Toward a new interpretation of subatomic particles and their motion inside a-temporal physical space

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Abstract

Four-dimensional a-temporal physical space is the stage in which natural phenomena happen. Quanta of space having the size of Planck length and vibrating at certain frequencies are the basic "packets of energy" which build up matter and A-Temporal Physical Space. In particular, quanta of space constituting A-Temporal Physical Space vibrate with the "basic frequency" and are the "non-entropy state" of energy, while quanta of space constituting matter vibrate with appropriate different lower frequencies and are the "entropy-state" of energy. Each subatomic particle can be interpreted as the result of the interaction of energy in the "entropy-state" with one or more quanta of the A-Temporal Physical Space. This interaction of energy in the "entropy state" with quanta of space is determined by the vibration of these quanta of space at appropriate frequencies. A new interpretation of quantum potential is thus proposed: the quantum potential intended as "special state of a-temporal physical space in the presence of microscopic processes". When we take into consideration an atomic or subatomic process, a-temporal physical space assumes the special "state" represented by quantum potential in consequence of the entropic energy shifting between certain quanta of space: this energy shifting (which is determined by the vibrations of the quanta of space occupied by the particle) materializes the subatomic particle into examination in the different points of physical space. We underline that this new interpretation of quantum potential appears permissible also in virtue of the fact that both a-temporal physical space and quantum potential allow us to explain quantum nonlocality.

1. Introduction

If we base ourselves on elementary perception (sight), no experimental evidence that material objects move in time exists. The passing of time cannot be perceived directly as matter and space; we can only perceive the irreversible changes and movements of matter in physical space (i.e. the space where material objects exist). The linear time in which events happen exists only in the scientific models of the universe, but not in the universe itself. On the basis of elementary perception, we can thus say that time exists only as a stream of irreversible material changes and movements happening in a-temporal space[1]. This is an alternative, different point of view from that conventionally adopted in physics, but is perhaps more correct and appropriate because it is more coherent with experimental facts.

The stage in which physical phenomena happen is not space-time but is really a four-dimensional a-temporal space. Phenomena run in space-time only in the mathematical models of reality, which sometimes become more real than reality itself, which instead – on the ground of our elementary perception – turns out to be a-temporal. General relativity can be therefore interpreted in the following way: gravity is transmitted by the density of the four-dimensional a-temporal physical space and its effect is to determine modifications in the geometry of this a-temporal space. This new interpretation of general relativity, which can be defined also a-temporal gravitation theory, implies that matter makes physical space dense and that material particles move in the direction where the density of physical space is increasing. A-temporal physical space allows us to provide a consistent explanation, an interesting interpretation not only of gravitational interaction. It can open new perspectives also as regards quantum nonlocality: the communication between two quantum particles is instantaneous just because it is transmitted by a-temporal physical space.

In virtue of these considerations, it appears permissible to consider four-dimensional a-temporal physical space as the possible intermediary of all phenomena observed or predicted by the different theories; in line of principle, this a-temporal space should be able to include all objects of physics (and therefore also ponderable matter and force fields). It is permissible to think that this a-temporal space represents a reality ontologically primary as to the matter and that the different types of fields (electromagnetic, quantum, nuclear) can be seen as special states of it.

Here the aim is to introduce a new interpretation of subatomic particles and their motion inside a-temporal physical space. This new interpretation, on one hand, can give results similar to standard quantum theory and, on the other hand, will allow us to open new perspectives as regards bohmian quantum potential.

2. Granular structure of a-temporal physical space

All we observes in space – matter or energy – is not distributed in continuous way but is quantized. In virtue of this consideration, one can suppose that, as matter and energy, also a-temporal physical space is not continuous, but is quantized, i.e. composed by quanta of space.

The idea regarding the quantization of space is supported also by significant theoretical results. There are different theories in which space is treated as a quantum. In particular, there are two theories whose results present a certain connection with the ideas which will be suggested in this article, whose results are helpful toward the new interpretation of subatomic particles which will be proposed here: space-time reticular dynamics and loop quantum gravity.

