

Should we start burying free will?

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Abstract

Neither classical physics nor quantum theory if interpreted as a purely statistical theory allows free will, and the materialists conclusion has been that free will is an illusion and consciousness epiphenomenon. The conclusion however follows basically from the inability to describe free will using the existing conceptual and mathematical framework: “What you cannot describe does not exist”!

The views have begun to change recently. So called free will theorem states that free will of the experimenter is necessary for the testability of the theory. State function reduction in general enough sense would be a good place for free will. This however requires macroscopic quantum coherence in macroscopic length scales. Second problem is that state function reduction in standard sense lead to conflict with the deterministic unitary time evolution. The randomness of outcome of the state function reduction can be also seen as a problem.

These problems are circumvented in Zero Energy Ontology (ZEO) leading to a generalization of standard quantum measurement theory. Quantum jumps can be said to occur between quantum superpositions of classical deterministic dynamical evolutions as recreations of the Universe in 4-D sense so that the causality of quantum jumps (identified as that of free will) are different from that of field equations, and one must distinguish between subjective and geometric time. Conscious entities can be said to result as a generalized Zeno effect: sequences of repeated state function reductions measuring the same observables and leaving the state unaffected in the standard quantum measurement theory. In ZEO the state remains unaffected only at the second boundary of causal diamond and the experience about flow of time and correlation between subjective and geometric time emerges. The first reduction to the opposite boundary means “death” of conscious entity and re-incarnation at the opposite boundary with reversed arrow of geometric time.

1 Introduction

Bee wrote in here blog about free will with the title “Free will is dead-lets bury it” (see <http://tinyurl.com/gnhr77k>). I see free will as quintessence of life and very much alive: I would feel like a murderer while trying to bury. I had to ask several times whether the beginning of the article was meant to be irony since later Bee gave link to her article The Free Will Function (see <http://arxiv.org/abs/1202.0720>) in which she proposed a model of free will but without any reference to metaphysics, which she obviously regarded as something non-scientific. The somewhat arrogant tone of the article got me a little bit irritated since I worked for last 25 years to develop quantum theory of consciousness and this theory is actually extension of quantum measurement theory proposing to solve its problems.

Since I have written so much about TGD inspired theory of consciousness and free will (not completely free of course) and I have so many other things to discuss, my decision was “No comments”. I was indeed happy that Lubos saw the trouble of writing a nice and reasonably polite blog article (see <http://tinyurl.com/jc81zcr>) about the issue of free will from the point of view of quantum measurement theory. Lubos wrote more recently a not so polite further article (<http://tinyurl.com/grbch4u>) about the same topic suggesting also free will at elementary particle level. I find the political attitudes of Lubos weird and also his superstring fanaticism looks strange to me but I had to agree with most what he wrote about free will.

The reason why I am not at all eager to start burying free will is following. Theoretical physics is basically as an attempt to understand our conscious experiences, in particular the regularities of conscious experience expressed in terms of laws of physics. Unfortunately, theoretical physicists have been so busy with their calculations that they have forgotten what theoretical physics basically is about: too many of them have degenerated to blind appliers of algorithms defining their specialization. They have forgotten that they experience free will directly. Anyone trying to pretend that she has no free will and that her experiences are just epiphenomena without any causal power, demonstrates in the first traffic lights that she is faking. We are continually making mental simulations of “What if...”, which probably involve free will in virtual world - kind of scaled down world representing external world. Without these simulations we would not survive. The belief in free will is so deeply rooted in language that it is practically impossible to speak or write without using concepts with relate to conscious experience and free will.

Lubos discusses several issues in his postings.

1. The outcome of quantum measurement is non-deterministic and random as one looks the outcomes of quantum measurements for an ensemble of similar systems. This neither implies free will at the level of measured systems nor excludes it: we do not know whether individual system experiences free will or not in state function (assuming conscious experiences are completely private: an assumption that TGD forces to challenge - sharing of mental images is predicted to be possible).
2. Free will theorem (see <http://arxiv.org/abs/quant-ph/0604079> [B1] is what forces free will in quantum measurement theory: the conscious entity performing quantum measurements must have free will to choose the observables measured. Without this assumption one cannot speak about quantum measurement theory. This does not mean that the decision to make certain quantum measurement could be state function reduction at higher abstraction level but it could be. The question of course is “What these abstraction levels could be physically and mathematically?”. Bee does not believe in free will and has proposed something that she calls superdeterminism (see <http://arxiv.org/abs/1105.4326>) presumably trying to make state function reductions in some sense deterministic: I could not make any sense of this idea.
3. In order to speak about free will at more detailed level one must have some idea what experiencer - “me” - is. This leads to further questions. For instance, there seems to be intentional, goal directed free will: does it reduce it to free will as a passive selection between given options as would occur if free will corresponds to state function reduction. A flood of questions emerges once the taboo is broken and the conclusion is that one should construct nothing less than a theory of consciousness to answer them.

2 Further points about free will

There were many points, which Lubos did not discuss but which from TGD point of view are central.

