consciousness the sensory input from the psychological now dominates and this contribution is masked. In near death experiences sensory input from the geometric now is diminished and the transpersonal background contribution becomes unmasked.

2.7 What after biological death?

Biological death could mean the loss of sub-self representing body image and involve extension of the physical self: this would explain out of body experiences and near death experiences (person near death looking his body from outside). In fact, an attractive hypothesis, motivated by the quantum model of brain, is that the topological field quanta associated with photons generated by EEG currents having size of order Earth by Uncertainty Principle, could correspond to selves in our personal self hierarchy. Also magnetic flux tube structures associated with body and brain could have similar sizes and serve as a magnetic body [K5]. In biological death these ELF selves could continue to oscillate as Schumann resonances in the wave cavity between Earth's surface and ionosphere interacting with magnetic flux tube structures!

If one believes that even cell sized structures have their own CDs then the primary p-adic length scale defined by the size scale of a large neuron (10^{-4} meters) would correspond to a time scale of the order of the age of the Universe! It seems implausible that these CDs could disappear totally although zero energy ontology in principle allows it.

Biological body is accompanied by magnetic body and radiation body which provide representation for the physical (or better to say, material) body. The latter consists of radiation selves (massless extremals representing topologically rays of light) representing classically the ELF radiation fields generated by EEG currents, one is led to ask what happens for these em selves in biological death. Some of them correspond to resonant frequencies of the em fields in the 80 km thick wave cavity between Earth surface and ionosphere known as Schumann frequencies and one can consider the possibility that that something which might be called soul remains after the biological death and is represented as Schumann resonances.

The most plausible hypothesis is that both ULF MEs and magnetic flux tube structures remaining after physical death together with the 4-dimensional body of geometric past define our self after the biological death. This leads to the following speculative vision about consciousness after the biological death.

1. The transformation of intentions to actions ceases in the biological death so that the dominating contribution of the psychological now to the experience disappears and conscious experience becomes kind of four-dimensional life review in which also the contributions from other bodies (say deceased relatives) appear as unmasked.
2. The geometric past, or rather experiences about it, can be gradually refined but no big changes are possible, so that a totally new life based on different

decisions does not seem to be possible. The assumption about totally new life would also lead to paradoxes. On the other hand, the instability of the long term memories suggests that the memories about the past life could be edited. The conscious experience contains also the contribution of the magnetic body continuing to exist.

3. The surviving magnetic body could attach to some new organism which it begins to use as a sensory and motor organ. The re-incarnation would have the memories of the past life as an unconscious background masked strongly by the sensory input and coming clearly conscious only in some altered states of consciousness. The reports about children remembering their previous life could be understood in this conceptual framework. This of course makes one wonder whether young children could remember their past lives. Perhaps someone should ask!
4. ZEO inspired view about state function reduction suggests more concrete view. The new self is generated at the previously active boundary of CD assignable to the biological body and the new life is lived in reversed direction.

2.8 Does soul exist in some sense?

An open question is what happens for the space-time sheet (or CD) assignable to self after biological death.

1. Could this space-time sheet or CD be called soul? Does this soul continue drift in light-cone and get attached to some new material system. Or can it disappear in quantum jump? This would not be a reincarnation in the usual sense of the word. The re-incarnation in the usual sense if the word would mean that one has memories about the life of someone whose has lived in past. In TGD Universe this is quite possible since the mechanisms of remote mental interactions are basically the same as the interaction mechanisms making possible for the magnetic body to control the biological body receive information from it.

“Ontogeny recapitulates phylogeny” principle suggests that the evolution of an individual is image for the evolution of the entire universe. Biological death would be only a metamorphosis to some new form of existence, perhaps as topologically quantized classical fields associated with the biological body. Magnetic flux tube structures having sizes measured in scale of light lifetime are especially promising candidates for the components of electromagnetic body surviving in the death of what is usually identified as the biological body. Some experimental facts lead to rather precise ideas about the geometric representation of our selves and also suggest that our existence continues in electromagnetic form after death [K1].

3. An attractive identification of “soul” would be as negentropic entanglement resources - Akashic records - serving also as a quantum correlate of love and other positive attributes of consciousness. Could this negentropic entanglement become conscious (be read) in repeated state function reductions or is

the counterpart of interaction free quantum measurement require for this to happen?

Indirect support for the survival of space-time sheets carrying associated with negentropic entanglement/large h_{eff} after death comes from rather unexpected direction.

