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Original Paper

Deficient Reality, the Circles Theory, and an Interpretation of the Complex Representation of the Observable Microscopic World

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Abstract: Since 2007, theoretical kinematical model has been developed. The work tries to explain the complex waveform. It is a non-quantum theory. The work is a circles theory and the complex waveform arises as a result of partial observation of rolling circles. The interesting thing is that the results show an analogy with relativistic quantum mechanics. The present article tries to put forward the conceptual background of that theory. The circles world is recognised as an external world and a mathematical world, whereas the observables represent the physical world or reality. The observation leads to physicalisation process. The difference between the two worlds is related to the resolution problem of observation that causes partial observation. When this problem is effective, the reality is deficient, and we deal with a deficient reality. Within this frame, the relativistic quantum mechanics may look like a description of an observable microscopic world that is related to a mathematical external world of circles combinations, but it is for the deficient reality.

Keywords: Complex function. Partial observation. Circle theory. External world. Deficient reality. External world.

1. Introduction

In natural sciences, a phenomenon is any event that is observable. The observation of only an event means that there is no consideration for the causes of the event. In physics, the phenomenon may be equivalent to the appearance. Examples of physical phenomena are the lunar orbit or oscillations of a pendulum. (Bernstein, 1996).

According to Husserl, the main function of phenomenology is to provide an explanation of how phenomena are constituted and how they are possible (Husserl, 1964). The observation itself is a physical process and is not an absolute process. It depends on the physics of observation. Thus, the constitution of phenomena forms our knowledge.

The external world may be defined as one that is independent of human senses. In physics, it can be represented by mathematical physical laws which are subject to experimental investigation. Physics is based on our acceptance of the existence of an external world and, in this case, it is the world that we see or, in other words, the world as it appears in terms of sensation (Russell, 1914). Reality is related to this external world and the observation process. This concept also concurs with classical physics.

Science tries to build an objective view of the external world. The problem of how one can know the external world is one of the oldest and most difficult problems in philosophy and psychology.

For John Locke (1632–1704), there are three degrees of knowledge: sensitive, intuitive and demonstrative. The knowledge of the external world is achieved sensitively and he used the phrase "sensitive knowledge" for the knowledge of the external world (Priselac, 2020). Since we accept the concepts of the hypothetical external world and consider them to be independent of the observer, we need a bridge or a connection between the external world and the sense. Russel asked, "Can we know of the existence of any reality which is independent of ourselves?" (Russel, 1914, p. 110). He introduced the concept of sense-data and argued that sense data are the functions of physical objects. In Russel's words, "If what we perceive directly are sense-data, then all we *know* about are sense-data. We believe that 'behind' the sense-data there is a real physical object, that physical objects cause our sense-data" (Russell, 1912). The sense-data as introduced by Russel was intended only to denote that which we are directly aware of in our perception (Huemer, 2019). The sense-data theory has been expanded in different forms (e.g., Jackson 1977; Ayer 1956; O'Shaughnessy 2003, Robinson 1994; Price 1950).

1.1. Quantum mechanics and the external world

Reality is related to the external world that is observable. This concept may be in agreement with classical physics but not with quantum mechanics. In quantum mechanics, reality is related to what we see experimentally. For Heisenberg, "[T]the measuring device has been constructed by the observer, and we have to remember that what we observe is *not nature in itself* but nature exposed to our method of questioning" (Heisenberg, 1958).

However, for Copenhagen, the interpretation of the opinion of the existing external world does not mean that we can study that independent world. Here, Heisenberg himself said: "Some physicists would prefer to come back to the idea of an objective real world whose smallest parts exist objectively in the same sense as stones or trees exist independently of whether we observe them. This, however, is impossible" (d'Espagnat, 1979), or "our common concepts cannot be applied to the structure of the atoms." (Heisenberg, 1959). When Bohr was asked whether the algorithm of quantum mechanics could be considered as somehow mirroring an underlying quantum world, he would answer, "There is no quantum world. There is only an abstract quantum physical description. It is wrong to think that the task of physics is to find out how nature *is*. Physics concerns what we can *say* about nature" (Petersen, 1963), or "there can be no question of an immediate connexion with our ordinary conceptions" (Bohr, 1928).

