

Advanced Relativity: Unification of Space, Matter and Consciousness

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ABSTRACT

Advanced Relativity (AR) is the model which fully integrates matter and consciousness by applying Hilbert spaces. Advanced Relativity reviews the key concepts of Einstein's Relativity, namely, space and time. In AR, space is what we measure with rods and time is what we measure with clocks. Space is not empty and deprived of physical properties; it is characterized by a variable energy density which gives origin to energy, mass and gravity from the micro to the macro scale. Time is merely numerical order of material changes, i.e. motion running in space. AR describes all phenomena of special relativity (SR) and general relativity (GR) and opens new perspectives in cosmology and astronomy, namely, no signal can move in time as time is merely numerical order of a given signal moving in space.

Key Words: space, time, consciousness, Hilbert spaces, Special Relativity, General Relativity, super-fluid quantum vacuum

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1. Introduction

Advanced Relativity (AR) is the development of Einstein's Relativity Theory which fully integrates the observer (Sorli, 2014) and gives curvature of space physical meaning, namely, variable energy density of space. Curvature of space is the mathematical expression of its energy density. Flat space has higher energy density than curved space (Fiscaletti and Sorli, 2015a; 2016). Variable energy density of space is origin of energy, mass and gravity of elementary particles (Sorli *et al.*, 2016).

In AR, universal space has its origin in the quantum vacuum, and time is merely the numerical order of changes, i.e. motion. Linear time - "past-present-future" - belong in the mind. The Observer in physics not only causes the collapse of the wave function when observing a given superposition, but also, when measuring a given physical phenomenon, defines duration as "emergent time". Until measured, time exists only as a fundamental time, which is the numerical order of material changes running in space (Fiscaletti and Sorli, 2015b). In AR, space is always NOW (Sorli *et al.*, 2016). In AR, time is not the 4th physical dimension of space, time is merely a mathematical parameter of changes which run in space. In AR it is not time that is relative, which is the common but mistaken interpretation of Einstein's Relativity. Time as the numerical order of changes in space cannot be relative; relative is the velocity of changes, which depends on the energy density of space. The less dense space is, the lower is the velocity of changes (Sorli, 2012).

The Special Relativity can be described in a three-dimensional (3D) Euclidean space. According to the 3D interpretation of special relativity – which can explain in a consistent way several relativistic phenomena, such as the aberration of light, the Doppler effect, Jupiter's satellites occultation and radar ranging of the planets – Einstein's formalism of special relativity (SR) based on the standard Lorentz transformations may be derived from a more fundamental 3D Euclidean space, with Galilean transformations for the three spatial dimensions and Selleri's transformation for the rate of clocks (Fiscaletti and Sorli, 2014a).

In AR, light does not bend because space is curved. Light bends because a photon has mass, which is attracted by the gravity of stellar objects.

Curvature of space in general relativity (GR) is the mathematical description of its variable energy density. Universal space itself is "flat" – Euclidean confirms NASA research (NASA, 2013).

2. Advanced Relativity is without length contraction and without time dilation

In AR we do not have "length contraction" and we do not have "time dilation". Length contraction was introduced by George FitzGerald and Hendrik Lorentz to explain the negative outcome of the Michelson-Morley experiment and to rescue the hypothesis of the stationary ether. The fact is that the Michelson-Morley experiment gave a null result because the ether around the Earth moves with the Earth and also rotates with the Earth. This phenomenon can be called the "dragging effect" (Fiscaletti and Sorli, 2016).

When at the beginning of the 20th century ether was abolished from physics, Einstein then proposed the idea that a photon can move in empty space deprived of physical properties. This discovery has caused a big theoretical problem, namely, at that time it was observed that light has the same speed independently from the fact that an observer moves from the source or moves towards the source. Considering that photon and the observer move in empty space, the Galilean transformation was not able to describe the constancy of light. If the model of a photon as the wave of ether were not abolished, the Galilean transformation would be suitable, namely, the source of light and all inertial systems are moving in ether where a photon is a wave of ether. The photon has the same velocity in all inertial systems because a photon is the wave of the medium in which all inertial systems move. Light obeys the Doppler effect.

Einstein invoked a much more complicated way, namely, the constancy of light as a postulate, which was not necessary because the constancy of light was already measured. In order to describe electromagnetism in empty space he used the Lorentz transformation and the Minkowski manifold. The idea of the "length contraction" was preserved in this model. The problem is that length contraction in SR is valid only for the observer "at rest" and is not valid for the moving observer. How this is possible no one can explain in today's physics. Length contraction in SR is illogical. We do not have in physics a single plausible physical explanation why the



length is different for rest observer than for the moving observer. We propose that it is time to abandon length contraction from physics and to accept that photon is the vibration of ether, which in modern physics has new name: the “super fluid quantum vacuum”.

Considering that a photon is the wave of the medium in which all inertial systems move, SR can be described in a 3D Euclidean space with a Galilean transformation for X, Y and Z and Selleri’s transformation for time t, without “length contraction”, “time dilatation” and “time coordinate” (Fiscaletti and Sorli, 2014a). In AR it is not time that is relative; “relative” is the velocity of material changes which we measure with clocks. Clocks run in the quantum vacuum only, not in time. Time is merely the numerical order of changes which run in the quantum vacuum, which is always NOW (Sorli *et al.*, 2016). GPS proves that the relative velocity of clocks, because of SR and GR effect, are valid for all observers. “Rest observer” and “moving observer” should be abolished because they do not have real existence; they are only theoretical unproved propositions, which are irrational.