1. The phenomenon of phantom DNA suggesting that dark space-time sheets associated with DNA remain in the chamber which contained DNA: in the experiments of Poponin [I1] the signature of phantom DNA is its interaction with laser light at visible frequencies. Phantom DNA would be represented by mind-like space-time sheets with size of at least the wavelength of visible light (10^{-7} meters). The em selves remaining after our death would have consirably larger size! One can however consider the possibility that some detectable interaction between ELF frequency em fields and “phantom brain” (“em soul”) could be possible and make it possible to prove experimentally the presence of em soul!
2. The claimed successes of homeopathy (for phantom DNA and homeopathy see [K6] and [K2]). could also have explanation in terms of the mind-like space-time sheets. Homeopathic drugs are fabricated by a repeated dilution of the active drug so that the concentration of the drug in solution becomes extremely low. The method of fabrication could however imply that final product contains quite many mind-like space-time sheets of the drug molecules. These mind-like space-time sheets might be able to affect the sickness since the mind-like space-time sheets provide a cognitive representation for drug and this mimicry could “cheat” the patient to cure. The law of similarities could have something to do with the mechanism involved.

More concretely, a given quantum transition frequency characterizing the medicine would be represented as ME with length equal to the wavelength associated with the transition frequency. The electromagnetic body of the molecule could be mimicked by liquid crystal water blobs producing similar transition frequencies and thus containing similar MEs in their electromagnetic bodies. The effect of the medicine would be mediated by the electromagnetic body so that the “fake” medicine could indeed cure.

Some support for the extension of self in death is provided by near death experiences (NDEs). For instance, looking one’s body from outside could mean that self is entangled with a larger self formed by the personnel of hospital in the hospital room and sees patient’s body with the eyes of the personnel. This experience could be understood as experience of, say self representing hospital room: in this experience the visual experiences of persons in the hospital room would fuse to the experience experienced by patient entangled with the hospital room. Meeting one’s relatives and elders could mean entanglement with a larger self formed by the selves of dead and living relatives. This larger self could experience the abstracted experiences of dead and living relatives. Also the ability of subjects of surgical operations to occasionally remember about events occurred during unconscious state, supports this view. Magnetic flux tube structures are the most plausible candidates for the “body” remaining in physical death: this point is discussed in more detail in [K1].

2.9 Is it possible to get into contact with deceased?

There is a lot of anecdotal evidence consistent with life after death. Near-death experiences are not the only manner to get convinced for life after death. So called eye-movement de-sensitization and reprocessing (EMDR) discovered by Francine Shapiro [J1, J2] induces what could be interpreted as after-death communications.

1. The experiences of subject persons can be induced by this therapy in highly reliable manner: according to [J1] 98 per cent of patients willing to participate the therapy had after death communication experience. It does not matter what the religious convictions of the subject person are and the experiences are actually rather easy to induce. It does not matter if the loss is traumatic or not or whether it is recent or occurred for decades in past.
2. The experiences resemble near death experiences (light tunnels, beautiful landscapes) and involve spiritual contact with the deceased. The EMDR technique involves getting the patient to move his or her eyes in a particular rhythmic fashion while at the same time attending to a particular aspect of the traumatic memory.
3. How EMRD works is poorly understood as yet: possibly the fact that the shifting of eyes leads to increased brain processing is of importance. Notice that rapid eye movements REM are also involved with dreams. A possible explanation is that EMDR experiences could involve communication with the recent selves of the deceased ones located possibly in the geometric recent or past and represented by magnetic flux tube structure and MEs interacting with them.

3 Good and Evil

The vision about life as something in the intersection of real and p-adic worlds together with the notion of negentropic entanglement gives hopes for understanding the quantum correlates of evolution and even ethics. The basic principle would be that good deeds generate negentropic entanglement and Negentropy Maximization Principle - perhaps suitably generalized from its original form- would define the basic principle of ethics.

3.1 Quantum ethics very briefly

The proposal is that the basic ethical principle is that good deeds help evolution to occur. This proposal can be criticized. Evolution should correspond to the increase of negentropic entanglement. NMP in strong form forces it and in weak form allows it.

1. If strong form of NMP prevails, one can worry that TGD Universe does not allow Evil at all, perhaps not even genuine free will! No-one wants Evil but Evil seems to be present in this world.