Thus, the Copenhagen interpretation denies that the wave function provides an image of the external world that is directly capable of being perceived and it is no more than a theoretical concept. The traditional interpretations of the wave function is mostly based on Born's rule, which was proposed after the existence of the wave function. These types of interpretations are related to the role of the wave function in Born's statistical proposal and not to its role in the representation of nature. So, these types of representations are not related to the external world.

The mathematical formulation is complex and is not as real as that of the macroscopic world. In spite of a large number of interpretation theories of quantum mechanics, there still are no definite answers for questions like:

- Is it (wave function) a complete and comprehensive representation of the world?

- Do we need additional physical quantities to fully capture reality, as Albert Einstein and others suspected?
- Does the wave function have no direct connection with reality at all, and merely characterizses our personal ignorance about what we will eventually measure in our experiments?

Such cases made some physicists believe that quantum mechanics is still ununderstandable. For example, Richard Feynman's opinion is "…I think I can safely say that nobody understands quantum mechanics" (Feynman, 1965) or Sean Carroll states "Until physicists definitively answer these questions, they can't really be said to understand quantum mechanics" (Carroll, 2019).

However, since it has been proposed, the wave function has been accepted as it is, without physical explanation. That is related to its complex nature. Moreover, there is no interest in looking for a physical meaning for it (Sanduk, 2019). Accordingly, the philosophical argument about its nature, without substantive physical explanation will be continuous.

1.2. Mathematical external world

The independent external world is a hypothetical concept. The physical world is the observable world. Both worlds can be represented by mathematical models, but the first is a proposed mathematical model for a hypothetical external world, whereas the second is a mathematical model for an observable world. The experimental test for the second may prove that it is in agreement with the external world.

In 1998, Tegmark has proposed the concept of a mathematical external reality (Tegmark, 1998, 2008). He regarded that as a pure mathematical world (Tegmark, 1998, 2008). For Tegmark, the physical universe is not merely *described by* mathematics, but it *is* of mathematical structure; the mathematical existence equals physical existence and *all structures that exist mathematically exist physically as well*. (Tegmark, 2007)

The agreement between the mathematical model and the external world can be checked experimentally. Then one can say as Tegmark said, "the mathematical existence equals physical existence, and *all structures that exist mathematically exist physically as well*". This concept fits well with that of Fig.1. When there is no problem (no missing data) with the data as shown in Fig.2, then the physics may be formed by:

- The mathematical model for the hypothetical external world, and
- The observation of the model. The observation forms physicalisation.

1.3. Physicalisation

The observation or experiment that deals with nature, matter or physics. Physicalism as a philosophical concept has been introduced in the 1930s by Otto Neurath (Neurath, 1931) and Rudolf Carnap (Carnap, 1959), both of whom were key members of the Vienna Circle.

Based on the rule of senses in the concept of reality, one can say that there are three elements:

1- There is an external world independent of observer (object).

2- An information carrier (probe).

3- An observer who receives the information.

Fig.1 depicts these three elements. The information carrier does not gain a large philosophical interest.

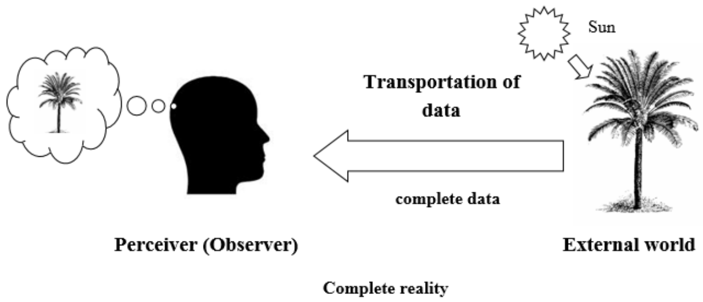


Fig. 1 The three elements that may be needed to form physical knowledge.

When this process transmits all the data perfects, the observer can form a similar representation (it may be a mathematical model) for what he/she got. This representation can be examined experimentally. The agreement leads to state that we face the reality or a complete reality, where there is no deformation or disparity in the received data. On the other hand and according to this concept of the transportation of data between the observer and the external world, one may say that the reality as recognised by the observer is controlled or restricted by any effect on the transported data or the limitation of the transportation. As an example for these cases, here we mention two problems of reality:

1-The deformation (due to a physical cause, there is a deformer) where the data are completed but deformed such as the optical refraction phenomena. In this case, there is an effect on the transported of data. There is deformation but it is still a realistic case and the problem can be identified.

