Consciousness, Brain Vibrations and Planck Mass

Janina Marciak-Kozłowska* and Miroslaw Kozlowski†

ABSTRACT

In this paper we investigate the brain vibrations as the quantum process. We argue that the brain emits the vibration which strongly depends on the mass of the oscillator. We show that the predominant frequency of the brain vibration \( \omega \approx 12\text{Hz} \) can be achieved for oscillator with mass of the order of Planck mass. It is interesting to observe that mass of the human neuron is of the order of Planck mass. It seems that there is strong connection of the structure of the Universe and the brain activity. In our paper we showed that the Planck vibration and the brain vibration can be described by the same second order Schrödinger equation.

Key Words: Brain vibrations, Planck mass

DOI Number: 10.14704/nq.2014.12.3.742

Introduction

Schrödinger equation is not the wave equation from the mathematical point of view. It is the first order (in time) parabolic equation, whereas the wave equation is the hyperbolic partial equation with the wavy motion solution. In this paper we obtain the Schrödinger second order (in time) wave equation. With this equation we will study the brain wave problems. In our earlier paper (Marciak-Kozłowska and Kozlowski, 2013), we showed that the spectrum of the brain photons can be analyzed with the help of the Planck formula for equilibrium thermal radiation. We calculated the temperature of the brain waves and compared it to the temperature of the Cosmic Microwave Background radiation. In this paper, we solve the second order Schrödinger equation for brain waves and calculate the brain wave frequencies. The model for brain waves presented in this paper opens the new horizon for the study of the human consciousness.

Quantum Mechanics and Consciousness

A majority of contemporary Western scientists specializing in consciousness research, such as neuroscientists, psychologists, psychiatrists, and philosophers, espouse a materialist and reductionist explanation for consciousness. The well-known philosopher Daniel Dennett, for example, adheres to monistic materialism (Dennett, 2011). Dennett, like many others, is of the opinion that consciousness is nothing but matter and that our subjective experience of consciousness as something purely personal and distinct from other people’s consciousness is merely an illusion. According to Dennett, consciousness is produced by the matter that comprises our brain. This materialist hypothesis is supported by scientific patterns of thought and paradigms that he and many other scientists and philosophers deem absolutely unassailable and are therefore reluctant to challenge. Scientists often struggle to free
themselves from prevailing paradigms. And such dogmatic convictions seem to beget prejudice.

If the materialist standpoint were correct, everything we experience in our consciousness would be nothing but the expression of a machine controlled by classical physics and chemistry. In Dennett's view, our behavior is the inevitable result of neuronal activity in our brains. The idea that all thoughts and feelings are no more than a consequence of brain activity obviously means that free will is an illusion. In response to this materialist position John C. Eccles said:

“I maintain that the human mystery is incredibly demeaned by scientific reductionism, with its claim in promissory materialism to account eventually for the entire spiritual world in terms of patterns of neuronal activity. This belief must be classed as superstition... We have to recognize that we are spiritual beings with souls existing in a spiritual world as well as material beings with bodies and brains existing in a material world.”

The materialist approach, which is based on the premise that consciousness is a product or effect of brain function, is taught at many medical schools in the Western world. The approach is generally not made explicit and simply taken for granted without any kind of debate. Not surprisingly then, nearly all Western doctors believe that consciousness is the result of brain function.

What have we read about the relationship between consciousness and the brain in the contemporary literature? (Pim van Lommel, 2010):

- Many serious and trustworthy people have reported that, to their great surprise, they were able to experience an enhanced consciousness, independently of their body.
- On the basis of a few scientifically sound studies of near death experience (NDE) among cardiac arrest survivors, researchers have come to the conclusion that current scientific knowledge cannot offer an adequate explanation for the cause and content of a near-death experience.
- Some prospective, empirical studies provide conclusive evidence that it is possible to experience an enhanced and lucid consciousness during a cardiac arrest.
  - We appear to have scientific proof that the cerebral cortex and brain stem are devoid of measurable activity during a cardiac arrest and that the clinical picture also reflects a loss of all brain function
  - Brain studies have shown that under normal circumstances a functioning; collaborative network of brain centers is a prerequisite for the experience of waking consciousness. This is absent during a cardiac arrest.
  - Oxygen deficiency in itself provides no explanation because NDEs can be reported under circumstances that are not life-threatening, such as mortal fear or a serious depression.
  - Our mind is capable of altering the anatomy and function of the brain (neuroplasticity).
  - In many respects, both consciousness and brain function remain a huge mystery.