2. Could one weaken NMP so that it does not force but only allows to make a reduction to a final state characterized by density matrix which is projection operator? Self would choose whether to perform a projection to some sub-space of this subspace, say 1-D ray as in ordinary state function reduction. NMP would be like Christian God allowing the sinner to choose between Good and Evil. The final entanglement negentropy would be measure for the goodness of the deed. This is so if entanglement negentropy is a correlate for love. Deeds which are done with love would be good. Reduction of entanglement would in turn mean loneliness and separation.
3. Or could think that the definition of good deed is as a selection between deeds, which correspond to the same maximal increase of negentropy so that NMP cannot tell what happens. For instance the density matrix operator is direct sum of projection operators of same dimension but varying coefficients and there is a selection between these. It is difficult to imagine what the criterion for a good deed could be in this case. And how self can know what is the good deed and what is the bad deed.

Good deeds would support evolution. There are many manners to interpret evolution in TGD Universe.

1. p-Adic evolution would mean a gradual increase of the p-adic primes characterizing individual partonic 2-surfaces and therefore their size. The identification of p-adic space-time sheets as representations for cognitions gives additional concreteness to this vision. The earlier proposal that p-adic-real-phase transitions correspond to realization of intentions and formations of cognitions seems however to be wrong. Instead, adelic view that both real and p-adic sectors are present simultaneously and that fermions at string world sheets correspond to the intersection of realities and p-adicities seems more realistic.

The inclusion of phases $q = \exp(i2\pi/n)$ in the algebraic extension of p-adics allows to define the notion of angle in p-adic context but only with a finite resolution since only finite number of angles are represented as phases for a given value of n . The increase of the integers n could be interpreted as the emergence of higher algebraic extensions of p-adic numbers in the intersection of the real and p-adic worlds. These observations suggest that all three views about evolution are closely related.

2. The hierarchy of Planck constants suggests evolution as the gradual increase of the Planck constant characterizing p-adic space-time sheet (or partonic 2-surface for the minimal option). The original vision about this evolution was as a migration to the pages of the book like structure defined by the generalized imbedding space and has therefore quite concrete geometric meaning. It implies longer time scales of long term memory and planned action and macroscopic quantum coherence in longer scales.

The new view is in terms of first quantum jumps to the opposite boundary of CD leading to the death of self and its re-incarnation at the opposite boundary.

3. The vision about life as something in the intersection of real and p-adic worlds allows to see evolution information theoretically as the increase of number entanglement negentropy implying entanglement in increasing length scales. This option is equivalent with the second view and consistent with the first one if the effective p-adic topology characterizes the real partonic 2-surfaces in the intersection of p-adic and real worlds.

The third kind of evolution would mean also the evolution of spiritual consciousness if the proposed interpretation is correct. In each quantum jump U -process generates a superposition of states in which any sub-system can have both real and algebraic entanglement with the external world. If state function reduction process involves also the choice of the type of entanglement it could be interpreted as a choice between good and evil. The hedonistic complete freedom resulting as the entanglement entropy is reduced to zero on one hand, and the negentropic entanglement implying correlations with the external world and meaning giving up the maximal freedom on the other hand. The selfish option means separation and loneliness. The second option means expansion of consciousness - a fusion to the ocean of consciousness as described by spiritual practices.

In this framework one could understand the physics correlates of ethics and moral. The ethics is simple: evolution of consciousness to higher levels is a good thing. Anything which tends to reduce consciousness represents violence and is a bad thing. Moral rules are related to the relationship between individual and society and presumably develop via self-organization process and are by no means unique. Moral rules however tend to optimize evolution. As blind normative rules they can however become a source of violence identified as any action which reduces the level of consciousness. There is an entire hierarchy of selves and every self has the selfish desire to survive and moral rules develop as a kind of compromise and evolve all the time. ZEO leads to the notion that I have christened cosmology of consciousness. It forces to extend the concept of society to four-dimensional society.

There is an entire hierarchy of selves and every self has the selfish desire to survive and moral rules develop as a kind of compromise and evolve all the time. The newest progress in this evolution is brought by the cosmology of consciousness, which forces to extend the concept of society to four-dimensional society! The decisions of “me now” affect both my past and future and time like quantum entanglement makes possible conscious communication in time direction by sharing conscious experiences. One can therefore speak of genuinely four-dimensional society. Besides my next-door neighbors I had better to take into account also my nearest neighbors in past and future (the nearest ones being perhaps copies of me!). If I make wrong decisions those copies of me in future and past will suffer the most. Perhaps my personal hell and paradise are here and are created mostly by me.