2-Deficient reality (due to the inability of the probe to detect all the parts of a system in the external world) where there is missing data (*partial observation*). Like a problem with optical resolution (Rayleigh criterion) of a system. In this case, there is a limitation of data recognition and lead to unrealistic case. As an example, let us consider a system of a moving car and a driver. If you cannot see the driver of the moving car (due to an optical resolution problem), then you may build a theory of a moving car by a ghost driver. It is a ghost, because, you may hear the driver voice but you cannot see him/her. So this type of reality may lead to a strange theory.

The problem of deficient reality is related to the limitation of observation, so it may be hard to identify the problem. Since this problem is related to the optical resolution, so it arises in recognising the microscopic world. In comparison with Fig.1, the deficient reality is shown in Fig.2.

It is worth mentioning here that the string theory adopted the concept of resolution to explain that the point particle is related to the string. In this theory, Planck length cannot be resolved and the string is accurately approximated by point particle (Schwarz and Schwarz, 2004). So the point particle is a strange model (There is no physical point particle, which has infinite density).

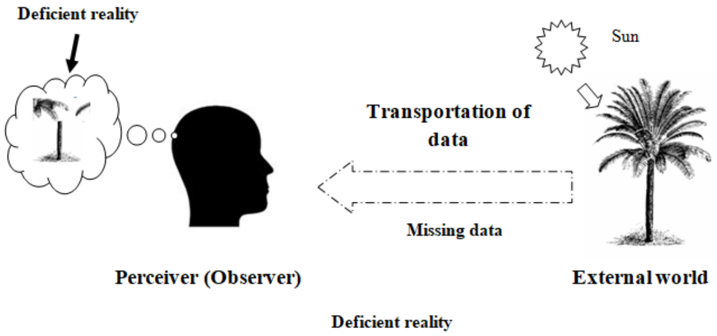


Fig.2 The deficient reality.

We have to mention that the case of the reality (Fig.1) is similar to the case of the deficient reality (Fig.2), where both cases are *without a deformer medium*.

The external world is a virtual world, whereas the physical world is the observable world (reflected in the brain). The scientific investigation tries to prove that the physical world fits the external world well. Since the external world is virtual, the observation is a physicalisation process. In other words, it is a conversion process from the virtual world to the physical world or the observable nature (Sanduk, 2019).

1.4. The kinematic model

The two distinguished features of the quantum mechanics, which are different from the classical or macroscopically physics, are:

1- The quantisation by quantity $\hbar$ which is the Planck constant and related to the Planck proposal in 1900.

2- The complex formulation, which related to the Heisenberg, Born and Schrödinger formulations in 1925–1926.

Let us consider the relativistic quantum mechanics. The relativistic quantum mechanics is based on a combination of two independent theories: the special relativity and the quantum mechanics. The equations of the relativistic quantum mechanics depend on the Hamiltonians (the relativistic in case of Klein-Gordon equation and the linearised one in case of Dirac equations). Both cases contain the constant $\hbar$ and the imaginary i. The Planck's constant is related to the quantised Hamiltonian, whereas i is not. With the aid of the de Broglie, Planck, and Einstein's equations, one can rewrite the equations of the relativistic quantum without Planck's constant. These forms are kinematic forms, and are in terms of space–time with the imaginary i.

These kinematic equations are not related to a real geometrical system. If there is a system (such as the external world) which may lead to the same forms of these kinematic relativistic quantum forms, then it may explain the problem of the imaginary i, and many other mysterious concepts. Since 2007, a theory has been developed to explain the complex wave function as a result of partial observation of a kinematic model (Sanduk, 2007, 2012, 2008a, 2008b, 2019). This theory is a classical work. The mathematical complexity in representation arises due to the partial observation problem and forms a deficient reality. The work may explain the duality of particle-wave and show analogy with kinematic relativistic quantum mechanics.

2. Circles theory

This theory is based on a proposal of an external mathematical model and then the observation effect is considered.

Since 2007, a model to describe a possibility for physical explanations of the complex waveform was started (Sanduk, 2007). In this theoretical research, an analogous form to the foundation of QM has been found. The project is based on a proposal of a mathematical model that acts as an external world which then may be perceived in different forms according to the properties of used light which are the data carrier (Sanduk, 2012, 2018a, 2018b). This property may lead to the problem of partial observation.

