

Mystery of Time

Matti Pitkänen ¹

Abstract

The relationship between experienced time and time of physics is one of the basic puzzles of modern physics. In the proposed framework they are certainly two different things and the challenge is to understand why the correlation between them is so strong that it has led to their identification. One can imagine several alternative views explaining this correlation and it is better to keep mind open.

1 Basic questions

The relationship between experienced time and time of physics is one of the basic puzzles of modern physics. In TGD framework [2, 1, 3, 4] they are certainly two different things and the challenge is to understand why the correlation between them is so strong that it has led to their identification. One can imagine several alternative views explaining this correlation and it is better to keep mind open.

The flow of subjective time corresponds in TGD framework to quantum jump sequences for sub-selves of self having interpretation as mental images. If mind is completely empty of mental images subjectively experienced time ceases to exist. This leaves however several questions to be answered.

1. Why the contents of conscious of self comes from a finite space-time region looks like an easy question. If the contents of consciousness for sub-selves representing mental images is localized to the sub-*CDs* with indeed have defined temporal position inside *CD* assigned with the self the contents of consciousness is indeed from a finite space-time volume. This implies a new view about memory. There is no need to store again and again memories to the "brain now" since the communications with the geometric past by negative energy signals and also time-like negentropic quantum entanglement allow the sharing of the mental images of the geometric past.
2. There are also more difficult questions. Subjective time has arrow and has only the recent and possibly also past. The subjective past could in principle reduce to subjective now if conscious experience is about 4-D space-time region so that memories would be always geometric memories. How these properties of subjective time are transferred to apparent properties of geometric time? How the arrow of geometric time is induced? How it is possible that the locus for the contents of conscious experience shifts or at least seems to be shifted quantum jump by quantum jump to the direction of geometric future? Why the sensory mental images are located in a narrow time interval of about .1 seconds in the usual states of consciousness (not that sensory memories are possible: scent memories and phantom pain in leg could be seen as examples of vivid sensory memory)?

Just to make illustrate how many different aspects are involved and in the hope that various constraints would allow to select among many alternatives that one can imagine (and have imagined!), let us first try to list basic questions in the framework provided by ZEO.

1. ZEO forces the arrow of geometric time to become a property of zero energy states. What does this mean concretely? Could the observed arrow of time reduce solely to this arrow?

¹Correspondence: Matti Pitkänen <http://tgdtheory.com/>. Address: Köydenpunojankatu 2 D 11 10940, Hanko, Finland. Email: matpitka@luukku.com.

2. Do sub-CD:s drift in preferred time direction inside CD ? Or do space-time sheets drift inside CD to preferred direction. Or is there a phase transition proceeding in the direction of geometric time of CD associated with the entire CD and inducing state function reduction for sub- CD s: it would not matter what boundary of sub- CD is selected if sub- CD would be effectively point-like. The quantum arrow of time for zero energy state should force preferred direction of this phase transition.
3. Does the U process as a cascade proceeding from long scales of CD s to short ones involve explicitly the arrow of geometric time. For instance, could state function reduction cascade for sub- CD s with a given scale correspond to a process analogous to burning proceeding towards geometric future? Or could a phase transition transforming p-adic space-time sheets to real ones as a realization of intentional action proceed in this manner?
4. Do space-time sheets possess an arrow of geometric time coming from the failure of strict determinism (shock waves in hydrodynamics) and giving space-time correlate for the quantum arrow of time? In hydrodynamics second law allows to select between alternative developments in multi-furcation. Could second law or NMP be involved also now?
5. What is the role of the fractal hierarchy of CD ? Also entanglement between sub- CD s carrying zero energy states is possible. Could the state function reductions occurring for sub- CD s give rise to the experience of flow of time at the level of CD . Do these quantum jumps occur for some reason in a time ordered manner (light-cone proper time defines a unique Lorentz invariant time ordering). Could the entanglement anatomy of zero energy states force this automatically? The process would be analogous to burning.
6. Suppose that the idea about time flip-flop meaning that unitary process reduces to a base change between basis with opposite arrows of geometric time. Doesn't this imply that the arrow of geometric time changes its direction alternately or is there a manner to avoid this conclusion?
7. State function reduction involves a reduction of entanglement between quantum variables and classical variables represented by zero modes in TGD Universe. Does this reduction play a key role in the generation of the arrow of time. What is the role of negentropic entanglement? For instance, could it be that the generation of negentropic entanglement at second end of the CD stabilizes the states with respect to state function reduction leading to counterpart of Orch OR?
8. The geometry of light-cone has intrinsic arrow of time. The question is how this arrow induces the arrow of experienced geometric arrow of time with minimal assumption (from structure of zero energy states).
9. The localization of sensory experience to short time interval does not define so strong constraint as one might think since if sensory mental images correspond to small enough sub- CD s, the localization inside sub- CD is enough. For CD itself the localization to either boundary looks natural since state function reduction takes place at the boundary.