Some prospective and many retrospective studies of near-death experience have shown that various aspects of an NDE correspond with or are analogous to some of the basic principles from quantum mechanics, such as nonlocality, entanglement or interconnectedness, and instantaneous information exchange in a timeless and placeless dimension. Past, present, and future are everywhere at once (nonlocally). We can say that the quantum physics idea that consciousness determines if and how we experience our reality is particularly important for the further theoretical underpinning of this relationship. However, this radical interpretation of quantum physics is not yet commonly accepted. Science challenges us to devise, test, and discuss new ideas that might explain the reported connection between one's own consciousness and that of other living persons or deceased relatives. The same applies to nonlocal phenomena such as the life review and preview, in which past, present, and future can be experienced simultaneously and which elude our conventional embodied conception of time and space. For me the biggest challenge is to find an explanation for the fact that an enhanced consciousness can be experienced independently of the body during the temporary loss of all cortical and brain-stem function.

A final theoretical possibility, one that has not been mentioned so far, is the theory of
transcendence, or rather the continuity hypothesis. It views the NDE as an altered state of consciousness, in which memories, self-identity, lucid thought, and emotions can be experienced independently of the unconscious body and in which (extrasensory) perception outside the body remains a possibility. The empirical studies have shown that NDEs can experience an enhanced consciousness independently of their normal, embodied waking consciousness. I am reluctant to use the word transcendence because it suggests something transcending or rising above the body. Transcendence is usually associated with the supernatural or with the concept of transcendental meditation. It is always present outside and often inside the body. As mentioned, current medical and scientific knowledge cannot account for all aspects of the subjective experiences reported by cardiac arrest survivors with an NDE. However, science means asking questions with an open mind. And science is also about searching for possible explanations for new, initially perplexing problems instead of clinging to old facts and concepts. The problem lies less in accepting the content of new ideas than in rejecting old and familiar conceptions. The history of science tells us that sooner or later—and sometimes very soon—new empirical findings will force us to abandon our acquired knowledge. Quantum physicist David Bohm (1987) believed that “fixed ideas which underlie scientific hypotheses are not aids but obstructions to clarity, and that a methodology which combines discipline with openness would be better equipped to keep pace with the truth that is revealed as scientific investigation progresses and deepens.”

According to one concept, our brain can be compared to a television set that receives information from electromagnetic fields and decodes it into sound and vision. Our brain can also be compared to a television camera, which converts sound and vision into electromagnetic waves, or encodes it. These electromagnetic waves contain the essence of all information for a TV program but are available to our senses only through a television camera and set. In this view, brain function can be seen as a transceiver; the brain does not produce but rather facilitates consciousness. Consciousness contains the seeds of all the information that is stored as wave functions in nonlocal space. It transmits information to the brain and via the brain receives information from the body and the senses. That consciousness affects both form and function of the brain and the body has been described in the discussion of neuroplasticity (The mind can change the brain). This view corresponds with what Bohm has written: “Consciousness informs and informs”.

The wave functions in nonlocal space, which possess both personal and universal information, is nonlocal consciousness. However, nonlocal space is more than a mathematical description; it is a metaphysical space in which consciousness can exert influence because nonlocal space possesses subjective properties of consciousness. In this view consciousness is nonlocal and functions as the origin or basis of everything, including the material world.