This work is classical and is unrelated to the QM approach. Despite this fact, the approach is classical, but the analogy shows excellent agreements with the relativistic quantum equations (Sanduk, 2018b). However, the theory is based on two postulates. The first is related to a system in the external world, and the second is related to the observation problem. This problem is introduced to play a serious rule in forming the representation of the external world. The string theory has used the concept of resolution to explain the point particle. The timeline of the circles theory is shown in Fig.3.

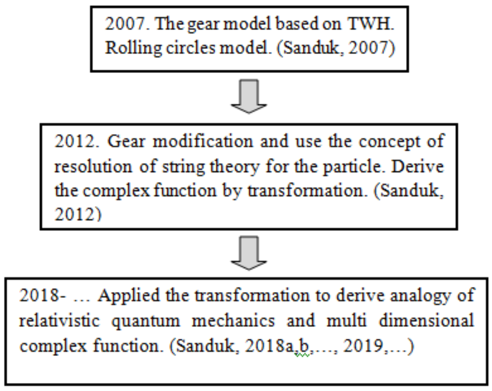


Fig.3 The timeline of the circles theory.

2.1. The external world

The model of the external world has been based and developed from the Three Wave Hypothesis that has been proposed at the end of the seventies of the last century (Kostro, 1978; Horodecki, 1981, 1982, 1983a,b). This hypothesis is based on two concepts (Kostro, 1985):

1- the Paris school interpretation of quantum mechanics, which is related to de Broglie's particle-wave duality (De Broglie, 1923a,b, 1924,1976,), Vigier's and others' works, and

2- Einstein's special relativity which is considered as a limitary case of Einstein's general relativity in which the existence of a covariant æther is assumed (Einstein, 1920, 1924, 1930: 1945).

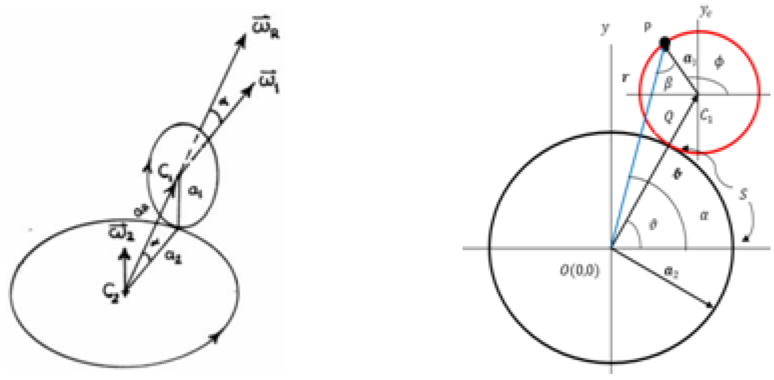
That system was of two perpendicular circles (Sanduk, 2007), as shown in Fig.4a. Then it is developed to a system of two rolling circles in a plan as shown in Fig.4B. (Sanduk, 2012, 2018a). This system is a mathematical model and is regarded as an external world.

The mathematical representation of the model is a kinematical work. To study the motion of a point in this system, the position vector must be determined with the time variation.

The length of the position vector of a point (P) on the small circle (Fig. 4B) according to Sanduk (2012, 2018a) is:

$$r = (a_2 + \mathscr{b}\sqrt{X})\left\{\cos\left(\boldsymbol{k}_2 \cdot \boldsymbol{s} - \omega_1 t + \omega_\beta t\right) \pm \sqrt{-sin^2\left(\boldsymbol{k}_2 \cdot \boldsymbol{s} - \omega_1 t + \omega_\beta t\right) + X}\right\}. \quad (1)$$

Owing to this circular structure of the system, this work is called circles theory.



A B

Fig.4 The rolling circles systems. A-The 2007 model based on TWH (Sanduk, 2007), B-The modified model of 2012 (Sanduk, 2012, 2018a, 2019).

2.2. Role of observation

The perceiver receives an image (perception) of the external world. To deal with the system as a physical object, testing (measuring) in a lab is an essential approach to prove its physical existence (positivism). It is the normal case for a lab observer to deal with observables. Thus, this case does not take classical and quantum physics into account.

In classical physics, the observable distinguishability may be related to the optical resolution (Rayleigh criterion).

The presented concept depends on using a *monochromatic* light (λ, f). d_λ is related to the wavelength so that ω_λ is related to the light frequency (f). The system (Figure3b) is fully observed when:

$$d_\lambda \ll a_1 \ll a_2, \quad (2)$$

Where the spatial resolution (d_λ) is the minimum linear distance between two distinguishable points, and the same for the angular frequency (ω_λ).