Space-time reticular dynamics replaces the idea of a continuous space-time with a discrete structure of elementary space-temporal quanta, unitary grains characterized by an elementary length $l_p = \sqrt{\frac{\hbar G}{c^3}}$ and by an elementary time $t_p = \sqrt{\frac{\hbar G}{c^5}}$. This theory implies that the motion of physical objects is continuous only in macroscopic ambit, but indeed happens in jerks[2,3].

Loop quantum gravity predicts that physical space is not indefinitely divisible, but it has a granular structure at the Planck scale, given by a net of intersecting loops, and just these loops constitute the quantum excitations of gravitational field, i.e. represent the elementary quanta of space. This theory predicts that the eigenvalue problem of the spatial volume operator admits physically acceptable solutions only in correspondence of determined discrete values of the volume, i.e. that volume is quantized, and that the elementary quanta of spatial volume reside precisely at the nodes of the net. Besides, loop quantum gravity predicts that also the separation surface between two adjacent quanta of space turns out to be quantized. In short, in this theory nodes carry quantum numbers of volume elements while links (among the different nodes of the net) carry quantum numbers of area elements. These quantum numbers and their algebra look like the spin angular momentum numbers of elementary particles, and therefore the elementary grains of space, i.e. the loops of the net, can be appropriately defined spin elements or “spin networks”.

The image of physical space provided by loop quantum gravity is mathematically precise and can be synthesized in this way: nodes of spin networks represent the elementary grains of space, and their volume is given by a quantum number that is associated with the node in units of the elementary Planck volume, $V = \left(\hbar G / c^3\right)^{3/2}$, where $\hbar$ is Planck’s reduced-constant, *G* the universal gravitation constant and *c* the speed of light. Two nodes are adjacent if there is a link between the two, in which case they are separated by an elementary surface the area of which is determined by the quantum number associated with that link. Link quantum numbers, j, are integers or half-integers and the area of the elementary surface is $A = 16\pi V^{2/3}\sqrt{j(j+1)}$, where *V* is the Planck volume[4,5].

Taking into account the results of reticular space-time dynamics and loop quantum gravity, if one assumes that space-time is really a four-dimensional a-temporal space (in which the fourth coordinate indicates the numerical order of material movements), it turns out to be permissible to assume that this a-temporal space has a granular structure at Planck scale. In other words, it turns out to be permissible to assume that quanta of space having the size of Planck length $l_p = \sqrt{\frac{\hbar G}{c^3}}$ are the fundamental constituents of space (namely that it is not possible to observe areas or volumes smaller than Planck scale) and that Planck time $t_p = \sqrt{\frac{\hbar G}{c^5}}$ is the least unit of motion (namely that it is not possible to observe numerical order of movements smaller than Planck time).

3. The interpretation of subatomic particles and their movement

If physical space is quantized and the matter placed in it is quantized, in the volume of physical space where a material object is present quanta of space and quanta of matter must somehow coexist. In order to get this coexistence, quanta of space and quanta of matter must be considered as different aspects of a one entity.

According to the model presented here, both matter and a-temporal physical space which is "empty" or without changes, are constituted by quanta of space: quanta of space are the fundamental bricks of all that we observe. The only difference is that a-temporal physical space (ATPS), in absence of matter, has not entropy (there is no experimental evidence that such a space has entropy; its only property is density); instead, matter has entropy and therefore can change its state (for example, its position, its atomic and molecular structure and its speed).

Quanta of space (QS) as elementary packets of energy have not been created and cannot be destroyed (on the ground of the first law of thermodynamics). They are a-temporal entities in the sense that no material change is necessary for their existence[6]. QS constituting physical space and QS constituting matter have different states of energy because are endowed with different frequencies of vibration.