The Shapiro experiment is interpreted in modern physics as a “gravitational time dilatation”, which is wrong. The measured fact is that light has minimally smaller speed in strong gravity. Stronger the gravity, the lower the density of the quantum vacuum, which changes its permittivity and permeability, and which causes minimal change of light velocity (Fiscaletti and Sorli, 2016). In modern physics it is not allowed even to think that light speed might have in some special cases minimal variations, which is not reasonable. Infinitesimal small variations of light speed do not call into question the validity of Einstein’s Relativity, which remains the foundation stone of physics, and needs only to be renewed in some minimal details.

One of these details is that space-time is a wrong concept, because space-time where time is the 4th dimension of space does not exist in physical reality. Space we measure with roads and time we measure with clocks. Time cannot dilate and space cannot shrink. Time dilatation and length contraction are only mathematical tricks of Einstein in order to solve the problem of the constancy of light speed in empty space. AR solves the constancy of light speed in a much more elegant and non-ambiguous way, which is valid for all observers.

The AR model of a dynamic quantum vacuum describes mathematically in details planetary precession, where quantum vacuum has a dragging effect because of the Sun’s motion. Our results on precession are to the second the same as those of Einstein. Also the Sagnac effect is described in detail by the dragging effect of a rotating interferometer (Fiscaletti and Sorli, 2016).

As Einstein kept length contraction in SR he also introduced it in GR, which is another mathematical trick of Einstein that is never observed and measured. Gravitational length contraction is based on length variation of beams by the LIGO interferometer, which also was not measured directly. The only plausible explanation of the LIGO results, namely, the variable time of laser motion inside the beams, is that gravitational waves are changing the energy density of the quantum vacuum, and so its permittivity and permeability, which changes minimally the speed of light (Sorli *et al.*, 2016). In AR, gravitational waves are areas of variable energy density of quantum vacuum.

3. Advanced Relativity unifies General Relativity (GR) and Quantum Mechanics (QM)

In AR, elementary particles and stellar objects both move in space only and not in time. Time is merely the numerical order of their motion. Every particle, massive body or stellar object diminishes the energy density of space in correspondence to the amount of its energy. Diminished energy density of space can be considered the origin of mass and gravity from the micro to the macro scale.

By starting from a Planck’s metric, emerging, for example, from loop quantum gravity (Rovelli, 2003, 2008, 2010), the variable energy density of space can be considered as the fundamental arena giving rise to the different entities and objects existing in the physical universe. In AR, in the absence of elementary particles, atoms or massive objects, the energy density of space is defined by the Planck energy density given by the following relation:

$$\rho_{pE} = \frac{m_p \cdot c^2}{l_p^3} \quad (1),$$

where m_p is Planck mass, and l_p is Planck length. The energy density of space (1) is the



maximum energy density that can be sustained in the minimum quantized space, and can be considered as the ground state of the same physical flat-space background. The appearances of material objects and subatomic particles correspond to changes of the energy density of space, and thus can be considered as the excited states of the same flat-space background, characterized by a lower energy density than the Planck energy density (1); where each excited state of the quantum vacuum is defined by a diminished energy density, which corresponds exactly to the energy of the particle under consideration (Fiscaletti and Sorli, 2016).

Each material object endowed with a mass m is produced by a change of the energy density of space on the basis of equation

$$m = \frac{V \cdot \Delta\rho_{qvE}}{c^2}$$

(2),

where

$$\Delta\rho_{qvE} = \rho_{pE} - \rho_{qvE} \quad (3),$$

$$\rho_{qvE} = \rho_{pE} - \frac{mc^2}{V} \quad (4),$$

where m is the mass of the object, V is its volume. It must be emphasized here that equations (2)-(4) describe baryonic matter both in macrophysics and in microphysics.

In an analogous way to Chiatti's and Licata's transactional approach (Chiatti, 2012 and Licata, 2013), where the creation and annihilation of an elementary quantum are the two only primary extreme physical events corresponding to a peculiar reduction of a state vector (which is constituted of interaction vertices in which real elementary particles are created or destroyed), in AR the appearance of baryonic matter derives from an opportune excited state of the 3D quantum vacuum defined by an opportune change of the quantum vacuum energy density and corresponding to specific reduction-state (RS) processes of creation/annihilation of quanta (Fiscaletti and Sorli, 2016). The excited state of the quantum vacuum corresponding to the appearance of a material particle of mass m is defined (in the centre of that particle) by the energy density (4) (and by the change of the energy density (3), with respect to the ground state), and its evolution is determined by opportune RS processes of

creation/annihilation of quanta described by a wave function at two components satisfying a time-symmetric extension of the Klein-Gordon quantum relativistic equation

$$\begin{pmatrix} H & 0 \\ 0 & -H \end{pmatrix} C = 0 \quad (5)$$

where $H = \left(-\hbar^2 \partial^\mu \partial_\mu + \frac{V^2}{c^2} (\Delta\rho_{qvE})^2 \right)$. Equation

