**Exploration**

# Sowed in Spacetime

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## Abstract

In this paper, we show that the generalization of the parabolic Schrodinger equation to hyperbolic partial differential equations leads to possibility of the study of consciousness on the quantum level. In our hypothesis, consciousness is operated by wave equation which do not dependent on the mass of particle.

**Keyword**: Spacetime, Schrodinger equation, parabolic, differential equation, consciousness.

> *I am opposing not a few special statements of quantum mechanics held today. I am opposing as it were whole of it, I am opposing its basics views that have been shaped 25 years ago, when Max Born put forward his probability interpretation, which was accepted by almost everybody. E. Schrodinger- July 1952 Colloqium.* E. Schrodinger in The interpretation of Quantum Mechanicsa, edited by Michel Bitbol, Ox Bow Press,,1995.

## 1. Introduction

We were sowed in 4D Space-time The seeds – Planck particles ($10^{-5}$g= $10^{19}$Gev) started our body from spacetime matter (virtual to real). The Planck particles contained all information on our body and consciousness (neurons). The creation is everlasting. In this paper, we describe the peculiarities of the creation in the language of physics.

One of the fundamental aspect of human consciousness is memory. Within contemporary science, memory as well as consciousness are far from being explained. The basic problem with consciousness is that we have not the master equation for describe the consciousness in mathematically precise way. For that we must reconsider *ab ovo the basic equation of physics – Schrodinger equation and generalize it for inclusion the memory (consciousness) term.*

In this paper we will followed the D. Bohm hypothesis on existence consciousness on the quantum level. To that aim started with classical diffusion theory we will obtain Schrodinger hyperbolic equation ( with second time derivative) which will describe elementary consciousness ( memory)

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## 2. Mathematical introduction to classical thermodynamics

In classical thermodynamics the energy flux is defined as (J. Marciak-Kozłowska, M.Kozłowski, 2017)

$$q(t) = -\int_{-\infty}^{t} \underbrace{K(t-t')}_{\text{thermal history}} \underbrace{\nabla T(t')dt'}_{\text{diffusion}}. \tag{1}$$

In Eq. (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*

$$K(t-t') = \frac{K}{\tau}\exp\left[-\frac{(t-t')}{\tau}\right], \tag{2}$$

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

As was shown in (J. Marciak-Kozlowska, M. Kozłowski,2017)

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

The damped wave or hyperbolic diffusion equation can be written as (J. Marciak-Kozlowska, M.Kozlowski, 2017):

$$\frac{\partial^2 T}{\partial t^2} + \frac{1}{\tau}\frac{\partial T}{\partial t} = \frac{D_T}{\tau}\nabla^2 T. \tag{3}$$

For $\tau \to 0$, Eq. (3) is the Fourier thermal equation

$$\frac{\partial T}{\partial t} = D_T \nabla^2 T \tag{4}$$

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. (3) has the form of the thermal wave (undamped) equation, or *ballistic* thermal equation (5).

$$\frac{\partial^2 T}{\partial t^2} = \frac{D_T}{\tau} \nabla^2 T. \tag{5}$$

In 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. For the systems with very long memory Eq. (3) is time symmetric equation with no arrow of time, for the Eq. (5) does not change the shape when $t \to -t$.

In Eq. (3) we define

$$\upsilon = \left( \frac{D_T}{\tau} \right), \tag{6}$$

velocity of thermal wave propagation and

$$\lambda = \upsilon \tau, \tag{7}$$

where $\lambda$ is the mean free path of the heat carriers. With formula (6) equation (3) can be written as

$$\frac{1}{\upsilon^2} \frac{\partial^2 T}{\partial t^2} + \frac{1}{\tau \upsilon^2} \frac{\partial T}{\partial t} = \nabla^2 T. \tag{8}$$

From the mathematical point of view equation:

$$\frac{1}{\upsilon^2} \frac{\partial^2 T}{\partial t^2} + \frac{1}{D} \frac{\partial T}{\partial t} = \nabla^2 T$$

is the hyperbolic partial differential equation (PDE). On the other hand Fourier equation

$$\frac{1}{D} \frac{\partial T}{\partial t} = \nabla^2 T \tag{9}$$

and Schrödinger equation

$$i\hbar \frac{\partial \Psi}{\partial t} = -\frac{\hbar^2}{2m} \nabla^2 \Psi \tag{10}$$

are the parabolic equations.