1. Free will theorem leaves many things open. State function reduction is in conflict with the determinism of unitary time evolution. Unless one is ready to give up completely the notion of reality and do without ontology one must be ready to modify the existing beliefs about time: more precisely, about the relationship between geometric time appearing in field equations and subjective time which could more or less correspond to a sequence of state function reductions. Usually these times are identified.

Copenhagenist option is to give up ontology and leave only epistemology would mean that we can have only knowledge represented by wave function. Knowledge is however about something and if we give up ontologizing altogether there is no objective reality! The neglect of this problem is to my opinion the greatest blunder of last century in theoretical physics. Taking it seriously could have led to revolution for long time ago.

2. To avoid the logical contradiction without becoming Copenhagenist, one must accept two causalities: causality of free will and of field equations. Since causality involves time there must be two different notions of time: subjective time associated with the sequence of state function reductions and geometric time associated with field equations. Quantum jumps should replace the entire deterministic time evolution with a new one: not just break the deterministic evolution in some time interval. Geometric causality would be respected.

But how do subjective and geometric time relate? They are not identical: subjective time is irreversible and has no future whereas geometric time is reversible and has both future and past. They are however not independent: subjective time can be measured by using clocks telling about the flow of geometric time. Why the flow of subjective time seems to correspond to movement of geometric time = constant surface towards geometric future at least approximately (memories might correspond to multitime experiences with inputs from geometric recent and past)?

3. Does state function reduction correspond to experience of free will at the level of measurement system? How this system could experience continuous flow of time if each state function reduction implies violent change. Could it be that Zeno effect or something more general makes possible experienced flow of subjective time. In standard quantum measurement theory repeated measurements do not change the state: could they give in a more general theory rise to the experience about flow of time. What the measurement of new observables causing dramatic state function reduction to a new eigenstate basis does mean: could the conscious existence of system end? Does the repetition of new kind of measurement give rise to re-incarnation of consciousness entity in some sense?
4. The intuitive view is that self - "me" - corresponds to something separate from the environment. Could self correspond to a system having no entanglement with the external world? In standard quantum theory this cannot be true. Interactions generate entanglement continually. On the other hand, self as an entity experiencing flow of time receives continually sensory input and already this seems to imply that it cannot remain unentangled. It seems that something is badly wrong in the standard ontology. Is quantum system something more than we have thought it to be? If it represents conscious entity, it should have two components of experience: the experience about unchanging self defining personal identity and the experiences induced by the sensory input.
5. The prevailing belief is that quantum effects are important only in short scales and in macroscopic scales quantum effects give only rise to statistical behaviour describable by kinetic equations. If one wants to understand human consciousness in terms of quantum theory, this seems to mean that macroscopic quantum coherence is possible. But this does not seem to be the case according to the standard quantum theory. Planck constant is too small. To obtain macroscopic quantum coherence much larger Planck constant would be needed. Could it be that Planck constant has a spectrum of values?

Usually new idea solves many problems and the problem of dark matter is certainly one of the biggest problems of modern physics. Could dark matter correspond to matter with non-standard value(s) of Planck constant? TGD based answer to this leading question is "Yes!". The levels in the fractal hierarchies of sub-algebras super-conformal algebras associated with quantum TGD are labelled by Planck constant and the identification is as dark matter hierarchy playing crucial role in living systems.

6. In principle quantum measurement can be carried out for any system. Does this mean that consciousness and free will are universal phenomena appearing in all scales? Physical systems form a hierarchy: do also conscious entities define hierarchy so that the notion of collective consciousness and consciousness even at elementary particle length scales would make sense.

7. Living matter is different. Is it different because it is more intelligent and can affect the environment and receive information from it? What is behind intelligence? Conscious information, one might call it negentropy, certainly relates to intelligence and cognition and the question is what negentropy is physically and mathematically. Here standard physics cannot help: the notion of Shannon entropy is all that it can give. How the mathematical formalism of standard physics could be generalized so that it could talk about negentropy?
8. A theory of consciousness is needed. This theory should be a generalization of quantum measurement theory. Indeed, the basic problem of quantum measurement theory is that observer remains outsider. Observations induce state function reductions but observer itself still remains a mystery. Observer - self - should emerge from the generalization of the quantum measurement theory. The first question concerns the variational principle for the dynamics of consciousness. Since information is so essential for consciousness, the optimist wanting to live in the best possible world someday might postulate that the variational principle must guarantee that the information gain of conscious experience is maximal in each state function reduction: every reduction creates a slightly better world. This boils down to Negentropy Maximization Principle. NMP would be analogous to second law but would state formally just the opposite. How do thermodynamical entropy and negentropy relate and can they be mutually consistent?

3 TGD view about consciousness and free will

There are many challenges and TGD suggest how to meet them.

1. One must generalize ontology in order to solve the contradiction between deterministic time evolution and evolution by state function reductions. One must understand the notion of subjective time and its relationship to the geometric time. The new ontology must allow to understand selves as something unchanged in some aspects and continually changing in some other aspects. Self as Zeno effect must allow the change due to the sensory input giving rise to the flow of subjective time.