(5) corresponds to the following equations

$$\left(-\hbar^2 \partial^\mu \partial_\mu + \frac{V^2}{c^2} (\Delta\rho_{qvE})^2 \right) \psi_{Q,i}(x) = 0 \quad (6)$$

for creation events and

$$\left(\hbar^2 \partial^\mu \partial_\mu - \frac{V^2}{c^2} (\Delta\rho_{qvE})^2 \right) \phi_{Q,i}(x) = 0 \quad (7)$$

for destruction events. By writing the two components of the wave function in polar form

$$\psi_{Q,i} = |\psi_{Q,i}| \exp\left(\frac{iS_{Q,i}^\psi}{\hbar}\right) \quad (8)$$

$$\phi_{Q,i} = |\phi_{Q,i}| \exp\left(\frac{iS_{Q,i}^\phi}{\hbar}\right) \quad (9)$$

and decomposing the real and imaginary parts of the Klein-Gordon equation (5), for the real part one obtains a couple of quantum Hamilton-Jacobi equations that, by imposing the requirement that they are Poincarè invariant and have the correct non-relativistic limit, assume the following form

$$\partial_\mu \begin{pmatrix} S_{Q,i}^\psi \\ S_{Q,i}^\phi \end{pmatrix} \partial^\mu \begin{pmatrix} S_{Q,i}^\psi \\ S_{Q,i}^\phi \end{pmatrix} = \frac{V^2}{c^2} (\Delta\rho_{qvE})^2 \exp\left(\frac{Q_{Q,i}^\psi}{-Q_{Q,i}^\phi}\right) \quad (10),$$

while the imaginary part gives the continuity equation

$$\partial_\mu \left(\rho \partial^\mu \begin{pmatrix} S_{Q,i}^\psi \\ S_{Q,i}^\phi \end{pmatrix} \right) = 0$$

(11)

where ρ is the ensemble of particles associated with the spinor under consideration and



$$Q_{Q,i} = \frac{\hbar^2 c^2}{V^2 (\Delta\rho_{qvE})^2} \left(\frac{\left(\nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \right) |\psi_{Q,i}|}{|\psi_{Q,i}|} \right) \left(\frac{\left(\nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \right) |\phi_{Q,i}|}{|\phi_{Q,i}|} \right) \quad (12)$$

is the quantum potential of the vacuum.

The quantum potential of the vacuum is the fundamental entity which the guides the occurring of the processes of creation or annihilation in space, and makes the 3D quantum vacuum a fundamentally non-local manifold. In virtue of the primary physical reality of the processes of creation and annihilation, and of the non-local action of the quantum potential associated with the amplitudes of them (as well as of the opposed sign of its second component with respect to the first component), this seems to indicate that it is not possible to go backwards in physical time (Fiscaletti and Sorli, 2014b). In the 3D quantum vacuum the duration of the processes, from the creation of a particle or object till its annihilation, has no primary physical reality, but exists only in the sense of numerical order. In other words, the 3D quantum vacuum, as a fundamental medium subtending the observable forms of matter, energy and space-time, is a timeless background. The behaviour of matter in the universe can be seen as an undivided network of RS processes that take place in the 3D timeless quantum vacuum and time exists merely as a mathematical parameter measuring the dynamics of a particle or object.

As regards the RS processes of creation, the quantum potential associated with the virtual particles of the RS processes of the 3D quantum vacuum may be written also as

$$Q = V \frac{p_1 + p_2}{n} = -\frac{\hbar^2 c^2 n^2}{4 \Delta\rho_{qvE}^2 V^2} \left[\nabla^2 \Delta\rho_{qvE} - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \Delta\rho_{qvE} \right] + \frac{\hbar^2 c^2 n^2}{8 \Delta\rho_{qvE}^3 V^2} \left[(\nabla \Delta\rho_{qvE})^2 - \frac{1}{c^2} \left(\frac{\partial}{\partial t} \Delta\rho_{qvE} \right)^2 \right] \quad (13)$$

This describes the geometry via the pressures that arise by the collisions between the virtual particles-antiparticles populating the vacuum corresponding to the RS processes. In this picture, the quantum potential of the vacuum (13) may be considered as the real origin of the quantum effects (Fiscaletti and Sorli, 2016b). In particular, the non-local correlations characterizing the quantum domain can be seen as effects deriving from the general Bell length of the 3D quantum vacuum

$$L_{quantum} = \frac{c^2 \hbar}{D \sqrt{\frac{V}{n} \left[-(\nabla \Delta\rho_{qvE})^2 + \frac{1}{c^2} \left(\frac{\partial}{\partial t} \Delta\rho_{qvE} \right)^2 - \Delta\rho_{qvE} \left(\nabla^2 \Delta\rho_{qvE} - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \Delta\rho_{qvE} \right) \right]}} \quad (14).$$

The quantum length (92) is the ultimate parameter that indicates that, at a fundamental level, the 3D quantum vacuum defined by RS processes of creation/annihilation of virtual particles-antiparticles organized in Bose ensembles, and corresponding to fluctuations of the quantum vacuum energy density, is a non-local and timeless manifold.