QS constituting ATPS have the following features. They change their electrical charge from positive to negative in a Planck time (5.39$\cdot 10^{-44} s$), which is the lowest unit of time, namely of motion. They vibrate at the "basic frequency" 0.19$\cdot 10^{44} s^{-1}$, which is defined as the inverse of Planck time, and have a "basic energy" given by the relation $E_{QS} = h \cdot 10^{44} s^{-1}$ where *h* is Planck constant (6.626069$\cdot 10^{-34} J \cdot s$), namely $E_{QS} = 1{,}26 \cdot 10^{10} J$. QS of ATPS are complete into themselves: their existence does not depend on other physical entities. They have no radiation, no "dispersion of the energy": their energy is always the same and exactly the basic energy $E_{QS} = 1{,}26 \cdot 10^{10} J$. This means that QS which build up ATPS have no entropy, in other words can be defined as the "non-entropy state" of energy.

Instead, QS constituting matter vibrate with appropriate different frequencies (lower than the basic one) and can be defined as the "entropy-state" of energy. First law of thermodynamics rules QS of ATPS, second law of thermodynamics rules QS which build up matter.

All material objects are different portions, aggregates of QS with their own characteristic frequencies of vibration. All material particles are composed by QS that vibrate at appropriate frequencies and that, in virtue of these vibrations, become seat of a discrete quantity of energy in the "entropy-state". While QS vibrating at their basic frequency have got energy in the “non-entropy state” (and constitute therefore “empty”, or without changes ATPS), QS vibrating at appropriate frequencies (lower than the basic one) assume energy in the “entropy state” and become thus material quanta, endowed with mass and therefore perceivable by our senses.

In this model based on an ATPS, each subatomic particle is therefore interpreted as the result of the interaction of energy in the “entropy-state” with one or more QS, determined by the vibration of these QS at appropriate frequencies. More precisely one can propose that particles devoid of internal structure, such as quarks, leptons and intermediate bosons, can be seen as the result of the interaction of energy in the “entropy-state” with one quantum of space (caused by the vibration of this quantum of space at a certain appropriate frequency); instead, particles endowed with an internal structure such as baryons (constituted by three quarks) and mesons (constituted by a quark-antiquark pair) are given by the interaction of entropic energy with more QS (caused by the vibration of these QS at certain appropriate frequencies).

For example, electron can be seen as the result of the interaction of energy in the “entropy-state” with one quantum of space (which is occupied by the electron), interaction determined by the vibration of this quantum of space at an appropriate frequency. The discrete quantity of entropic energy that a quantum of space assumes when it becomes electron depends on the features of the region in exam, on the situation existing in that particular region of ATPS (namely on the type of interaction, “potential” to which the region of ATPS is subjected). In fact, in this model, the fundamental interactions and physical fields can be interpreted as special states, as special ambient situations existing in ATPS in presence of certain material particles, and produce modifications in the properties of ATPS (in particular, gravity has the effect to produce modifications in the geometrical properties of ATPS while the other three interactions – electromagnetic, weak and strong – can determine modifications in the “vibrations” of QS of the region of ATPS into examination).

In order to illustrate this new interpretation of subatomic particles, let us consider for example an electron being in a stationary state of hydrogen atom. According to this model, the electron being in a stationary state of hydrogen atom, i.e. the ambient situation existing in ATPS represented by the Coulomb field created by a proton, can be seen as the result of the interaction of entropic energy, given by one of the eigenvalues of the energetic spectrum $E_n = -\frac{1}{2} m_e \frac{e^4}{\hbar^2 n^2}$ (where m_e is the mass of electron and *n* is an integer positive number), with one quantum of space. This quantum of space becomes seat of this entropic energy as a consequence of the vibration at an appropriate frequency ν_n which is obtained by the relation: $E_n = h\nu_n = -\frac{2\pi^2 m_e e^4}{h^2 n^2}$ and thus is given by $\nu_n = -\frac{2\pi^2 m_e e^4}{h^3 n^2}$. The particular value of the frequency of vibration determined by the Coulomb potential in a quantum of space depends on the position of this quantum of space. We will say in fact that the Coulomb potential created by a proton changes the frequency of a quantum of space being at a distance $r_n = \frac{n^2\hbar^2}{m_e e^2}$ from the proton, from the value given by the "basic frequency" to the value $\nu_n = -\frac{2\pi^2 m_e e^4}{h^3 n^2}$ (and therefore determines the appearance in it of the entropic energy $E_n = h\nu_n = -\frac{2\pi^2 m_e e^4}{h^2 n^2}$). For example, in the case in which the quantum of space is at a distance $r_1 = \frac{\hbar^2}{m_e e^2}$ from the proton, the Coulomb potential produces the change of the frequency of this quantum of space from the value given by the "basic frequency" to the value $\nu_1 = -\frac{2\pi^2 m_e e^4}{h^3}$ (and therefore determines the appearance in this quantum of space of the entropic energy $E_1 = -\frac{m_e e^4}{2\hbar^2}$ equal to the first eigenvalue of the energetic spectrum of an hydrogen atom): a quantum of space being at a distance $r_1 = \frac{\hbar^2}{m_e e^2}$ from the proton, under the action of the Coulomb potential $V(r) = -e^2/r$, vibrates at the frequency $\nu_1 = -\frac{2\pi^2 m_e e^4}{h^3}$ and becomes therefore seat of a quantity of entropic energy equal to the first eigenvalue of the energetic spectrum of an hydrogen atom, i.e. becomes an electron being in the first stationary state of the hydrogen atom.