Aspects of consciousness must resonate in different parts of the brain in order to be experienced as waking consciousness. Resonance involves oscillation with the same frequency. As we saw earlier, neurological imaging techniques such as fMRI and PET show that different states of consciousness activate various brain centers (Lommel, 2010). Depression, joy, fear, pain, meditation, decision making, cognitive functions, mindfulness, sleeping, or perception all activate different centers of the brain. But while the imaging techniques can establish the neurological correlations, they do so without accounting for the content of the different aspects of consciousness. They merely point out the place of resonance of the different aspects of consciousness. Our waking consciousness has a biological basis because our body functions as an interface. But there is no logical basis for endless or enhanced consciousness, which is located in a multidimensional nonlocal space. So enhanced consciousness is not limited to our brain because it is nonlocal, and under normal circumstances our brain only allows us to experience waking consciousness. Like the particle and wave aspects of light, this perspective on the relationship between nonlocal and waking consciousness constitutes a complementary theory. Conscious subjective experiences and their corresponding objective and visible brain activities, the physical effects of waking consciousness, which can be established with the help of an fMRI or EEG, are two different manifestations of one and the same underlying reality; they cannot be reduced to one another. Experiments appear to provide
One scientific proof of the nonlocal entanglement or connectedness of consciousness. Pairs of people were placed in two separate Faraday cages, which are rooms shielded from electromagnetic radiation to block out any electromagnetic information transfer. If these two people were strongly connected to each other, such as parent and child or two people who practiced many years of joint meditation, simultaneous changes in their EEG could be registered. In one isolated Faraday chamber, sensory stimulation through random computer-generated flashes of light caused visual evoked potentials in the EEG registration of the stimulated person, and this activity was instantaneously received by the other, unstimulated person in the second Faraday cage (Lommel, 2010). As a result, the registered patterns in the EEG of the unstimulated person changed the moment the lights flashed in the other Faraday cage. This transferred electrical activity, the so-called transferred potentials, the coherence or correlation between the two EEGs, can be ascribed only to nonlocal influence. Because the experiment design excluded electromagnetic information transfer, this correlation cannot be explained with classic scientific models.

Physicist Fred H. Thaheld has outlined a potential scientific basis for this macroscopic and biological nonlocal entanglement (Thaheld, 2009). The first studies of this nonlocal entanglement of consciousness were carried out at the University of Mexico by the neurophysiologist Jacobo Grinberg-Zylberbaum (Grinberg-Zylberbaum, 1994). The research initially met with criticism because of its poor design, but scientists at three different laboratories later replicated identical EEG correlations. Two fMRI studies found evidence of nonlocal entanglement between the brains of two isolated individuals while nonlocal influence has also been identified in subjects whose fMRI registration changed significantly when a healer at some distance focused attention on these subjects. And a recent study using laser stimulation and local EEG registration has shown nonlocal biological and macroscopic entanglement between two cultivated specimens of fully isolated human neural networks. Carefully executed and replicated empirical studies confirm the nonlocal properties of consciousness and point to a nonlocal entanglement in biological and macroscopic systems such as the brain. Neither the classical physics model of science nor contemporary biological theories can account for this correlation of biological systems. The human brain is an extremely complex and in many respects mysterious organ with physiological, chemical, and biological properties. But because consciousness is not physiological, chemical, or biological, the brain is much harder to analyze. Mathematician and physicist Roger Penrose has argued that on theoretical grounds consciousness cannot be produced by the brain. He has also demonstrated that computers will never be able to fully replicate or produce consciousness.

Consciousness is nonlocal, that is, everywhere in nonlocal space and intrinsically entangled with all potential information stored in wave functions. Consciousness triggers collapse of the wave function and is thus the source of embodied waking consciousness. There is a theoretical possibility that consciousness in nonlocal space is linked to—or serves as the basis for—the electromagnetic field connected to the nervous system and the brain. In that case consciousness would be hitchhiking, as it were, on the electromagnetic field that probably originates, like consciousness, in nonlocal space.

The process shows a certain analogy with the double-slit experiment, in which as soon as the intensity of the light dwindles from a massive bombardment to the transmission of individual photons there is a shift from an electromagnetic wave to a probability wave. In the case of a single photon, no electromagnetic wave can be measured, but the (immeasurable) probability wave is used to statistically predict where the photon will hit the photographic plate. Perhaps we could apply this to the brain, with brain activity measured through the registration of the electromagnetic field (EMF). In the event of a cardiac arrest this electromagnetic activity will slow to individual pulses with extremely low electromagnetic energy so that these minimal energy packets (pulses) come to resemble individual photons. These minimal energy packets must then be described with the probability waves from quantum physics instead of the electromagnetic waves from classical physics. When the electromagnetic activity can no longer be measured, it does not mean that there are no more probability waves. In fact, this is where the probability wave becomes a useful descriptor. In theory, the complete loss of brain function is still accompanied by (immeasurable)
probability waves. Any potential influence on the minimal processes occurring in the brain at that moment cannot be ruled out (the neurons' pilot-light state). NDE studies suggest that during the loss of all measurable brain function people continue to experience nonlocal consciousness (Lommel, 2010); this nonlocal consciousness is theoretically based on probability waves.