The maximum value of the Bell length of the 3D quantum vacuum (14), which implies the maximum de-localization of a quantum system, is 1, which means

$$\frac{2 \Delta\rho_{qvE} V^{1/2}}{n^{1/2} \sqrt{\left[-(\nabla \Delta\rho_{qvE})^2 + \frac{1}{c^2} \left(\frac{\partial}{\partial t} \Delta\rho_{qvE} \right)^2 - \Delta\rho_{qvE} \left(\nabla^2 \Delta\rho_{qvE} - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \Delta\rho_{qvE} \right) \right]}} = 1 \quad (15).$$

Hence one obtains the following simple relation satisfied by the number of virtual particles-antiparticles of the RS processes of the 3D quantum vacuum in the condition of maximum entanglement, of the maximum grade of non-locality and de-localization in a quantum system



having the mass $m = \frac{\Delta\rho_{qvE}V}{c^2n}$ produced by the fluctuations of the quantum vacuum energy density corresponding to the same RS process:

$$n^{1/2} = \frac{2\Delta\rho_{qvE}V^{1/2}}{\sqrt{\left[-(\nabla\Delta\rho_{qvE})^2 + \frac{1}{c^2}\left(\frac{\partial}{\partial t}\Delta\rho_{qvE}\right)^2 \right] \left[-\Delta\rho_{qvE}\left(\nabla^2\Delta\rho_{qvE} - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\Delta\rho_{qvE}\right) \right]}} \quad (16).$$

The other important feature of the 3D quantum vacuum of AR is its action as a super-fluid medium. Taking account of Sbitnev's results (Sbitnev, 2014, 2015a, 2015b and 2016), in which the physical vacuum is described as a super-fluid medium, containing pairs of particles-antiparticles which give rise a Bose-Einstein condensate, in AR it is assumed that, in the presence of ordinary baryonic matter, the 3D quantum vacuum physically acts as a super-fluid medium, which consists of an enormous amount of RS processes of creation/annihilation of particles-antiparticles with opposite orientations of spins.

As a consequence of the motion of the virtual particles corresponding to the elementary fluctuations of the energy density, space is filled with virtual radiation with frequency

$$\omega = \frac{2\Delta\rho_{qvE}V}{\hbar n} \quad (17).$$

In the light of equation (17), each elementary fluctuation of the energy density of space in a given volume produces an oscillation of space at a peculiar frequency. This means that each material object given by mass (2) corresponds to oscillations of the 3D quantum vacuum given by equation (17).

The total effect of the motion of the virtual particles produced by the amount of RS processes characterizing a given region – in correspondence to changes of the energy density of space – is to generate a dragging, pushing effect of the 3D quantum vacuum. In particular, one may describe the pushing effect of a region of volume V of space in a given point at a distance R from the centre of that volume by defining a

velocity of the 3D quantum vacuum on the basis of equation

$$v_{qv} = \frac{2\Delta\rho_{qvE}V}{\hbar n} R \quad (18).$$

The frequency (18) may also be considered to be the origin of the electromagnetic effects of the 3D quantum vacuum. In fact, the electromagnetic field inside a cavity of perfect reflecting can be seen as an expansion of infinite different modes of the fundamental 3D quantum vacuum, where each mode corresponds to an independent oscillation defined by frequency (17) produced by a specific RS process of creation/annihilation of quanta in correspondence to elementary fluctuations of the 3D quantum vacuum (Fiscaletti and Sorli, 2016b). In AR the inertial mass of an object emerges from the interacting fraction of an energy density characterizing electromagnetic properties of the 3D quantum vacuum, which are determined by the frequencies associated with opportune RS processes of creation/annihilation, and corresponding to elementary fluctuations of the quantum vacuum energy density, according to equation

$$m_i = \left[4 \frac{V^4}{\hbar^2 \pi^2 n^3 c^5} \int \eta(\rho)(\rho_{pE} - \rho)^3 d\rho \right] \quad (19)$$

where c is the speed of light, $\eta(\omega)$ is the spectral factor, interacting with the body, which physically measures the relative strength of the interaction between the oscillations produced by the motions of the virtual particles of the RS processes and the massive object, an interaction which acts to oppose the acceleration. As a consequence, the explanation of the weak equivalence principle provided by Haisch, Rueda and Puthoff gets a new simple, suggestive and more unifying re-reading: here, the equivalence principle does not need to be independently postulated but derives directly as a consequence of the RS processes, and thus of the elementary fluctuations of the energy density, of the same 3D quantum vacuum.