3.2 What could the quantum correlates of moral be?

We make moral choices all the time. Some deeds are good, some deeds are bad. In the world of materialist there are no moral choices, the deeds are not good or bad, there are just physical events. I am not a materialist so that I cannot avoid questions such as how do the moral rules emerge and how some deeds become good

and some deeds bad. Negentropic entanglement is the obvious first guess if one wants to understand emergence of moral.

1. One can start from ordinary quantum entanglement. It corresponds to a superposition of pairs of states. Second state corresponds to the internal state of the self and second state to a state of external world or biological body of self. In negentropic quantum entanglement each is replaced with a pair of sub-spaces of state spaces of self and external world. The dimension of the sub-space depends on the which pair is in question. In state function reduction one of these pairs is selected and deed is done. How to make some of these deeds good and some bad?
2. Obviously the value of $h_{eff}/h = n$ gives the criterion in the case that weak form of NMP holds true. Recall that weak form of NMP allows only the possibility to generate negentropic entanglement but does not force it. NMP is like God allowing the possibility to do good but not forcing good deeds.

Self can choose any sub-space of the subspace defined by n -dimensional projector and 1-D subspace corresponds to the standard quantum measurement. For $n = 1$ the state function reduction leads to vanishing negentropy, and separation of self and the target of the action. Negentropy does not increase in this action and self is isolated from the target: kind of price for sin.

For the maximal dimension of this sub-space the negentropy gain is maximal. This deed would be good and by the proposed criterion the negentropic entanglement corresponds to love or more neutrally, positively colored conscious experience. Interestingly, there are $2^n - 1$ possible choices which is almost the dimension of Boolean algebra consisting of n independent bits. The excluded option corresponds to 0-dimensional sub-space - empty set in set theoretic realization of Boolean algebra. This could relate directly to fermionic oscillator operators defining basis of Boolean algebra- here Fock vacuum would be the excluded state. The deed in this sense would be a choice of how loving the attention towards system of external world is.

3. A map between between the different choices of k -dimensional sub-space to k -fermion states is suggestive. The realization of logic in terms of emotions of different degrees of positivity would be mapped to many-fermion states - perhaps zero energy states with vanishing total fermion number. State function reductions to k -dimensional spaces would be mapped to k -fermion states: quantum jumps to quantum states!

The problem brings in mind quantum classical correspondence in quantum measurement theory. The direction of the pointer of the measurement apparatus (in very metaphorical sense) corresponds to the outcome of state function reduction, which is now 1-d subspace. For ordinary measurement the pointer has n positions. Now it must have $2^n - 1$ positions. To the discrete space of n pointer positions one must assign fermionic Clifford algebra of second quantized fermionic oscillator operators. The hierarchy of Planck constants and dark matter suggests the realization. Replace the pointer with its space-time n -sheeted covering and consider zero energy energy states made of pairs of

k-fermion states at the sheets of the n-sheeted covering? Dark matter would be therefore necessary for cognition. The role of fermions would be to “mark” the k space-time sheets in the covering.

One can make further questions.

1. Could the moral rules of society be represented as this kind of entanglement patterns between its members? Here one of course has entire fractal hierarchy of societies corresponding different length scales. Attention and magnetic flux tubes serving as its correlates is the basic element also in TGD inspired quantum biology already at the level of bio-molecules and even elementary particles. The value of $h_{eff}/h = n$ associated with the magnetic flux tube connecting members of the pair, would serve as a measure for the ethical value of maximally good deed. Dark phases of matter would correspond to good: usually darkness is associated with bad!
2. These moral rules seem to be universal. There are however also moral rules or should one talk about rules of survival, which are based on negative emotions such as fear. Moral rules as rules of desired behavior are often tailored for the purposes of power holder. How this kind of moral rules could develop? Maybe they cannot be realized in terms of negentropic entanglement. Maybe the superposition of the allowed alternatives for the deed contains only the alternatives allowed by the power holder and the superposition in question corresponds to ordinary entanglement for which the signature is simple: the probabilities of various options are different. This forces the self to choose just one option from the options that power holder accepts. These rules do not allow the generation of loving relationship.