## 3. Hyperbolic Schrodinger equation

Formally with substitutions

$$t \leftrightarrow it,\ \Psi \leftrightarrow T \tag{11}$$

Fourier equation (9) can be written as

$$i\hbar\frac{\partial\Psi}{\partial t} = -D\hbar\nabla^2\Psi \tag{12}$$

and by comparison with Schrödinger equation one obtains

$$D_T\hbar = \frac{\hbar^2}{2m} \tag{13}$$

and

$$D_T = \frac{\hbar}{2m}. \tag{14}$$

Considering that $D_T = \tau v^2$ (6) we obtain from (14)

$$\tau = \frac{\hbar}{2mv_h^2}. \tag{15}$$

Formula (15) describes the relaxation time for quantum thermal processes.

Starting with Schrödinger equation for particle with mass m in potential V:

$$i\hbar\frac{\partial\Psi}{\partial t} = -\frac{\hbar^2}{2m}\nabla^2\Psi + V\Psi \tag{16}$$

and performing the substitution (11) one obtains

$$\hbar\frac{\partial T}{\partial t} = \frac{\hbar^2}{2m}\nabla^2 T - VT \tag{17}$$

$$\frac{\partial T}{\partial t} = \frac{\hbar}{2m}\nabla^2 T - \frac{V}{\hbar}T. \tag{18}$$

Equation (18) is Fourier equation (parabolic PDE) for $\tau = 0$. For $\tau \neq 0$ we obtain

$$\tau \frac{\partial^2 T}{\partial t^2} + \frac{\partial T}{\partial t} + \frac{V}{\hbar} T = \frac{\hbar}{2m} \nabla^2 T, \tag{19}$$

$$\tau = \frac{\hbar}{2m\upsilon^2} \tag{20}$$

or

$$\frac{1}{\upsilon^2} \frac{\partial^2 T}{\partial t^2} + \frac{2m}{\hbar} \frac{\partial T}{\partial t} + \frac{2Vm}{\hbar^2} T = \nabla^2 T.$$

With the substitution (11), equation (19) can be written as

$$i\hbar \frac{\partial \Psi}{\partial t} = V\Psi - \frac{\hbar^2}{2m} \nabla^2 \Psi - \tau\hbar \frac{\partial^2 \Psi}{\partial t^2} . \tag{21}$$

The new term, relaxation term

$$\tau\hbar \frac{\partial^2 \Psi}{\partial t^2} \tag{22}$$

describes the *memory term* for particle with mass $m$. The relaxation time $\tau$ can be calculated as:

$$\tau^{-1} = \left(\tau_{e-p}^{-1} + \ldots + \tau_{Planck}^{-1}\right), \tag{23}$$

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 $\tau_{Planck}$ is the Planck time ($\tau_{Planck} \sim 10^{-43}$s).

From equation (23), we conclude that $\tau \approx \tau_{Planck}$ and equation (21) can be written as

$$i\hbar \frac{\partial \Psi}{\partial t} = V\Psi - \frac{\hbar^2}{2m} \nabla^2 \Psi - \tau_{Planck}\hbar \frac{\partial^2 \Psi}{\partial t^2} , \tag{24}$$

where

$$\tau_{Planck} = \frac{1}{2}\left(\frac{\hbar G}{c^5}\right)^{\frac{1}{2}} = \frac{\hbar}{2M_p c^2} . \tag{25}$$

In formula (25), $M_p$ is the mass Planck. Considering Eq. (25), Eq. (24) can be written as

$$i\hbar\frac{\partial\Psi}{\partial t}=-\frac{\hbar^2}{2m}\nabla^2\Psi+V\Psi-\frac{\hbar^2}{2M_p}\nabla^2\Psi+\frac{\hbar^2}{2M_p}\nabla^2\Psi-\frac{\hbar^2}{2M_pc^2}\frac{\partial^2\Psi}{\partial t^2}. \tag{26}$$

