

TGD approach leads to a prediction that bio-photons result when dark photons with large value of effective Planck constant and large wavelength transform to ordinary photons with same energy. The recent progress in understanding the implications of basic vision behind TGD inspired theory of consciousness served as a particular motivation for developing a more detailed view about bio-photons.

\begin{enumerate}

\item The anatomy of quantum jump in zero energy ontology (ZEO) allows one to understand basic aspects of sensory and cognitive processing in the brain without ever mentioning the brain. Sensory perception – motor action cycle with motor action interpreted as time-reversed sensory perception directly reflects the fact that state function reductions occur as sequences to the same boundary of causal diamond (CD) (which itself or rather, quantum superposition of CDs, changes in the process such that either the upper or lower boundaries of all CDs involved are localized at the same light-cone boundary). The first reduction of sequence corresponds to genuine state function reduction and the next induce changes only at the second boundary giving rise to experience flow of time and arrow of time.

\item Also the abstraction and de-abstraction processes in various scales which are essential for neural processing emerge already at the level of quantum jump. The formation of associations is one aspect of abstraction since it combines different manners to experience the same object. Negentropic entanglement of two or more mental images (CDs) gives rise to rules in which superposed  $n$ -particle states correspond to instances of the rule or association of  $n$  events. Schrödinger cat serves as an example: the superposition of living cat-closed bottle and dead-cat-open bottle gives a quantum representation for the rule that it is not good idea to open the bottle. Cat attending to/quantum entangling with the

bottle is  
conscious about the rule. Tensor product formation generating  
negentropic  
entanglement between new mental images and earlier ones generates  
longer  
sequences of memory mental images and gives rise to negentropy gain  
generating experience of understanding, recognition, something which  
has  
positive emotional coloring. Quantum superposition of perceptively  
equivalent zero energy states in given resolution gives rise to  
averaging.  
Increasing the abstraction level means poorer resolution so that the  
insignificant details are not perceived.

\item Various memory representations should be approximately  
invariant  
under the sequence of quantum jumps. Negentropic entanglement gives  
rise to  
this kind of stabilization. The assumption that self model is a  
negentropically entangled system which does not change in state  
function  
reduction, leads to a problem. If the conscious information about  
this  
kind of subself corresponds to change of negentropy in quantum jump,  
it  
seems impossible to get this information. Quite generally, if  
moment of  
consciousness corresponds to quantum jump and thus {\it change},  
how is  
it possible to carry conscious information about {\it quantum  
state}?  
Interaction free measurement however allows to circumvent the  
problem:  
non-destructive reading of memories and future plans becomes  
possible in  
arbitrary good approximation.

This memory reading mechanism can be formulated for both photons and  
phonons and these two reading mechanisms could correspond to visual  
memories as imagination and auditory memories as internal speech.  
Therefore dark photons decaying to bio-photons could be crucial  
element of  
imagination. The notion of bio-phonon could also make sense and even  
follow  
as a prediction. The identification of dark photons responsible  
for the  
reading of memories with EEG is suggested by the strong  
correlation of  
latter with the contents consciousness. This would also suggest a  
correlation of bio-photon emission with EEG for which there is a  
considerable evidence. The indications that bio-photons are  
associated only  
with the right hemisphere suggests that at least some parts of  
right

hemisphere prefer dark photons and are thus specialized to visual imagination: spatial relationships are the speciality of the right hemisphere. Some parts of the left hemisphere at least might prefer dark photons in IR energy range transforming to ordinary phonons in ear or dark phonons: left hemisphere is indeed the verbal hemisphere specialized to linear linguistic cognition.

\item After the writing of the original version of the chapter it turned out that there are good justifications for the proposal that the energy spectrum of dark photons might be universal and do not depend on the mass of the charged particle. This requires that  $\hbar_{\text{eff}}$  is proportional to the mass of the charged particle. This conforms with the hypothesis that bio-photons result in the transformation of dark photons to ordinary photons and the hypothesis cyclotron frequencies code serve as kind of passwords characterizing the ion. Dark ions could also affect ordinary matter by inducing molecular transitions in visible and UV range by transforming first to bio-photons.

\end{enumerate}

In the following I shall discuss bio-photons in TGD Universe as decay products of dark photons and propose among other things an explanation for the hyperbolic decay law in terms of quantum coherence and echo-like mechanism guaranteeing replication of memory representations. Applications to biology, neuroscience, and consciousness are discussed and also the possible role of bio-photons for remote mental interactions is considered. Also the phenomenon of Taos hum is discussed as a possible evidence for biophonons.