Moral rules seem to be generated by society, up-bringing, culture, civilization. How the moral rules develop? One can try to formulate and answer in terms of quantum physical correlates.

1. Basically the rules should be generated in the state function reductions which correspond to volitional action which corresponds to the first state function reduction to the earlier active boundary of CD. Old self dies and new self is born at the opposite boundary of CD and the arrow of time associated with CD changes.
2. The repeated sequences of state function reductions can generate negentropic entanglement during the quantum evolutions between them. This time evolution would be the analog for the time evolution defined by Hamiltonian - that is energy - associated with ordinary time translation whereas the first state function reduction at the opposite boundary inducing scaling of h_{eff} and CD would be accompanied by time evolution defined by conformal scaling generator L_0 .

Note that the state at passive boundary does not change during the sequence of repeated state function reductions. These repeated reductions however change the parts of zero energy states associated with the new active boundary and generate also negentropic entanglement. As the self dies the moral choices can be made if the weak form of NMP is true.

3. Who makes the moral choices? It looks of course very weird that self would apply free will only at the moment of its death or birth! The situation is saved by the fact that self has also sub-selves, which correspond to sub-CDs and represent mental images of self. We know that mental images die as also we do some day and are born again (as also we do some day) and these mental images can generate negentropic resources within CD of self.

One can argue that these mental images do not decide about whether to do maximally ethical choice at the moment of death. The decision must be made by a self at higher level. It is me who decides about the fate of my mental images - to some degree also after their death! I can choose the how negentropic the quantum entanglement characterizing the relationship of my mental image and the world outside it. I realize, that the misused idea of positive thinking seems to unavoidably creep in! I have however no intention to make money with it!

4. It is difficult to avoid an association with the basic myth of Christianity about the death of God's Son which is said to mean that sins of sinners are forgiven. How could one make sense of this? Or is the Freudian interpretation the only possible explanation? If negentropy increases as self dies, the paradox begins to disappear. God was self and his Son was his mental image, whose death increased the negentropic resources of the Universe and made it better. We are Gods of our mental images and we are mental images of higher level Gods.

3.3 Do positively colored emotions allow a representation of Boolean logic?

Weak form of NMP allows the state function reduction to occur in $2^n - 1$ manners corresponding to subspaces of the sub-space defined by n-dimensional projector if the density matrix is n-dimensional projector (the outcome corresponding to 0-dimensional subspace and is excluded). If the probability for the outcome of state function reduction is same for all values of the dimension $1 \leq m \leq n$, the probability distribution for outcome is given by binomial distribution $B(n, p)$ for $p = 1/2$ (head and tail are equally probable) and given by $p(m) = b(n, m) \times 2^{-n} = (n!/m!(n - m)!) \times 2^{-n}$. This gives for the average dimension $E(m) = n/2$ so that the negentropy would increase on the average. The world would become gradually better. Note that one assumes that there is some preferred basis for the states and these numbers apply when this basis is given.

One cannot avoid the idea that these different degrees of negentropic entanglement could actually give a realization of Boolean algebra in terms of conscious experiences.

1. There should be a mapping of k-dimensional subspaces of n-dimensional space to the fermionic representation of Boolean algebra
2. Could one speak about a hierarchies of codes of cognition based on the assignment of different degrees of "feeling good" to the Boolean statements? If one assumes that the n:th bit is always 1, all independent statements except

one correspond at least two non-vanishing bits and corresponds to negentropic entanglement. Only of statement (only last bit equal to 1) would correspond 1 bit and to state function reduction reducing the entanglement completely (brings in mind the fruit in the tree of Good and Bad Knowledge!).

3. A given hierarchy of breakings of super-symplectic symmetry corresponds to a hierarchy of integers $n_{i+1} = \prod_{k \leq i} m_k$. The codons of the first code would consist of sequences of m_1 bits. The codons of the second code consists of m_2 codons of the first code and so on. One would have a hierarchy in which codons of previous level become the letters of the code words at the next level of the hierarchy.

In fact, I ended up with almost Boolean algebra for decades ago when considering the hierarchy of genetic codes suggested by the hierarchy of Mersenne primes $M(n+1) = M_{M(n)}$, $M_n = 2^n - 1$.