Photons (waves or particles) are intrinsic quantum objects and natural long-distance carriers of information both in classical communication via radio, TV, mobile phones, and wireless Internet and in quantum communication. In Science (Matsukievich and Kuzmich, 2004) and Nature (Chanliere, 2005) recently the results were published of research carried out under laboratory conditions that proved information transfer between matter and light through electron spin and nuclear spin resonance on the basis of nonlocal quantum entanglement. This form of information transfer between light and matter is comparable to reciprocal information transfer between nonlocal consciousness and the brain via the model of nuclear spin correlation or nuclear spin coherence.

Recent studies among volunteers have found strong indications of a nonlocal therapeutic effect of certain drugs such as morphine, when the substance was placed between a pulsating magnetic source and the brain (Matsukievich and Kuzmich, 2004). The subjective therapeutic effect in these volunteers was identical to the effect of receiving this drug directly into the body. And the same subjective therapeutic effect was achieved when the subjects drank water that had been exposed to a pulsating magnetic source, to laser light, microwaves, or even to a flashlight, with the drug placed between the photon source and the water. The authors ascribe this empirically proven positive effect to quantum entanglement between nuclear spin and/or electron spin in the water and nuclear spin and/or electron spin in the brain. The nonlocal information transfer is made possible by, respectively, the magnetic, laser, or flashlight source or the microwaves.

In conclusion, these three possible models of an interface between nonlocal consciousness and the brain will have to be elaborated though future research because the questions continue to outnumber the answers. As mentioned, nonlocal and reciprocal information exchange between consciousness and the brain will never be fully knowable or verifiable, rendering any theories on the subject by definition difficult prove or disprove. Perhaps a combination of data from empirical and theoretical scientific research could contribute to more definitive answers.

On the strength of the prospective studies of near-death experience and recent data from neurophysiological research and concepts from quantum theory, I strongly believe that consciousness cannot be localized in any particular place—not even in the brain. It is nonlocal (that is, everywhere) in the form of probability waves. For this reason it cannot be demonstrated or measured in the physical world. There is, independent of the body, a continuity of consciousness that is intrinsically connected to or entangled in nonlocal space, though not identical to this space. The different aspects of consciousness are all nonlocal and accessible, although there is probably some kind of hierarchy. The essence or foundation of consciousness (protoconsciousness) probably lies in the vacuum or plenum of the universe, from where it has a nonlocal connection with consciousness in nonlocal space (paraproto-psychoism). In this view, the vacuum is the source both of the physical world and of consciousness. Perhaps nonlocal space could be called the absolute or true vacuum because the vacuum and nonlocal space is either identical or nonlocally connected and therefore indistinguishable. Everything is a form of space. Consciousness encompasses nonlocal space, and both my consciousness and yours encompass all space. In fact, each part of our consciousness encompasses all space because each part of infinite is infinite itself. This is exactly what the concept of nonlocality means.

Nonlocal consciousness is the source of our waking consciousness. The two are complementary aspects of consciousness. Under normal, everyday circumstances people experience waking consciousness (the "particle" aspect), which is just one small part of overall and endless nonlocal consciousness (the "wave function" aspect). During life people perceive with the senses while the brain functions as interface. Under abnormal circumstances, people can experience the endless aspect of nonlocal consciousness independent of the body, which is called the continuity of consciousness, and perceive directly via consciousness in space. This is known as a near-death experience. DMT from the pineal gland,
of which the release seems to be triggered or stimulated by events in our consciousness, could play a key role in establishing and disrupting the interface between the brain and nonlocal consciousness. As mentioned, this interface may be based on quantum spin coherence (nuclear spin resonance) (Keevil, 2006).

Nonlocal consciousness is endless, just as each part of consciousness is endless. But our body is not endless. Every day, fifty billion cells are broken down and regenerated in our body. And yet we experience our body as continuous. Where does the continuity of the constantly changing body come from? How can we explain long-term memory if the molecular composition of the neurons’ cell membrane is completely renewed every two weeks? And how can we have a long-term memory if the millions of synapses in the brain undergo a process of constant adaptation (neuroplasticity).