Therefore, in this model, the electron being in a stationary state of the hydrogen atom derives from a quantum of space vibrating at appropriate frequencies less than the basic one. It is the vibration of a quantum of space at an appropriate frequency that causes the change of energy of this quantum of space from the "non-entropy state" to the "entropy state" and, therefore, creates the appearance of an electron in a stationary state of the hydrogen atom. Therefore, the following reading of the mathematical formalism concerning the electron of an hydrogen atom turns out to be permissible: in a given region of ATPS, the ambient situation represented by the Coulomb field created by a proton (i.e. $V(r) = -e^2/r$ where *r* is the distance from the proton) determines a modification in the properties of that region: more precisely, it produces the change of the frequency of a quantum of space surrounding the proton from the value given by the "basic frequency" to one of the values $\nu_n = -\frac{2\pi^2 m_e e^4}{h^3 n^2}$. This quantum of space, vibrating at one of these frequencies ν_n becomes seat of a discrete quantity of entropic energy given by $E_n = h\nu_n = -\frac{2\pi^2 m_e e^4}{h^2 n^2}$ and this means that it has become an electron being in a stationary state of the hydrogen atom.

On the ground of this interpretation of the electron being in a stationary state of the hydrogen atom, also the following important consequence can be drawn. One can say that it is the special "state" of ATPS (in this case represented by the Coulomb potential) to "create" matter (in this case the electron being in a stationary state of hydrogen atom). In other words, we can also say that the presence, in a given point of ATPS, of a mass and a charge equal to the mass and the charge of electron is an effect of the vibration of a quantum of space at a frequency given by one of the values $\nu_n = -\frac{2\pi^2 m_e e^4}{h^3 n^2}$, caused by the ambient situation existing in the region of ATPS in examination.

Also the quantum wave associated to the electron being in a stationary state of the hydrogen atom can be considered an effect of the vibration at the frequencies $\nu_n = -\frac{2\pi^2 m_e e^4}{h^3 n^2}$; in fact, since the appearance in a quantum of space of an entropic energy given by $E_n = h\nu_n = -\frac{2\pi^2 m_e e^4}{h^2 n^2}$ is determined by its vibration at the frequency $\nu_n = -\frac{2\pi^2 m_e e^4}{h^3 n^2}$, and since an electron having energy equal to one of the values $E_n = h\nu_n = -\frac{2\pi^2 m_e e^4}{h^2 n^2}$ is described by an eigenfunction of the hydrogen atom, i.e. $\psi_{nlm}(r,\vartheta,\varphi) = R_{nl}(r)Y_l^m(\vartheta,\varphi)$, one can say that the quantum wavefunction of the electron being in a stationary state of the hydrogen atom can be seen itself as a consequence of the vibration at the frequency $\nu_n = -\frac{2\pi^2 m_e e^4}{h^3 n^2}$.