1. The hierarchy starting from $M_2 = 3$ contains the Mersenne primes 3, 7, 127, $2^{127} - 1$ and Hilbert conjectured that all these integers are primes. These numbers are almost dimensions of Boolean algebras with $n = 2, 3, 7, 127$ bits. The maximal Boolean sub-algebras have $m = n - 1 = 1, 2, 6, 126$ bits.
2. The observation that $m = 6$ gives 64 elements led to the proposal that it corresponds to a Boolean algebraic assignable to genetic code and that the sub-algebra represents maximal number of independent statements defining analogs of axioms. The remaining elements would correspond to negations of these statements. I also proposed that the Boolean algebra with $m = 126 = 6 \times 21$ bits (21 pieces consisting of 6 bits) corresponds to what I called memetic code obviously realizable as sequences of 21 DNA codons with stop codons included. Emotions and information are closely related and peptides are regarded as both information molecules and molecules of emotion.
3. This hierarchy of codes would have the additional property that the Boolean algebra at $n + 1$:th level can be regarded as the set of statements about statements of the previous level. One would have a hierarchy representing thoughts about thoughts about.... It should be emphasized that there is no need to assume that the Hilbert's conjecture is true.

One can obtain this kind of hierarchies as hierarchies with dimensions $m, 2^m, 2^{2^m}, \dots$ that is $n(i+1) = 2^{n(i)}$. The conditions that $n(i)$ divides $n(i+1)$ is non-trivial only for at the lowest step and implies that m is power of 2 so that the hierarchies starting from $m = 2^k$. This is natural since Boolean algebras are involved. If n corresponds to the size scale of CD, it would come as a power of 2.

p-Adic length scale hypothesis has also led to this conjecture. A related conjecture is that the sizes of CDs correspond to secondary p-adic length scales which indeed come as powers of two. In case of electron this predicts that the minimal size of CD associated with electron corresponds to time scale $T = .1$ seconds, the fundamental time scale in living matter (10 Hz is the fundamental biorhythm). It seems that the basic hypothesis of TGD inspired partly

by the study of elementary particle mass spectrum and basic bio-scales (there are 4 p-adic length scales defined by Gaussian Mersenne primes in the range between cell membrane thickness 10 nm and size $2.5 \mu\text{m}$ of cell nucleus!) follow from the proposed connection between emotions and Boolean cognition.

Hilbert's conjecture relates in interesting manner to space-time dimension. Suppose that Hilbert's conjecture fails and only the four lowest Mersenne integers in the hierarchy are Mersenne primes that is 3, 7, 127, $2^{127} - 1$. In TGD one has hierarchy of dimensions associated with space-time surface coming as 0, 1, 2, 4 plus imbedding space dimension 8. The abstraction hierarchy associated with space-time dimensions would correspond discretization of partonic 2-surfaces as point set, discretization of 3-surfaces as a set of strings connecting partonic 2-surfaces characterized by discrete parameters, discretization of space-time surfaces as a collection of string world sheet with discretized parameters, and maybe - discretization of imbedding space by a collection of space-time surfaces. Discretization means that the parameters in question are algebraic numbers in an extension of rationals associated with p-adic numbers.

In TGD framework it is clear why imbedding space cannot be higher-dimensional and why the hierarchy does not continue. Could there be a deeper connection between these two hierarchies. For instance, could it be that higher dimensional manifolds of dimension $2 \times n$ can be represented physically only as unions of say n 2-D partonic 2-surfaces (just like $3 \times N$ dimensional space can be represented as configuration space of N point-like particles)? Also infinite primes define a hierarchy of abstractions. Could it be that one has also now similar restriction so that the hierarchy would have only finite number of levels, say four. Note that the notion of n-group and n-algebra involves an analogous abstraction hierarchy.

3.4 Some questions

There are still many questions that are waiting for more detailed answer. These questions are also a good manner to detect logical inconsistencies.

1. What is the size of CD characterizing self? For electron it would be at least of the order of Earth size. During the lifetime of CD the size of CD increases and the order of magnitude is measured in light-life time for us. This would allow to understand our usual deeds affecting the environment in terms of our subselves and their entanglement with the external world which is actually our internal world, at least if magnetic bodies are considered.
2. Can one assume that the dynamics inside CD is independent from what happens outside CD. Can one say that the boundaries of CD define the ends of space-time or does space-time continue outside them. Do the boundaries of CD define boundaries for 4-D spotlight of attention or for one particular reality? Does the answer to this question have any relevance if everything physically testable is formulated in term physics of string world sheets associated with space-time surfaces inside CD?