2. Modified Schrödinger Equation
When Max Planck made the first quantum discovery he noted an interesting fact. The speed of light, Newton’s gravity constant and Planck’s constant clearly reflect fundamental properties of the world. From them it is possible to derive the characteristic mass $M_P$, length $L_P$ and time $T_P$ with approximate values

$$L_P = 10^{-35} \text{ m}$$
$$T_P = 10^{-43} \text{ s}$$
$$M_P = 10^{-5} \text{ g} .$$

The constants $L_P$, $T_P$ and $M_P$ describe Planck Epoch. The enormous efforts of the physicists, mathematicians and philosophers investigate the Planck Epoch. In the subsequent we argue that the source of the “hard” consciousness phenomena are routed in Planck Epoch.

To start with we derive modified Schrödinger equation from the study of the thermal phenomena. The thermal history of the system (brain, universe) can be described by the generalized Fourier equation

$$q(t) = -\int K(t - t') VT(t')dt'. \tag{2.1}$$

In Eq. (2.1) $q(t)$ is the density of the energy flux, $T$ is the temperature of the system and $K(t - t')$ is the thermal memory of the system

$$K(t - t') = \frac{K}{\tau} \exp \left[ -\frac{(t - t')}{\tau} \right], \tag{2.2}$$

where $K$ is constant, and $\tau$ denotes the relaxation time.

As was shown in (Marcia-Kozlowska and Kozlowski, 2013):

$$K(t - t') = \begin{cases} 
K\delta(t - t') \text{ diffusion} \\
\frac{K}{\tau} \exp \left[ -\frac{(t - t')}{\tau} \right] \text{ damped wave or hyperbolic diffusion}.
\end{cases} \tag{2.3}$$

The damped wave or hyperbolic diffusion equation can be written as:

$$\frac{\partial^2 T}{\partial t^2} + \frac{1}{\tau} \frac{\partial T}{\partial t} = \frac{D_T}{\tau} \nabla^2 T. \tag{2.4}$$

For $\tau \to 0$, Eq. (3.3) is the Fourier thermal equation

$$\frac{\partial T}{\partial t} = D_T \nabla^2 T \tag{2.4}$$

and $D_T$ is the thermal diffusion coefficient. The systems with very short relaxation time have very short memory. On the other hand for $\tau \to \infty$ Eq. (2.3) has the form of the thermal wave (undamped) equation, or ballistic thermal equation. In the solid state physics the ballistic phonons or electrons are those for which $\tau \to \infty$. The experiments with ballistic phonons or electrons demonstrate the existence of the wave motion on the lattice scale or on the electron gas scale.

$$\frac{\partial^2 T}{\partial t^2} = \frac{D_T}{\tau} \nabla^2 T. \tag{2.5}$$

For the systems with very long memory Eq. (3.3) is time symmetric equation with no arrow of time, for the Eq. (2.5) does not change the shape when $t \to -t$.

In Eq. (2.3) we define:

$$v = \left( \frac{D_T}{\tau} \right), \tag{2.6}$$

velocity of thermal wave propagation and

$$\lambda = \nu \tau, \tag{2.7}$$

ISSN 1303-5150  www.neuroquantology.com
where $\lambda$ is the mean free path of the heat carriers. With formula (3.6) equation (3.3) can be written as
\[
\frac{1}{v^2} \frac{\partial^2 T}{\partial t^2} + \frac{1}{v^2} \frac{\partial T}{\partial t} = \nabla^2 T. \tag{2.8}
\]