Moreover, as shown in (Fiscaletti and Sorli, 2015a, 2016), AR allows us to provide a unifying approach suggesting that the real explanation for the dark energy lies in the fluctuations of the 3D quantum vacuum energy density. This approach introduces the interesting perspective to interpret the curvature of spacetime associated with a dark energy density,



as a consequence of more fundamental changes of the 3D energy density of space, through a quantized metric, characterizing the underlying microscopic geometry of the 3D quantum vacuum, expressed by the relation

$$d\hat{s}^2 = \hat{g}_{\mu\nu} dx^\mu dx^\nu \quad (20)$$

where here the (quantum operators) coefficients of the metric are defined (in polar coordinates) as

$$\hat{g}_{00} = -1 + \hat{h}_{00}, \quad \hat{g}_{11} = 1 + \hat{h}_{11}, \quad \hat{g}_{22} = r^2(1 + \hat{h}_{22}), \\ \hat{g}_{33} = r^2 \sin^2 \vartheta(1 + \hat{h}_{33}), \quad \hat{g}_{\mu\nu} = \hat{h}_{\mu\nu} \text{ for } \mu \neq \nu \quad (21)$$

and

$$\langle \hat{h}_{\mu\nu} \rangle = 0 \text{ except}$$

$$\langle \hat{h}_{00} \rangle = \frac{8\pi G}{3} \left(\frac{\Delta\rho_{qvE}}{c^2} + \frac{35Gc^2}{2\pi\hbar^4 V} \left(\frac{V}{c^2} \Delta\rho_{qvE}^{DE} \right)^6 \right) r^2$$

and

$$\langle \hat{h}_{11} \rangle = \frac{8\pi G}{3} \left(-\frac{\Delta\rho_{qvE}}{2c^2} + \frac{35Gc^2}{2\pi\hbar^4 V} \left(\frac{V}{c^2} \Delta\rho_{qvE}^{DE} \right)^6 \right) r^2 \quad (22).$$

In this picture, dark energy represents itself as structured energy of space on the basis of equation

$$\rho_{DE} \equiv \frac{35Gc^2}{2\pi\hbar^4 V} \left(\frac{V}{c^2} \Delta\rho_{qvE}^{DE} \right)^6 \quad (23)$$

and the variable energy density of space (producing dark energy) acts as a two-point correlation function according to relation

$$\frac{c^4}{4\pi\hbar^4} \left(\frac{V}{c^2} \Delta\rho_{qvE}^{DE} \right)^6 \equiv \int_0^\infty C(s) ds \quad (24).$$

In synthesis, in the approach of AR, a 3D quantum vacuum consisting of an enormous amount of RS processes of creation/annihilation of particles-antiparticles with opposite orientations of spins and acting as a super-fluid medium is the fundamental background which determines a unifying view of gravity, electromagnetic fields and quantum behaviour of matter as different aspects of the same fluctuations of the quantum vacuum energy density.

4. Advanced Relativity combines entropy and syntropy

As regards the understanding of the nature of evolution, the most popular idea is that there are two main trends: one is thermodynamic concerning matter, evolving downwards, i.e. towards higher entropy, and one concerns life and consciousness, evolving upwards, i.e. towards higher organization. The main differences that characterize these two trends of evolution are that, in contrast to physical systems in which the main trend is approaching thermodynamic equilibrium, living organisms are organized as hierarchical systems of biological functions acting against decay. As a consequence, a fundamental difference exists between physical order created by physical self-organization and biological organization. About this second trend in evolution, the Hungarian scientist Grandpierre has shown that the increase of the organizational state, and therefore the consequent decrease of entropy of the living organisms, is determined by the biological electromagnetic radiation, by biological photons (Grandpierre, 2004, 2005). He computed the entropy content of the human being tied to *in vivo* radiation, showing that it is larger than the standard physical entropy of the materials of the living organism. In Grandpierre's approach, a living organism can be compared to a football team, in the sense that it is *organized* in a way that all the players are endowed with special tasks to perform certain functions (that are additional to their space-temporal coordinates), and these goal-oriented (teleological) functional activities are organized to achieve the ultimate aim of living and flourishing (Grandpierre and Kafatos, 2013). Here, in order to build an exact theoretical biology, the fundamental difficulty lies in resolving the incompatibility between deterministic physical equations and genuine biological teleology expressing an end-point "selection," goal-orientation and purpose. In order to approach this issue, Grandpierre recently proposed to generalize the least action principle, one of the most powerful tools of physics, so that it becomes compatible with life's ultimate aim of flourishing (Grandpierre, 2007), thus allowing that living organisms select the endpoint of their biological processes to be compatible with their biological aims. Fundamentally, the biological principle of greatest action expresses the fact that all living organisms strive to maximize action, actively



maintaining their states far away from thermodynamic equilibrium as long as possible.

In AR the two main trends of evolution (of matter and life respectively) can be considered parts of one universal process. In AR entropy is valid only for material objects. Space in which material objects exist has no entropy; it does not follow the second law of thermodynamics. Matter is the entropic state of primordial energy of space, which itself is syntropic. In living organisms, the syntropic energy of space is the physical basis for negative entropy (negentropy) of the living organism. Evolution of life is a continuous process of decreasing of entropy, which converges to the non-entropy state of the fundamental 3D quantum vacuum. The evolution of life on Earth is part of a universal process which runs through the entire universe, and is developing towards the syntropic energy of space. Matter has the property of “self-organization” because it exists in space which is syntropic. Physical homogeneity of the universe also implies biological homogeneity. In the entire universe matter has a tendency to develop into intelligent conscious beings.