The last two terms in Eq. (26) can be defined as the *Schrodinger Bohmian* (D. Bohm) pilot wave equation

$$\frac{\hbar^2}{2M_p}\nabla^2\Psi-\frac{\hbar^2}{2M_pc^2}\frac{\partial^2\Psi}{\partial t^2}=0, \tag{27}$$

i.e.,

$$\nabla^2\Psi-\frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2}=0. \tag{28}$$

It is interesting to observe that pilot wave $\Psi$ does not depend on the mass of the particle. The pilot wave holds the memory (consciousness) of the particle. With postulate (28), we obtain from equation (26)

$$i\hbar\frac{\partial\Psi}{\partial t}=-\frac{\hbar^2}{2m}\nabla^2\Psi+V\Psi-\frac{\hbar^2}{2M_p}\nabla^2\Psi \tag{29}$$

and simultaneously

$$\frac{\hbar^2}{2M_p}\nabla^2\Psi-\frac{\hbar^2}{2M_pc^2}\frac{\partial^2\Psi}{\partial t^2}=0. \tag{30}$$

In the operator form, Eq. (21) can be written as

$$\hat{E}=\frac{\hat{p}^2}{2m}+\frac{1}{2M_pc^2}\hat{E}^2, \tag{31}$$

where $\hat{E}$ and $\hat{p}$ denote the operators for energy and momentum of the particle with mass $m$. Equation (31) is the new dispersion relation for quantum particle with mass $m$. From Eq. (21) one can concludes 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 $m \ll M_{P,}$ Eq. (29) has the form of the Schrodinger equation

$$i\hbar\frac{\partial\Psi}{\partial t} = -\frac{\hbar^2}{2m}\nabla^2\Psi + V\Psi. \tag{32}$$

In the case when $m \approx M_p$ Eq. (29) can be written as

$$i\hbar\frac{\partial\Psi}{\partial t} = -\frac{\hbar^2}{2M_p}\nabla^2\Psi + V\Psi, \tag{33}$$

but considering Eq. (30) one obtains

$$i\hbar\frac{\partial\Psi}{\partial t} = -\frac{\hbar^2}{2M_p c^2}\frac{\partial^2\Psi}{\partial t^2} + V\Psi \tag{34}$$

or

$$\frac{\hbar^2}{2M_p c^2}\frac{\partial^2\Psi}{\partial t^2} + i\hbar\frac{\partial\Psi}{\partial t} - V\Psi = 0. \tag{35}$$

We look for the solution of Eq. (35) in the form

$$\Psi(x,t) = e^{i\omega t}u(x). \tag{36}$$

After substitution formula (36) to Eq. (35) we obtain

$$\frac{\hbar^2}{2M_p c^2}\omega^2 + \omega\hbar + V(x) = 0 \tag{37}$$

with the solution

$$\begin{aligned} \omega_1 &= \frac{-M_p c^2 + M_p c^2\sqrt{1-\frac{2V}{M_p c^2}}}{\hbar} \\ \omega_2 &= \frac{-M_p c^2 - M_p c^2\sqrt{1-\frac{2V}{M_p c^2}}}{\hbar} \end{aligned} \tag{38}$$

for $\frac{M_p c^2}{2} > V$

and

$$\omega_1 = \frac{-M_p c^2 + iM_p c^2 \sqrt{\frac{2V}{M_p c^2} - 1}}{\hbar}$$
$$\omega_2 = \frac{-M_p c^2 - iM_p c^2 \sqrt{\frac{2V}{M_p c^2} - 1}}{\hbar} \tag{39}$$

for $\frac{M_p c^2}{2} < V$.

Both formulae (38) and (39) describe the string oscillation, formula (27) damped oscillation and formula (28) over damped string oscillation.