From the mathematical point of view equation:
\[
\frac{1}{v^2} \frac{\partial^2 T}{\partial t^2} + \frac{1}{D} \frac{\partial T}{\partial t} = \nabla^2 T
\]
is the hyperbolic partial differential equation (PDE). On the other hand Fourier equation is the hyperbolic partial differential equation (PDE). On the other hand Fourier equation:
\[
T = \frac{1}{D} \frac{\partial T}{\partial t} \tag{2.9}
\]
and Schrödinger equation
\[
\hbar \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m} \nabla^2 \psi \tag{2.10}
\]
are the parabolic equations. Formally with substitutions
\[
t \leftrightarrow it, \quad \Psi \leftrightarrow T \tag{2.11}
\]
Fourier equation (3.9) can be written as
\[
\hbar \frac{\partial \psi}{\partial t} = -D \hbar \nabla^2 \psi \tag{2.12}
\]
and by comparison with Schrödinger equation one obtains
\[
D \hbar = \frac{\hbar^2}{2m} \tag{2.13}
\]
and
\[
D \tau = \frac{\hbar}{2m v}\tag{2.14}
\]
Considering that $D \tau = v^2$ (3.6) we obtain from (3.14)
\[
\tau = \frac{\hbar}{2mv^2}. \tag{2.15}
\]
Formula (3.15) describes the relaxation time for quantum thermal processes.

Starting with Schrödinger equation for particle with mass m in potential $V$:
\[
\hbar \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m} \nabla^2 \psi + V\psi \tag{2.16}
\]
and performing the substitution (3.11) one obtains
\[
\hbar \frac{\partial T}{\partial t} = \frac{\hbar^2}{2m} \nabla^2 T - VT \tag{2.17}
\]
\[
\frac{\partial T}{\partial t} = \frac{\hbar}{2m} \nabla^2 T - \frac{V}{\hbar} T. \tag{2.18}
\]
Equation (2.18) is Fourier equation (parabolic PDE) for $\tau = 0$. For $\tau \neq 0$ we obtain
\[
\tau = \frac{\hbar}{2mv^2}
\]
where the relaxation time $\tau$ is the real constant. Considering (3.19) we obtain
\[
\frac{1}{v^2} \frac{\partial^2 T}{\partial t^2} + \frac{2m}{\hbar} \frac{\partial T}{\partial t} + \frac{2Vm}{\hbar^2} T = \nabla^2 T. \tag{2.20}
\]
With the substitution (2.11) equation (2.19) can be written as
\[
\hbar \frac{\partial \psi}{\partial t} = V\psi - \frac{\hbar^2}{2m} \nabla^2 \psi - \tau \hbar \frac{\partial^2 \psi}{\partial t^2}. \tag{2.21}
\]
The new term, relaxation term
\[
\tau \hbar \frac{\partial^2 \psi}{\partial t^2} \tag{2.22}
\]
describes the interaction of the particle with mass $m$ with space-time. The relaxation time $\tau$ can be calculated as:
\[
\tau = \left( \tau_{e-p}^{-1} + \ldots + \tau_{\text{Planck}}^{-1} \right), \tag{2.23}
\]
where, for example $\tau_{e-p}$ denotes the scattering of the particle m on the electron-positron pair ($\tau_{e-p} \sim 10^{-17}$ s) and the shortest relaxation time $\tau_{\text{Planck}}$ is the Planck time ($\tau_{\text{Planck}} \sim 10^{-43}$ s).

From equation (2.23) we conclude that $\tau \approx \tau_{\text{Planck}}$ and equation (2.21) can be written as
\[
\hbar \frac{\partial \psi}{\partial t} = V\psi - \frac{\hbar^2}{2m} \nabla^2 \psi - \tau_{\text{Planck}} \hbar \frac{\partial^2 \psi}{\partial t^2}, \tag{2.24}
\]
where
\[
\tau_{\text{Planck}} = \frac{1}{2} \left( \frac{\hbar G}{c} \right) = \frac{\hbar}{2M_p c^2}. \tag{2.25}
\]
In formula (2.25) $M_p$ is the mass Planck. Considering Eq. (2.25), Eq. (2.24) can be written as
The last two terms in Eq. (3.26) can be defined as the Bohmian pilot wave
\[
\frac{\hbar^2}{2M_P} \nabla^2 \psi - \frac{\hbar^2}{2M_P c^2} \frac{\partial^2 \psi}{\partial t^2} = 0,
\]
(2.27)
i.e.
\[
\nabla^2 \psi - \frac{1}{c^2} \frac{\partial^2 \psi}{\partial t^2} = 0.
\]
(2.28)