2 First trial

Possible answers to these questions could rely on NMP if understood as a sufficiently general principle. Suppose that NMP translates to the statement that selves are eager to gain conscious information. The mere assumption that selves are curious leaves a lot of room for alternatives and one can imagine several models. Note also that geometric time can correspond to the local time assignable to space-time sheet or to the cosmic time assignable to the CD or to 8-D imbedding space.

1. The space-time in the geometric future above the "upper" light-like boundary of CD represents the unknown where the news come from. Negentropic self has to some extent free will and can

perform quantum jumps inducing effectively the shift of the quantum superposition of the space-time surfaces towards geometric past. The news come from the future and represent sensory input and induce subselves as mental images. The population of sensory subselves would tend to be created near the "upper" boundary of CD . This would induce a breaking of time reversal invariance and spontaneous arrow of geometric time. Self would be like a person in movie theater. Self would not move anywhere, space-time surfaces -the film- would move with respect to self.

2. One can consider also alternative view analogous to the standard view if one assumes that the CD s representing subselves can shift towards geometric future in the sequence of quantum jumps. Suppose that U process creates a quantum superposition over temporal positions of CD and that temporal localization takes place during the state function reduction process. Also now the strong form of NMP could force a drift of the sub-self population towards unknown defining the geometric future. The geometric time would be assignable to the larger CD . Also the first option allows drifting of subselves to the upper boundary of CS as a consequence of strong form of NMP.

One might hope that spontaneous breaking of time reversal invariance alone could explain the induced arrow of geometric time so that the arrow of time would not be a result of intentional action. Following options represent attempts to understand the arrow of cosmic time as something analogous to diffusion in half-space.

1. Self is a subself of larger self and the corresponding CD could induce a breaking of time reversal invariance since the proper time coordinate for CD has only positive values so that a diffusion and even drift towards geometric future could result. If subself is nearer to the lower boundary of the larger CD it tends to diffuse upwards and vice versa. In the middle of the larger CD , where the analog of cosmic expansion changes to contraction geometric time would stop.
2. Second option is based on the observation that the size scale of given CD must increase on the average during quantum jump sequence. These events correspond to phase transitions increasing the size scale of CD by a factor of two and could serve as correlate for cosmic expansion. When one fixes either tip of CD , the second tip moves towards future with respect to it in discrete phase transition like steps. This discrete time evolution might define a quantum correlate for the flow of cosmic time at imbedding space level [5].

More detailed discussions of the problem can be found in [3]. In any case, it must be admitted that something important piece of understanding is still lacking. The following represents one of the many attempts to identify this piece and relies on single new input: zero energy states possess quantum arrow of time.

3 Second trial

ZEO allows to assign to zero energy states an arrow of time naturally since one can require that states have well defined single particle quantum numbers at either upper or lower boundary of CD . Also the spontaneous change of the arrow of geometric time is possible. The simplest possible description for U -process is that U -matrix relates to each other these two kinds of states and state function reductions occur alternately at upper and lower boundaries of CD meaning reduction to single particle states with well defined quantum numbers. The localization of sensory experience to short time interval could also correspond to mental images with size scale of CD being about .1 seconds so that the assumption that localization inside CD to either boundary takes place is not absolutely necessary.

It is unclear whether this identification of the unitary process allows a generation of a universal arrow of geometric time. It would seem that the arrow of time as a property of zero energy states must alternate for the proposed mechanism. But is this really the case? To answer this question one must try to understand how the observer concludes that there is geometric arrow of time.

1. This situation could correspond to single arrow of geometric time for a conscious entity if it resides permanently at either boundary of CD : does this mean a sleep-awake cycle of consciousness as a basic attribute of conscious experience? The hierarchy of CD s allows however to think that the scale in which the arrow of time as deduced from cosmology alternates in time scale of lifetime of the Universe so that unique arrow of time would be observed. In time scales shorter than that assignable to the CD of observer the arrow of time would vary periodically (generalized sleep-wake cycle).
2. Does the time flip-flop between upper and lower boundaries of CD really give rise to a variation of perceived arrow of geometric time? Suppose that quantum arrow of time has a direct counterpart in the time evolution of preferred extremals (dissipative processes). The direction of classical dissipation changes as the quantum arrow of time changes. Space-time evolution with a fixed geometric arrow of time would be effectively folded forth and back.

If this were the case, it seems that self has no means of detecting this change in the classical dynamics of preferred extremals assignable to its own CD . This if only the information about space-time sheet is used. The only manner to detect the change of the arrow of time would be by looking the classical dynamics of larger CD s.