In TGD framework the answer is Zero Energy Ontology (ZEO) [K1]. The concept of quantum state is generalized. States are now analogs for physical events characterized by initial and final quantum state that is pairs of positive and negative energy states. The conserved quantum numbers of the members are opposite so that zero energy states can be created from vacuum. This is a radical generalization of the physicalist world of view but entirely consistent with conservation laws: there is no need to give laws of physics in order to have free will. Positive and negative energy parts of the zero energy states can be assigned to opposite light-like boundaries of causal diamonds (CDs), which are intersections of future and past directed light-cones multiplied by CP_2 . CDs form a fractal scale hierarchy. They can be seen as imbedding space correlates for the 4-D perceptive fields of selves.

2. One must generalize standard quantum measurement theory to a theory of consciousness. Negentropy Maximization Principle or something akin to it should be consistent with the standard rules of quantum measurement theory and possibly generalize them. In particular, NMP should tell which observables are measured in given entangled situation. The density matrix defined by the entanglement is the unique candidate for the universal observable. All systems could be said to give rise to quantum measurements. NMP must decide how long the self "lives": self lives as long as repeated state function reductions at the same boundary give the maximal negentropy gain.

State function reductions occur at either boundary of CD as long as they produce maximal negentropy gain. If the reduction at opposite boundary produces larger negentropy gain, it occurs. Self dies and re-incarnates as time reversed self. During repeated state function reductions at same boundary the part of state at that boundary and boundary itself remains unaffected (this corresponds to unchanging part of self) whereas the state at opposite boundary changes and the boundary also shifts outwards. The increase of the distance between the tips of CD corresponds to the flow of geometric time and gives precise meaning for the ageing of self.

The totally unexpected prediction is that life is not just a brief spark in cosmic darkness. This particular life is only one in a sequence of lives: the next life will be lived at the opposite boundary of personal CD to opposite direction of geometric time. The negentropy gained during his life will be usable as possibly unconscious knowledge during the next life. What our next life will be depends how much we gather negentropic resources for the next life. We can also make moral choices since NMP in its weak form leaves us freedom to make also bad choices or especially negentropic choices. Thus we can make also choices, which do not yield optimal negentropy gain. By allowing sin NMP also makes possible really big negentropy gains: NMP is like venture capitalist in this sense. In statistical sense there is however an evolution as increase of the negentropic sources of the Universe. Crime is part of being alive: living creatures are fighting desperately for NE and a clever but immoral manner to gain it is to eat other living beings.

3. One must have a mathematical definition of negentropy [K1]. When negentropic entanglement (NE) is possible and what is the measure for the negentropy? Shannon entropy is the natural starting point and p-adic generalization of Shannon entropy might fit the bill: it is well defined for algebraic entanglement probabilities belonging to the algebraic extension of rationals defining also the extensions of various various p-adic number fields). This requires a generalization of real physics from physics of matter to that of matter and cognition and this demands new mathematics.

Cognition [K2] could correspond to entire hierarchy of p-adic physics assignable to various p-adic number fields and their extensions. Combining all these physics together one obtains something that one might call adelic physics and number theoretic constraints give powerful conditions on physics in various number fields: p-adic physics - cognition- should provide representations of real physics - material world. What I call algebraic universality and strong form of holography could realize this principle.

The possibility of NE implies that the reduction does not always lead to an unentangled state but can generate NE. Living systems would be systems generating NE and biological evolution could be seen as a gradual generation of negentropic resources - I have called them Akashic Records.

What is important that entanglement negentropy and thermodynamical entropy are *not* negatives of each other. Hence NMP is not in conflict with the second law but predicts it for the ordinary matter as a consequence of non-determinism of state function reduction. It is however true that large entropic resources realized as a large number of states with the same energy makes possible both large thermodynamical entropy and NE with large negentropy.

4. What makes possible macroscopic quantum coherence? An answer to this question has been already proposed: hierarchy of dark matters realized as large h_{eff} phases [K3]. These phases are associated with quantum criticality for which generalized conformal symmetries provide mathematical realization. Large value of h_{eff} makes possible long range correlations and also space-time correlates for the non-determinism of the critical systems. Living matter represents key example of quantum critical system involving dark matter in an essential manner.

To summarize, the inclusion of free will to physics requires extension of quantum measurement theory to a theory of consciousness. ZEO provides a new ontology in which the sequence of quantum jumps can be regarded as a sequence of recreations of the universe as 4-D sense, as superpositions of time evolutions. ZEO provides also the generalization of state function reduction concept: life is generalized Zeno effect and the first state function reduction to the opposite boundary of CD means the death of self and re-incarnation at the opposite boundary of CD. NMP is the variational principle of consciousness and the notion of NE is possible if one extends quantum physics to adelic physics with cognition described in terms of p-adic physics. Evolution emerges as a continual recreation of the quantum Universe in 4-D sense increasing negentropic resources of the Universe. One can understand Darwinian fight for survival as fight for negentropic resources forced by the demands of NMP: produce (or steal!) negentropy or perish.

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