The idea of an eternal universe ruled by syntropy is not familiar with the cosmological models prevailing today, although all experimental data are on the side of such an eternal universe. The universe is eternally NOW and space plays an active role into evolution of life; it is sending information into 3D quantum vacuum which generates living organisms. Evolution of life cannot be imagined without space and 3D quantum vacuum as originators of life. All over the universe matter has tendency to develop into intelligent and conscious organisms whose evolution tends to rediscover the fundamental 3D quantum vacuum itself.

5. In Advanced Relativity the model of consciousness which is the origin of the observer is n-dimensional Hilbert space

AR is based on experimental data, namely NASA results confirms universal space is “flat”. This means universal space has Euclidean shape and is not “finite”, but it is infinite. From mathematics we know that “infinite distance + 1000km” is still infinite distance. Infinity in mathematics and physics is not a metrical term. Infinity of universal space cannot be fully comprehended by the rational mind, but can be experienced in

meditation. For millennia, spiritual researchers have experienced “infinite spaciousness” when meditating on the subject of human real nature - consciousness. Buddhists use term “Emptiness”, “Nothingness”, “Shunyata”; Taoists use term “Tao”. AR is enlarging the reductionist approach to physics that phenomena only exist that can be measured with an integral approach, confirming that which can be experienced (without being measured) is real.

Consciousness is widely considered to be the greatest challenge for modern science. Consciousness may exist not in, but beyond, the experienced dimension, in the deep dimension of the cosmos. The idea that consciousness belongs to another, deeper dimension of reality has been frequently voiced not only by poets but by scientists. Erwin Schrödinger said, “The overall number of minds is just one. . . . In truth, there is only one mind.” In his later years’ psychologist Carl Jung came to a similar conclusion, claiming that the psyche is not a product of the brain; it is part of the generative, creative principle of the cosmos — of the *unus mundus*. Consciousness is the origin of the observer, which is real and can be described as n-dimensional Hilbert space (where n is cardinal number of natural numbers). In physics we observe a photon in a 3D material world. When the frequency of the 3D photon increases to an infinite value, it also enters higher dimensions of Hilbert space. Finally, in n-dimensional Hilbert space the energy of photons is transformed into the energy of consciousness. In a human being the neural networks of the brain resonate with the information associated with n-dimensional Hilbert space. The human brain translates the information carried in that background in a holographically-distributed form into linear signals that affect the functioning of the brain’s neural networks. In principle, the human brain is in-formed by the totality of the information in the deep-dimension of n-dimensional Hilbert space.

In AR the photon is a wave of universal space corresponding to the fundamental “3D quantum vacuum” or “3D physical vacuum”. In quantum mechanics the energy of the photon is:

$$E = n \cdot h \cdot \nu \quad (25)$$

where h is the Planck constant, ν is the photon frequency and n is an integer number (1,2,3...). Consciousness can be described as the photon which has infinite frequency and exists in n-



dimensional Hilbert space:

$$\lim_{\nu \rightarrow \infty} n \cdot h \cdot \nu = \text{consciousness} \quad (26).$$

In the formula (26) integer n represents the dimensionality of Hilbert spaces. When vibration ν becomes infinite, integer n becomes cardinal number of natural numbers. Consciousness is the vibration of n -dimensional Hilbert space whose limit is tending to the infinite value of frequency and zero value of the wave length λ . Out of that it follows that the velocity v of consciousness is zero:

$$v = \nu \cdot \lambda = 0 \quad (27).$$

This mathematical model cannot be considered as a real picture of the consciousness; it only indicates its real nature. Consciousness is beyond logic and therefore beyond mathematics, which can only help us to build an approximate model. Mathematics cannot explain the physical reality of the universe; it can only describe it with its limitations.

The idea that consciousness can be associated with photons of infinite frequency is supported by recent experiments, which show that a bio-photon coherent system constitutes an ultra-rapid communication system not only in the brain but also functioning in the whole organism, explaining the amazing concerted actions of complex living organisms. According to these experiments, bio-photonic and bio-electronic activities are not independent biological processes in the nervous system, and their synergistic action play a significant role in neural signal processes (Dotta and Persinger, 2011; Dotta *et al.*, 2012; Sun *et al.*, 2010).

Consciousness does not move in space; consciousness is the fundamental vibration of space. When the vibration of consciousness becomes lower it transforms into the light. Consciousness acts via bio-photons on the microtubules of the brain (Sorli, 2014). Information flows from consciousness to three-dimensional living matter composing living organisms, running from n -dimensional Hilbert space via less dimensional Hilbert spaces until it arrives at three-dimensional matter. Each “information jump” to a space with a lower number is accompanied with the lower energy of the “photon, according to equation (25) in which

we can see the Planck constant is the constant which bridges different Hilbert spaces.

Our standard scientific view that vibration can exist only in a 3D reality is now upgraded with the understanding that higher dimensions also exist, and that they have their own vibrations. The Planck constant is the constant connecting these n -dimensional vibrations.

A photon observed in a 3D world is connected with consciousness via Hilbert spaces. That is why bio-photons discovered by Russian physicist Alexander Gurwitsch Gurjjef and German physicist Albert Fritz Popp are of immense importance. Bio-photons are an “information bridge” between the atomic level and high dimensional Hilbert spaces. Information which flows from the higher Hilbert spaces to the lower Hilbert spaces designs not only functioning of the single living organism, but also the entire evolution of life developing in the entire universe.