This particular example of the electron of an hydrogen atom shows that the ordinary stationary states predicted by quantum mechanics can be seen as the effect of the vibration of a quantum of space at appropriate frequencies characteristic of that particle: the fact that the frequency is quantized implies that also the energy (in the entropy state) that a quantum of space acquires (as a consequence of that vibration) is quantized and a different quantum wavefunction will be associated with each of these values of energy. In synthesis, the following facts can be drawn as regards this model. On one hand, we can say that this model can give results similar to standard quantum theory, in the sense that the quantum states of the particles into consideration coincide with the correspondent states predicted by standard quantum mechanics. On the other hand, at the same time, this model introduces these new simple elements: the idea that space is a-temporal and has a granular structure at the Planck scale and the fact that the state of each subatomic particle can be always seen as the consequence of the vibration of one or more QS at appropriate frequencies.

Therefore, on the ground of this model one can say that it is just the vibrations of QS at the frequencies characteristic of subatomic particles which give place to the quantum waves associated with the material particles. The wave behaviour of the subatomic particles arises from the vibrations of QS constituting them. In short, one can say that all derives from the vibrations at appropriate frequencies (characteristic of material particles). The vibrations of QS at appropriate frequencies create the appearance of material particles (in the sense that, because of them, these QS become seat of a discrete quantity of energy in the "entropy state") and, at the same time, create the wave behaviour, the quantum waves associated with such particles. These quantum waves can be interpreted both in standard sense (as mathematical tools to compute certain probabilities) and in more "realistic" senses. We emphasize however that we prefer to interpret them in a realistic sense. We suggest, in particular, that these quantum waves can be interpreted like in Bohm's pilot wave theory.

In this regard, it is important to underline the following facts. Firstly, we can say that there is a certain analogy, resemblance between the wave equation $\left(\nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\right)\psi = -\frac{\delta Q[\psi, t]}{\delta\psi}$ (where c is the speed of light) of Bohm's quantum field theory concerning a massless quantum field and the classical massive Klein-Gordon equation $\left(\nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\right)\psi = -m^2\psi$. Secondly, it has been shown that for particular solutions of the Klein-Gordon equation the quantum potential associated with a one-quantum state acts so that the massless quantum field behaves as if it were a classical field with mass. As a consequence of these facts, in Bohm's quantum field theory, we are presented with the possibility that the attribute of mass can be seen as an effect of quantum potential, i.e. that quantum potential can be viewed as the origin of the mass of a subatomic particle[7].

Then, if we take into account that in Bohm's quantum field theory there is a possible link between the mass of a particle and the quantum potential, and that, in the model here suggested, the appearance of a mass means the appearance of an entropic energy, the following idea turns out to be completely permissible: the quantum waves guide the corresponding particles, through the action of quantum potential, during their motion, in different QS of ATPS. More precisely, one can suggest that the quantum potential is responsible of the entropic energy shifting between different QS.

For example, in the case of the stationary states of the hydrogen atom, on the ground of our model, the action of quantum potential is to create the appearance of an electron of mass m_e (and consequently of the entropic energy $E_n = h\nu_n = -\frac{2\pi^2 m_e e^4}{h^2 n^2}$) in the different QS of each energetic level. The role of quantum potential is to transfer, to guide this entropic energy among the different QS composing the trajectory described by the electron in an energetic level of the hydrogen atom. There is a correspondence between quantum potential and the appearance of entropic energy in the different points of ATPS.

In short, as far as the interpretation of matter is concerned, on the ground of this model all derives from the vibrations at appropriate frequencies (characteristic of material particles). The vibrations of QS at appropriate frequencies create the appearance of material particles (in the sense that because of them, these QS become seat of a discrete quantity of energy in the "entropy state") and, at the same time, create the wave behaviour, the quantum waves associated with such particles. One can suggest that the role of quantum potential is just to transfer a discrete quantity of entropic energy among different QS of ATPS (making thus a particle appear in the QS which compose its trajectory). Therefore, on the ground of the model proposed here, one can say that the quantum waves associated with material particles guide the corresponding particles in the regions where the wavefunction is more intense, through the action of quantum potential, which is responsible of the entropic energy shifting between the different QS composing the trajectory described by the particle in ATPS.