In considering the inability and when:

$$a_1 \ll d_\lambda \ll a_2, \quad (3a)$$

and

$$\omega_1 \gg \omega_\lambda \gg \omega_2. \quad (3b)$$

to resolve a_1 and ω_2. In this case $a_1 = 0$ and $\omega_2 = 0$ (missing data), then Eq. (1) transformed to (Sanduk, 2012, 2018a):

$$\mathcal{Z}(\boldsymbol{s}, t, 0) = a_{2m} \exp \pm i(\boldsymbol{k}_{2m} \cdot \boldsymbol{s} - \omega_{1m} t). \quad (4)$$

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In this case, a_2 and ω_1 are resolved (observable) whereas a_1 and ω_2 are unobservable. Thus, this case is a partial observation of the model. Equation (4) looks like the structure of the wave function.
The same technique is applied to the equations of velocity and acceleration of the point. The transformations show these equations respectively (Sanduk, 2018b):

$$i\frac{\partial \boldsymbol{\mathcal{Z}}}{\partial t} = (-iv\boldsymbol{A}' \cdot \nabla + B'\omega_{1m})\boldsymbol{\mathcal{Z}}\,, \tag{5}$$

And

$$\frac{\partial^2 \boldsymbol{\mathcal{Z}}}{\partial t^2} = (-v^2\nabla^2 + \omega_{1m}^2)\boldsymbol{\mathcal{Z}}\,. \tag{6}$$

Equations 5 and 6 are for complex velocity and complex acceleration.
In case of partial observation, we may get *some* knowledge regarding the structure of the external world, while this can also cause a deformation in the received image. Such partial knowledge will lead the perceiver to make abstracted mathematical formulations.

3. Towards quantum mechanics!

The two distinguished features of quantum mechanics, which are different from the classical or macroscopically physics are:

1- The quantisation by quantity $\hbar$ which is the Planck constant and related to the Planck proposal in 1900 (Planck, 1901).

2- The complex formulation which related to the Heisenberg, Born and Schrödinger formulations (Heisenberg 1925; Born 1925; Born, et, al. 1926; Schrödinger 1926).

So far, the circle theory is not a quantum mechanics theory and does not take into account the Planck constant, but it tries to explain the complexity kinematically. In order to show a relationship of the two rolling circles model under the effect of the partial observation technique with the relativistic quantum mechanics, this model was used to show an analogy with the relativistic quantum mechanics (Sanduk, 2018 a, b). Table 1 shows the comparisons between the forms of the relativistic quantum mechanics in the kinematic form (without Planck constant $\hbar$) and the obtained forms by the physical complexification technique. It is obvious that the agreement is quite good. These comparisons may support the concept of physical complexification (Sanduk, 2019).

Table 1 The comparisons (Sanduk 2018a, 2018b).

Conventional definition	**Conventional equations of the relativistic quantum mechanics**	**Analogical model forms**	**Analogical definition**
Dirac wave function	$\psi_D = u_D \exp i(\boldsymbol{k}\cdot\boldsymbol{x} - \omega t)$	$\boldsymbol{\mathcal{Z}} = \boldsymbol{a}_{2m} \exp \pm i(\boldsymbol{k}_{2m}\cdot\boldsymbol{s} - \omega_{1m} t)$	*Z-complex vector*
Dirac equation	$i\frac{\partial \psi}{\partial t} = (-ic\boldsymbol{\alpha}\cdot\nabla + \beta\omega)\psi$	$i\frac{\partial \boldsymbol{\mathcal{Z}}}{\partial t} = (-iv\boldsymbol{A}\cdot\nabla + B\omega_{1m})\boldsymbol{\mathcal{Z}}$	Complex velocity equation
The coefficients	$\boldsymbol{\alpha}$ and β	$\boldsymbol{A}$ and B	*Coefficients*
Property	$\boldsymbol{\alpha}_i\boldsymbol{\alpha}_j + \boldsymbol{\alpha}_j\boldsymbol{\alpha}_i = 0$	$\boldsymbol{A}_\theta\cdot\boldsymbol{A}_\varphi + \boldsymbol{A}_\varphi\cdot\boldsymbol{A}_\theta = 0$	*Property*