From the formalism (25) we can see that the energy of primordial consciousness in n -dimensional Hilbert space has infinite energy. This “infinite energy” is spiritual energy, the energy of the pure Spirit-Consciousness. The 3D world exists within this pool of infinite Spirit-Consciousness energy. On descending into lower Hilbert spaces this spiritual energy becomes more and more “structured” and “dense” and appears in a 3D world as the photon. Recent discoveries confirm matter is made out of photons (Firstenberg *et al.*, 2013), which mean that matter is consciousness in its most dense form.

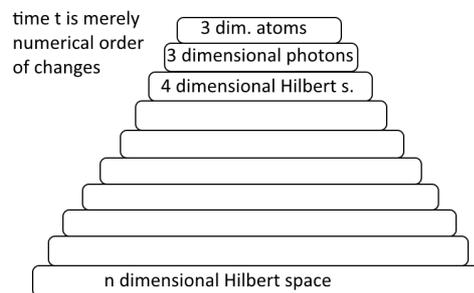


Figure 1. AR structure of the universe where the photon is the wave of a 3D quantum vacuum and time has merely mathematical existence.

6. N-dimensional Hilbert spaces, consciousness and the De Broglie-Bohm pilot wave model in a 3D quantum vacuum

Advanced Relativity (AR) can be also considered as a development of the De Broglie-Bohm pilot wave model. Every elementary particle in a 3D universal physical space has its pilot waves in higher dimensional Hilbert spaces. Consciousness is the higher Hilbert space and “guides”, via lower dimensional spaces, 3D elementary particles.

The idea that consciousness can be related to Hilbert spaces is not new in current research. For example, in two papers of 2007 and 2009 Martin and Carminati studied the individual unconscious and consciousness as quantum systems, i.e., as vectors of a Hilbert space. In such a frame they studied the phenomenon of consciousness and especially the awareness of unconscious components. Writing down the state of the unconscious as $|U\rangle$ and the state of consciousness as $|C\rangle$, they introduced another state of the unconscious $|I\rangle$ which is the insight or pre-consciousness. By building a model of quantum entanglement between those three states they applied it to the awareness of unconscious components. In a similar way, starting from Jung’s psychoanalytical perspective on mind and building on cognitive systems theory based on the mathematics of a Hilbert space, van den Hooff recently developed a formalism in which mental states, conscious as well as unconscious, are described by state vectors in a Hilbert space in a picture where the mental process of metabolization of blurred, semiconscious, or dreamlike mental states into clear ideas and unambiguous cognitive states can be formalized using eigenvalue equations (Van den Hooff, 2013).

According to our model everything in the world is ruled by a wave of primordial energy of n-dimensional Hilbert space. Consciousness acts as a wave belonging to a universal n-dimensional Hilbert space and governs the behaviour of particles and material objects via lower dimensional spaces.

Information theory indicates that there is a multi-dimensional connection between radiant energy and information signals “carried” by that energy, and that somewhat radiant energy and information are aspects of the same thing. It was Claude Shannon (a cousin of Thomas Edison) who in 1946 first discovered that thermodynamic equations could be used to relate the flow of thermal (radiant heat) energy to the flow of information signals encoded in any medium.

The branch of mathematical physics pioneered by Shannon and the science of cybernetics developed by Norbert Wiener at MIT led to methods of modulating information signals in a wide range of radiant energy spectrums from radio waves to visible light waves. Using the Fourier integral to analyze brain waves, Wiener described how frequency within the brain centres tend to attract one another, resonate and “self-tune” in the frequency domain: “We thus see that a non-linear interaction causing the attraction of frequency can generate a self-organizing system, as it does in the case of the brain waves we have discussed...This possibility of self-organization is by no means limited to the very low frequency of these two phenomena. Consider self-organizing systems at the frequency level, say, of infrared light or radar spectra” (Wiener, 1948).

Two spectral domains, spacetime and frequency are of essential importance in this field of information theory and signal communication. On the first page of his standard textbook on electronic network information theory, Kuo states: “In describing signals, we use the two universal languages of electrical engineering – *time* and *frequency*. Strictly speaking, a signal is a function of time. However, the signal can be described equally well in terms of *spectral* or *frequency* information. As between any two languages, such as French and German, translation is needed to render information given in one language comprehensible in the other. Between time and frequency, the translation is effected by the *Fourier series* and the *Fourier integral*.” (Kuo, 1962).

In the light of these considerations and results, in our AR approach to consciousness, the Fourier transforms, which decompose a function of time (a *signal*) into the frequencies that make it up, namely transform time-space signals out of the space-time domain into a conceptually mysterious frequency domain, in which information is no longer measured by time or distance but by frequency and signal strength (amplitude), play a fundamental role. The Fourier integral transform of a continuous time function into the frequency domain is defined by relation

$$f(t) = \int_{-\infty}^{+\infty} g(\nu) e^{2\pi i \nu t} d\nu \quad (28)$$

which implies that energy radiant signals and information signals are two different aspects of



one and the same thing, namely energy signals with information content, but potentially existing in either, or both simultaneously, of two very different dimensions, one with a spacetime component which is the human mind construct, the other a spaceless atemporal frequency dimension of consciousness. Human mind has its origin in neuronal activity of the brain; consciousness has its origin in n-dimensional Hilbert space. Observer which is aware that linear time “past-present-future” belongs to the mind has ability to experience material changes i.e. motion directly as they run in timeless n-dimensional Hilbert space of consciousness (Sorli, 2014).