4. Quantum potential as "special state of a-temporal physical space in the presence of microscopic processes"

In Bohm's pilot wave theory, the movement of a subatomic particle is determined by the sum of a classic potential and a quantum potential (according to the law $m\frac{d^2\vec{x}}{dt^2} = -\nabla(V+Q)$ where *m* is the mass of the particle, *V* is the classic potential and *Q* is the quantum potential)[7,8,9]. On the other hand, in the model here suggested about quantized ATPS, the motion of a subatomic particle is tied to the interaction of entropic energy with the various QS composing the trajectory described by the particle into consideration (and this interaction is produced by the vibration of these QS at certain frequencies). According to this model, the vibration at appropriate frequencies of one or more QS determines the interaction of entropic energy with these QS and the appearance in them of a subatomic particle; this vibration produces also a quantum wave that guides the particle during its motion, making it appear in different points of ATPS. The motion of a subatomic particle is therefore always caused by the vibration of certain QS at appropriate frequencies.

The evolution of the wavefunction of a physical system happens in space-time only in the mathematical models of reality. In an a-temporal view of the universe, the wavefunction ψ which describes the state of a given physical system does not vary in time but vary in a four-dimensional ATPS and the stream of changes that it has in space is itself time. This means that, in this model, the coordinate *t* which appears in Schrödinger equation $i\hbar\frac{\partial\psi}{\partial t} = H\psi$ (*H* being the Hamiltonian of the system) does not represent time but rather the stream of changes that the physical system has in ATPS and thus $\frac{\partial\psi}{\partial t}$ is the partial derivative of the wavefunction in respect to the stream of changes of the system in ATPS.

Also the law of motion of the particle in Bohm's version of quantum mechanics, $m\frac{d^2\vec{x}}{dt^2} = -\nabla(V+Q)$, can receive an analogous interpretation: here, *t* does not represent a "real" physical time, but rather the stream of changes of the particle into consideration in ATPS. The acceleration $\frac{d^2\vec{x}}{dt^2}$ is not the variation of the speed in time but the stream of changes to which the speed is subjected in ATPS. The law of motion written above says us then that the total force (classic + quantum) acting on a physical system is tied to the stream of changes of the speed of the system in ATPS (and thus if the particle into consideration is still, there is not stream of changes in space and therefore no force acts on the particle).

Now, we can understand well the connection between this a-temporal interpretation of the law of motion in Bohm's pilot-wave theory and the interpretation of a subatomic particle in quantized ATPS. As we have said in the previous chapter, it is the vibration of certain QS at appropriate frequencies that determines the appearance of a particle in ATPS and creates the wave which guides the particle during its motion. One can deduce thus that the motion, the stream of changes to which a particle is subjected in ATPS is itself tied to the vibration at appropriate frequencies of the QS composing its trajectory. Therefore, quantum potential itself is determined, in short, by the vibration at appropriate frequencies of some QS of ATPS.

Here the following idea is therefore proposed. There is someway a connection, a correspondence, between the entropic energy movement among the various QS, these elementary grains of ATPS - movement that, as said before, materializes a particle making it appear in the different points of space - and the action of the total force that produces the motion of that particle, as we know it from Bohm's pilot wave theory. The movement of a particle under the action of the total force (classic + quantum) can be seen as the effect of the entropic energy transfer among the different QS in which the trajectory described by the particle can be decomposed. In other words, one can think that the total force (classic + quantum) which acts on a particle represent the immediate effect, the immediate manifestation of the entropic energy shifting between the various QS composing the trajectory described by this particle[10]. It is important to underline that this idea, according to which the total force acting on subatomic particles can be seen as the effect of the entropic energy shifting between different QS, appears consistent also on the ground of the results of space-time reticular dynamics mentioned in chapter 2. The results of space-time reticular dynamics can be seen as other important elements which give plausibility, acceptability to the idea, proposed here, according to which there be a correspondence between the entropic energy movement among different QS - movement that materializes a particle making it appear in the different points of space - and the action of the total force that produces the motion of that particle, as we know it from Bohm's pilot wave theory.