## 4. The time evolution of the memory Schrodinger-Bohmian pilot wave

Bohm presented the pilot wave theory in 1952 (Bohm D,1979) and de Broglie had presented a similar theory in the mid 1920's. It was rejected in 1950's and the rejection had nothing to do with de Broglie and Bohm later works.

There is always the possibility that the pilot wave has *mind like property*. That's how Bohm described it. We can say that all the particles in the Universe and even Universe have their own pilot waves, their own information. Then the consciousness is the very complicated receiver of the surrounding pilot wave fields.

In our paper, we study of the Schrödinger-Bohm (SB) equation for the pilot wave

$$i\hbar\frac{\partial\Psi}{\partial t} = -\frac{\hbar^2}{2m}\nabla^2\Psi + V\Psi - \frac{\hbar^2}{2M_p}\nabla^2\Psi + \frac{\hbar^2}{2M_p}\left(\nabla^2\Psi - \frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2}\right). \tag{40}$$

In Eq. (40) $m$ is the mass of the quantum particle and $M_P$ is the Planck mass ( $M_P \approx 10^{-5}$ g).

For elementary particles with mass $m << M_P$, we obtain from Eq. (40)

$$i\hbar\frac{\partial\Psi}{\partial t}=-\frac{\hbar^2}{2m}\nabla^2\Psi+V\Psi+\frac{\hbar^2}{2M_p}\left(\nabla^2\Psi-\frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2}\right) \tag{41}$$

and for macroscopic particles with $m >> M_P$ equation (40) has the form:

$$i\hbar\frac{\partial\Psi}{\partial t}=-\frac{\hbar^2}{2M_p}\nabla^2\Psi+\frac{\hbar^2}{2M_p}\left(\nabla^2\Psi-\frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2}\right)+V\Psi \tag{42}$$

or

$$i\hbar\frac{\partial\Psi}{\partial t}=-\frac{\hbar^2}{2M_pc^2}\frac{\partial^2\Psi}{\partial t^2}+V\Psi$$

and is independent of $m$.

In the following, we will discuss the pilot wave time evolution for the macroscopic particles, i.e. for particles with $m >> M_P$ .

For $V$ = const. we seek the solution of Eq. (3.42) in the form:

$$\Psi=e^{\gamma t}. \tag{43}$$

After substitution formula (.43) to Eq. (42) one's obtains

$$M_P\gamma^2+\frac{2M_P^2c^2}{\hbar}\gamma-\frac{2M_P^2c^2}{\hbar^2}V=0 \tag{44}$$

with the solution

$$\gamma_{1,2}=-\frac{iM_Pc^2}{\hbar}\pm\frac{M_Pc^2}{\hbar}\sqrt{-1+\frac{2V}{M_Pc^2}}. \tag{45}$$

For a free particle, $V$ = 0 we obtain:

$$\gamma_{1,2}=\begin{cases}0,\\ -\frac{2M_Pc^2}{\hbar}i.\end{cases} \tag{46}$$

According to formulae (43) and (46) equation (42) has the solution

$$\Psi(t) = A + Be^{-\frac{2M_P c^2 i}{\hbar}t}. \tag{47}$$

For $t$ = 0 we put $\Psi(0) = 0$, then

$$\Psi(t) = A\left(1 - e^{-\frac{2it}{\tau_P}}\right), \tag{48}$$

where $\tau_P$ = Planck time

$$\tau_P = \frac{\hbar}{M_p c^2} \ . \tag{49}$$

From formula (48) we conclude that the free particle in reality is jittering with frequency $\omega = \tau^{-1}$ and quantum energy $E = \hbar\omega$ = $10^{19}$ GeV and period $T$ = $10^{-43}$ s.

## 5. Conclusions

In this paper, we show that the generalization of the parabolic Schrodinger equation to hyperbolic partial differential equations leads to possibility of the study of consciousness on the quantum level. The consciousness is operated by wave equation (hyperbolic equation) which do not dependent on the mass of particle, even for humans. This is the first time when new quantum equation can describe consciousness as a pure quantum phenomenon.

## References

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