The mathematics discovered by Fourier operates on vibrational frequency information of every range. Accordingly, they must be involved in information processing of thought and communication at all levels and frequencies, between and among humans, animals, tectonic plates, and perhaps at even greater macro and micro scales, with frequencies corresponding to waves ranging from the physical size of the expanding universe (calculated to be currently about 47 billion light years in diameter) down to the Planck length. Suggestive scenarios might derive from these theories. In particular, the existence of the frequency domain and Bell's theorem would explain non-locality in quantum mechanics, synchronicity, and morphic resonance, and perhaps telepathy and precognition.

In the AR approach, the crucial point is that Fourier transformations can describe transformation of waves from n-dimensional to n-1 dimensional Hilbert space. In order to show this, let us consider the fundamental equations of evolution of the RS processes occurring in the 3D quantum vacuum (5)-(12). By applying the Fourier Transform, equations (6) and (7) concerning the evolution of creation events and destruction events become respectively

$$\left(-\hbar^2 \partial^\mu \partial_\mu + \frac{V^2}{c^2} (\Delta \rho_{qvE})^2 \right) \int_{-\infty}^{+\infty} g_{Q,i}(v) e^{2\pi i v t} = 0 \quad (29)$$

and

$$\left(\hbar^2 \partial^\mu \partial_\mu - \frac{V^2}{c^2} (\Delta \rho_{qvE})^2 \right) \int_{-\infty}^{+\infty} h_{Q,i}(v) e^{2\pi i v t} = 0 \quad (30),$$

where

$$\psi_{Q,i}(t) = \int_{-\infty}^{+\infty} g_{Q,i}(v) e^{2\pi i v t} dv \quad (31)$$

and

$$\phi_{Q,i}(t) = \int_{-\infty}^{+\infty} h_{Q,i}(v) e^{2\pi i v t} dv \quad (32),$$

$g_{Q,i}(v)$ and $h_{Q,i}(v)$ being the frequency modes characterizing the creation and destruction processes respectively. In this way, in the quantum Hamilton-Jacobi equations (10)-(11), the quantum potential of the vacuum which the guides the occurring of the processes of creation or annihilation in space and makes the 3D quantum vacuum a fundamentally non-local manifold, assumes the following form

$$Q_{Q,i} = \frac{\hbar^2 c^2}{V^2 (\Delta \rho_{qvE})^2} \left(\frac{\left(\nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \right) \int_{-\infty}^{+\infty} g_{Q,i}(v) e^{2\pi i v t} dv}{\int_{-\infty}^{+\infty} g_{Q,i}(v) e^{2\pi i v t} dv} - \frac{\left(\nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \right) \int_{-\infty}^{+\infty} h_{Q,i}(v) e^{2\pi i v t} dv}{\int_{-\infty}^{+\infty} h_{Q,i}(v) e^{2\pi i v t} dv} \right) \quad (33).$$

According to equation (33), one can say that the non-local action of the quantum potential to guide the occurring of the processes of creation or annihilation in space is determined by the frequency modes which appear in the wave of the quantum vacuum. Consciousness is linked with the frequency modes $g_{Q,i}(v)$ and $h_{Q,i}(v)$ characterizing the creation and destruction events of quanta in the 3D quantum vacuum. The evolution of the elementary particles we experience occurs in a 3D space but the waves which guide the creation and destruction events and determine their behaviour are associated with frequency modes that, in line of principle, are infinite and therefore “live” in higher dimensional Hilbert space. According to equations (31) and (32), which relate the waves associated with the creation and destruction events to their corresponding frequency modes, in virtue of the Fourier transformations, the frequency modes characterizing the creation and



destruction events of quanta in the 3D quantum vacuum belong to higher dimensional Hilbert spaces. These frequency modes are, in line of principle, infinite and it is according to the Fourier transforms (31) and (32) that they make possible the fact that the behaviour of elementary particles is ruled in a 3D background. This means, in other words, that elementary particles we experience and live in a 3D space are guided by waves which ultimately originate from higher dimensional spaces, just associated with the frequency modes appearing in their Fourier decompositions. The approach here introduced, based on equations (29)-(33), implies that consciousness can be defined as the higher Hilbert space which is "guiding", via lower dimensional spaces, 3D elementary particles.

7. Conclusions

The vital force of physics is in the constant re-examination of the validity of the fundamental principles of physics. The model of space-time

where time is considered to be 4th physical dimension of space has no experimental verification. In the equations of SR and GR and in physics in general the symbol for time t , when measured by the observer, means duration of changes running in space. Experimental data show that space and time are two different physical phenomena. Advanced Relativity takes this into account. The result is a renewed Relativity Theory, which has turned from mathematical theory to physical theory where the variable energy of space is the driving force of the physical world on the micro and macro scale. Consciousness, which is the origin of the observer, is the fundamental reality of the universe acting on matter via lower dimensional Hilbert spaces.

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