If the arrow for the larger C remains the same when the arrow of geometric time for CD changes, self could detect the change of its own geometric arrow of time. For instance, self would experience dissipation inside its own CD to take place in opposite direction compared to that in larger scales. Here one however encounters a problem since in living systems the dissipation indeed could take place in wrong direction: this has even inspired the introduction of the notion of syntropy [6]. Self should however observe that the clocks defined by larger scale system run in wrong direction. But if the single half-period in the reduction cycle corresponds to life-cycle then also this is possible only after what we would call biological death!

Suppose that one just for a moment accepts this picture in absence of anything better. One can argue that there must exist concrete correlates for the flow of time experienced by self in terms of quantum dynamics of sub-selves. One should understand what the fractal hierarchy of selves really means at the level of conscious experience and of its physical correlates. Several mechanisms at space-time level for the generation of arrow of time have been discussed but the really satisfactory mechanism remains to be identified.

Is there a phase transition proceeding in the direction of geometric time of CD associated with the entire CD and inducing state function reduction for sub- CD s: it would not matter what is boundary of sub- CD is selected if sub- CD would be effectively point-like. The quantum arrow of time for zero energy state should force preferred direction of this phase transition.

1. Could it be that this phase transition like process corresponds to a sequence of state function reductions for sub- CD s of given size proceeding to the future. Could the fractal structure of zero energy states give rise to this structure? Ordinary Feynman diagrams would describe only single level in this hierarchy and state function reductions selecting subset of diagrams with given incoming and outgoing states are not possible. Suppose that zero energy states satisfy in very symbolic sense the recursion relation

$$\Psi_n = \Psi_{n,0} + \sum_{0 < k < n} \Psi_{n-k} \circ \Psi_k .$$

Here n corresponds to the size scale of CD . $\Psi_{n,0}$ corresponds an irreducible contribution corresponding to the ordinary Feynman diagrams for which no state function reduction in intermediate states is possible: this would be like dropping out subset of Feynman diagrams. The second term corresponds to splitting two two sub- CD s and is possible only in ZEO. We of course do physics in

various scales without formal theoretical justification. For instance, we calculate QCD type process we can restrict the consideration to corresponding time scales. The decomposition would express this fact as a law of physics.

For these lower level contributions similar equation can be applied and one repeat the recursion down to the lowest level. \circ symbolizes entanglement between the zero energy states Ψ_{n-k} and Ψ_k .

2. Suppose that at the first step state function reduction has led to prepared states at -say- upper end (corresponding to Ψ_k). This is nothing but the basic assumption about zero energy states. At the next step the reduction reduces the entanglement between Ψ_{n-k} and Ψ_k : essentially the sum defining an element for a product AB of matrices reduces to a product of two elements: $\sum_j A_{ij}B_{jk} \rightarrow A_{ij}B_{jk}$. Time ordering of the reductions is unavoidable at this level since sub-CDs are in question. This process would continue fractally downwards to shorter scales. Complete time ordering results if the reduction for Ψ_k proceeds to the short scales first and only then for Ψ_{n-k} . Otherwise reduction sequences would occur for sub-CDs at different temporal positions simultaneously.
3. There is also entanglement with zero modes at each level but it seems that this entanglement is not relevant for this argument reducing the arrow to recursive property of states and to the factorization of two entangled zero energy states at given level of recursion.
4. This view about unitary process would explain the arrow of geometric time, explain why self experiences lower level state functions as time flow, and would also allow to understand the localization of sensory and various other kinds of experiences and also intentional action to short time interval.

References

- [1] M. Pitkänen. Time and Consciousness. In *TGD Inspired Theory of Consciousness*. Onlinebook. http://tgdtheory.com/public_html/tgdconsc/tgdconsc.html#timesc, 2006.
- [2] M. Pitkänen. Time, Spacetime and Consciousness. In *Bio-Systems as Conscious Holograms*. Onlinebook. http://tgdtheory.com/public_html/hologram/hologram.html#time, 2006.
- [3] M. Pitkänen. About Nature of Time. In *TGD Inspired Theory of Consciousness*. Onlinebook. http://tgdtheory.com/public_html/tgdconsc/tgdconsc.html#timenature, 2006.
- [4] M. Pitkänen. Quantum Model of Memory. In *TGD Inspired Theory of Consciousness*. Onlinebook. http://tgdtheory.com/public_html/tgdconsc/tgdconsc.html#memoryc, 2006.
- [5] M. Pitkänen. TGD and Cosmology. In *Physics in Many-Sheeted Space-Time*. Onlinebook. http://tgdtheory.com/public_html/tgdclass/tgdclass.html#cosmo, 2006.
- [6] L. Fantappie. *Teoria Unitaria del Mondo Fisico e Biologico*. Di Renzo Editore, Roma, 1942.