It is interesting to observe that pilot wave \(\psi\) does not depend on the mass of the particle. With postulate (2.28) we obtain from equation (2.26)
\[
\frac{i\hbar}{\hbar} \frac{\partial \psi}{\partial t} = \frac{-\hbar^2}{2m} \nabla^2 \psi + V \psi - \frac{\hbar^2}{2M_P} \nabla^2 \psi
\]
(2.29)

and simultaneously
\[
\frac{\hbar^2}{2M_P} \nabla^2 \psi - \frac{\hbar^2}{2M_P c^2} \frac{\partial^2 \psi}{\partial t^2} = 0.
\]
(2.30)

In the operator form Eq. (2.21) can be written as
\[
\hat{E} = \frac{\hat{\beta}^2}{2m} + \frac{1}{2M_P c^2} \hat{E}^2,
\]
(2.31)
where \(\hat{E}\) and \(\hat{\beta}\) denote the operators for energy and momentum of the particle with mass \(m\). Equation (2.31) is the new dispersion relation for quantum particle with mass \(m\). From Eq. (3.21) one can conclude that Schrödinger quantum mechanics is valid for particles with mass \(m \ll M_P\). But pilot wave exists independent of the mass of the particles.

For particles with mass \(m \ll M_P =\) neuron mass Eq. (2.29) has the form
\[
\frac{i\hbar}{\hbar} \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m} \nabla^2 \psi + V \psi.
\]
(2.32)

In the case when \(m \approx M_P\) Eq. (2.29) can be written as
\[
\frac{i\hbar}{\hbar} \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2M_P} \nabla^2 \psi + V \psi,
\]
(2.33)
but considering Eq. (2.30) one obtains
\[
\frac{i\hbar}{\hbar} \frac{\partial \psi}{\partial t} = \frac{\hbar^2}{2M_P c^2} \frac{\partial^2 \psi}{\partial t^2} + V \psi
\]
(2.34)

We argue that Equations (2.35) and (2.30) are the master equation for the brain oscillations, \(\psi\). We look for the solution of Eq. (2.35) in the form
\[
\psi(x,t) = e^{-i\omega t} u(x).
\]
(2.36)

After substitution formula (2.36) to Eq. (2.35) we obtain
\[
\frac{\hbar^2}{2M_P c^2} \omega^2 - i\hbar \omega + V(x) = 0
\]
(2.37)

with the solution
\[
\omega_1 = -\frac{M_P c^2 + M_P c^2 \sqrt{1 - \frac{2V}{M_P c^2}}}{h}
\]
(2.38)
for \(\frac{M_P c^2}{2} > V\) and
\[
\omega_2 = \frac{M_P c^2 - M_P c^2 \sqrt{1 - \frac{2V}{M_P c^2}}}{h}
\]
(2.39)
for \(\frac{M_P c^2}{2} < V\).
Both equations (2.38) and (2.39) describe the vibration of the Planck mass, equation (2.38) damped oscillation and formula (2.39) over damped oscillation. From elementary particles physics we know that the internal energy \( M_P c^2 \) is the maximum energy per particle in the Universe for elementary particles (Figure 1). In that case we argue that the first solution (2.38) is the valid solution.

For \( \frac{M_P c^2}{2} \gg V \) we obtain

\[
\omega_1 = \frac{2M_P c^2}{\hbar}
\]

\[
\omega_2 = \frac{V}{\hbar}
\]

(2.40)

The angular frequency \( \omega_1 \) represents the Planck frequency \( \omega_\tau = \tau^{-1} \) and \( \omega_2 \) is the frequency of the brain waves. Figure 2 presents the \( \omega_2 \) as the function of \( V \). As can be seen from Figure 2, for the potential energy \( V \approx 10^{-15} cV \) angular frequency of the brain oscillations is of the order of 12Hz in agreement with the measured frequencies. It is very interesting to observe that the same equation describes the two modes of the wave motion: the vibration of the space-time, Planck vibration, for primordial Universe and the brain vibration. It is interesting to observe that mass of the human neuron is of the order of Planck mass.

**Conclusion**

It seems that there is strong connection of the structure of the Universe and the brain activity. In our paper we showed that the Planck vibration and the brain vibration can be described by the same second order Schrödinger equation.

**References**

Dennet DC, Plantinga A. Science and Religion, Oxford University Press, 2011

Bohm D, Science, order and creativity, Bantam Books, 1987