Note that the (average) size of CDs (, which could be in superposition but need not if every repeated state function reduction is followed by a localization in

the moduli space of CDs) increases during the life cycle of self. This makes possible generation of negentropic entanglement between more and more distant systems. I have written about the possibility that ZEO could make possible interaction with distant civilizations [K7]. The possibility of having communications in both time directions would allow to circumvent the barrier due to the finite light-velocity, and gravitational quantum coherence in cosmic scales would make possible negentropic entanglement.

3. How selves interact? CDs as spot-lights of attention should overlap in order that the interaction is possible. Formation of flux tubes makes possible quantum entanglement. The string world sheets carrying fermions also essential correlates of entanglement and the possibly entanglement is between fermions associated with partonic 2-surfaces. The string world sheets define the intersection of real and p-adic worlds, where cognition and life resides.

3.5 How the law of Karma could be realized?

The existence of self hierarchy means that our deeds are remembered also after our death at higher level of self hierarchy although only as an abstracted summary. Also the shadow me which is born at the opposite boundary of my personal CD remembers my deeds like a person remembers his dreams just after wake-up.

One can therefore ask whether the law of Karma or something akin to it might be implied by basic principles of consciousness theory.

First of all, self has two life strategies: be a sinner or saint. Sinner is selfish and minimizes the dependence on the environment by avoiding negentropic entanglement. Saint does the opposite and develops love towards surrounding world.

1. Self can fight for the metabolic energy feed giving rise to the self-organization of self. This strategy works as long as self is a young, brisk and arrogant sinner. Sinners are not desirable mental images from the point of view of higher level self since they induce a lot of entropic mental images (pain). This strategy is also in conflict with the possible goal of the higher level self to achieve fusion of its own mental images.
2. Self can attempt to share mental images by quantum entangling its sub-selves with the sub-selves of other, possibly, higher level selves. This mechanism gives rise to quantum metabolism and expanded states of consciousness, favors the generation of social structures, and means fusion of mental images from the point of view of higher level self. The cognitive mental images of the saintlike self are highly negentropic and favored by p-adic NMP.

On basis of these findings the policy for higher level selves looks obvious: try to get rid of the unpleasant mental images represented by sinners. Higher level self could apply this policy for purely selfish reasons: too bad sinners might affect like a poison to the moral level of the higher level self and, since the law of Karma is universal, could eventually lead to the decline of the higher level self to a lower level of the hierarchy: the world would seem to be a tough place also after death!

3.6 What “liberation” might mean?

The strong analogies with eastern spirituality encourage to ask whether the TGD inspired quantum counterpart for the concept of liberation might make sense.

1. Quantum-classical correspondence suggests that the endless evolution at the level of the entire universe corresponds to endless evolution at the level of individual so that the notion of liberation would make sense only as kind of transformation to a higher level of consciousness.
2. In the real context selves having only single mental image or no mental images at all are in state of “oneness” and experience no divisions and separations since the analysis process represented by state function reductions and self measurements is absent. This kind of state realized at the level of field body is a possible candidate for enlightened state. Certainly it cannot last forever.
3. Liberation experience might also relate to the experience of “cosmic consciousness”. Most naturally a generation of negentropic entanglement fusing self to a self at higher level of self hierarchy. The fear about the loss of consciousness is what gives self an ego, since ego is something which can be lost. This can happen via the generation of entropic bound state entanglement with some other system. This can happen for any subsystem of Universe but not for the entire Universe enjoying an eternal state of consciousness. The state of cosmic consciousness thus means being a self without ego. The counterpart for this would be negentropic entanglement. Leaving aside the question whether we are able to experience ideal cosmic consciousness, one can consider the possibility that even human beings could achieve a state of consciousness in which the loss of consciousness is highly un-probable and that this loss of ego is synonymous with the experience of liberation.

The term “cosmic consciousness” looks somewhat pompous notion to anyone identifying himself with his suffering biological body and it would be certainly very difficult to sell this concept to a neuroscientist. The notion of magnetic body, the hierarchy of Planck constants, and the identification of quantum gravitational bound states in terms of astrophysical quantum coherence assignable to gravitational Planck constant, allow to take this notion seriously. In ZEO the arrow of geometric time can change so that finite light velocity does not prevent instantaneous communications over cosmic distances so that communications with life forms in distant galaxies become possible. I have considered a concrete model for what might be involved in [K7].

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