In this way, a new interpretation of quantum potential can be proposed: the idea that quantum potential has origin from this deeper level of reality, in which one assumes that physical space is a-temporal, composed by a net of QS having the size of Planck length (which represent its elementary grains) and in which one assumes that subatomic particles appear in virtue of the interaction of entropic energy with one or more QS. This new interpretation opens the possibility that there be a possible link between quantum potential and granular structure of physical space at the Planck scale. It implies in fact a correspondence between bohmian quantum potential and the entropic energy shifting among the QS (responsible of the materialization in different points of space of an elementary particle): as regards microscopic processes, ATPS assumes the special "state", represented by quantum potential, in consequence of the entropic energy shifting between various QS, and therefore in consequence of the vibration of such QS at appropriate frequencies. In short, the movement of atomic and subatomic particles is determined by the energy shifting among the various QS (caused by the vibration at certain frequencies) and it is in consequence of this energetic shifting that ATPS assumes the special "state" represented by quantum potential.

The interpretation of quantum potential as the special "state" of ATPS in the presence of microscopic processes, can be also seen as a natural consequence which derives from quantum nonlocality. Nonlocality provides to us another element for which this new interpretation of quantum potential appears completely permissible. The instantaneous connection between two subatomic particles separated by big distances, in Bohm's version of quantum mechanics, is explained by quantum potential. But at the same time nonlocality of quantum phenomena can be also seen as an effect of ATPS. That is to say: one can think that it is ATPS to transmit the information between two particles, before joined and then removed and carried at big distances one from the other, to let these two particles communicate instantaneously. Just as gravitational interaction expected by a-temporal gravitation theory, also the information between two quantum particles is a-temporal, has not speed[11]. Hence we are presented immediately with the possibility that there be a sort of correspondence between quantum potential and ATPS, in particular that quantum potential can be just interpreted as the special “state” of ATPS in the presence of microscopic processes, and thus of quantum particles. When one takes into consideration an atomic or subatomic process (such as for example the case of an EPR-type experiment, of two subatomic particles, before joined and then separated and carried away at big distances one from the other), ATPS assumes the special “state” represented by quantum potential, and this allows an instantaneous communication between the two particles under study.

5. Conclusions

Universe is an a-temporal phenomenon and QS having the size of Planck length are its elementary packets of energy. QS constituting ATPS vibrate at the “basic frequency” and are the “non-entropy” state of energy; QS constituting matter vibrate at appropriate frequencies (lower than the basic one) and are the “entropy state” of energy. It is in virtue of the vibration at appropriate frequencies that QS assume a discrete quantity of energy in the “entropy state”, becoming therefore material quanta, perceivable to our senses. Each subatomic particle can be seen as a structure composed by one or more QS vibrating at an appropriate frequency: in virtue of this vibration, these QS become seat of a discrete quantity of entropic energy (whose value and form depend on the particular ambient situation of the region in exam, on the particular “potential” to which the region of ATPS is subjected).

The quantum waves of the subatomic particles can be considered themselves an effect of the vibrations of the QS constituting those particles, and we suggest that these quantum waves guide the corresponding particles in their movement in agreement with Bohm’s pilot wave theory. In this way, it is possible to propose a new interpretation of quantum potential as “special state of a-temporal physical space in the presence of microscopic processes”. This new interpretation of quantum potential can provide us a more profound view, at a more fundamental level, of atomic and subatomic processes. The trajectory described by a subatomic particle in a given quantum experiment can be seen as the consequence of the state of ATPS when that experiment is performed; ATPS assumes that state, represented just by quantum potential, because of the vibration at appropriate frequencies of some QS constituting the region of ATPS in examination, vibration which causes the interaction of entropic energy with such QS. It is the entropic energy shifting between these particular QS composing a given region of ATPS (determined in turn by the vibration at appropriate frequencies) to materialize a subatomic particle in the different points of its trajectory, and it is permissible to think that the way of acting of quantum potential emerge just from here.

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