Property	$\boldsymbol{\alpha}_i\boldsymbol{\alpha}_i + \boldsymbol{\alpha}_i\boldsymbol{\alpha}_i = 2$	$\boldsymbol{A}_\theta \cdot \boldsymbol{A}_\theta + \boldsymbol{A}_\theta \cdot \boldsymbol{A}_\theta = 2$	*Property*
Property	$\alpha_i^2 = \beta^2 = 1$	$A^2 = B^2 = 1$	*Property*
Property	$\boldsymbol{\alpha}_i\beta + \beta\boldsymbol{\alpha}_i = 0$	$\boldsymbol{A}B + B\boldsymbol{A} = 0$	*Property*
Klein-Gordon equation	$\frac{\partial^2\psi}{\partial t^2} = [c^2\nabla^2 - \omega^2]\psi$	$\frac{\partial^2\boldsymbol{\mathcal{Z}}}{\partial t^2} = [v^2\nabla^2 - {\omega_{1m}}^2]\boldsymbol{\mathcal{Z}}$	*Complex acceleration equation*

3.1 The unifications

In his words, Einstein described, "The real goal of my research has always been the *simplification* and *unification* of the system of theoretical physics. I attained this goal satisfactorily for macroscopic phenomena, but not for the phenomena of quanta and atomic structure. I believe that, despite the considerable success, the modern quantum theory is still far from a satisfactory solution of the latter group of problems" (Einstein, 1979)
The circle theory may lead to show a unification of both quantum mechanics and special relativity. In addition to that, the approach is simple. The results above may lead to say that there may be two types of unifications.

The relativistic quantum mechanics is an artificial combination of both quantum mechanics and special relativity. In circles theory, both forms of Dirac equation and Klein-Gordon equation are obtained (Table 1). Thus, one may suggest that quantum mechanics and the special relativity are not separated and both are related to the same origin.

The scale of macroscopic and microscopic in this theory depends on the used light properties. When the scale of an object is much larger than the wavelength of the light, it will be easy to resolve optically, and then it will be considered macroscopic. When this scale of the object is comparable or is smaller than the wavelength, it will be hard to resolve optically, and then it will be considered microscopic.
Regarding this approach, one can say that what we observe is not the external world itself: it is the external world as it is exposed to us. Such a notion is quite similar to Heisenberg's comments mentioned above. The two aforementioned statements (the partially observed external world and Heisenberg's concept of the nature in itself) are similar, but the first is related to the partially observed external world that has been mathematically proven, whereas Heisenberg's statement is related to his point of view about the experience of QM.

3.2 The deficient reality and atom theory (physics-metaphysics)

The phenomenon is based on the observation process. Any problem in observation may show a deformed phenomenon. Therefore, any unsolved problem of the observation process may cause a permanent unexplained phenomenon, and it is accepted as a normal phenomenon.

The physicists of the macroscopic world may not need to postulate a virtual external world because there is a complete observation and the observable world is similar to the external world by experimental investigation. In this case, there are no missing parameters that describe the external world. That is because of the resolution criterion, and the negligible scale of the wavelength in comparison with the macroscopic world.

On a microscopic scale when the wavelength scale is comparable with the external world dimensions, it is expected that there would be a problem. Some parameters of the external world may be missing due to the resolution criterion. Hence, the reality in this microscopic world is different from that of the macroscopic world. This may lead some to assume a deficient reality. This deficiency may lead to a mathematically complex representation. Then the deficient reality in the microscopic world is a mathematical reality or may be called *epistemic*. The circle theory tries to explain the complex form as a physical result due to the partial observation. The observer regards the function (Eq. (4)) to be an epistemological structure, but the origin is the ontological structure, note Fig.5.

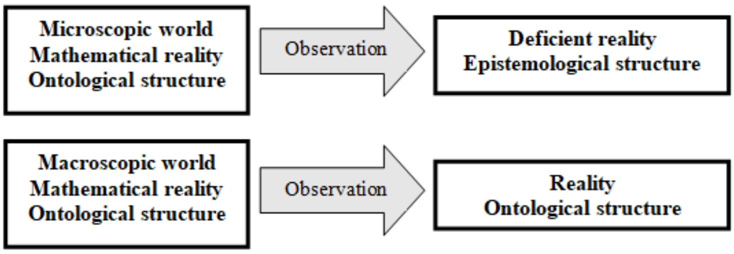

Fig.5 The transformation and missing ontology

In this new approach, there seems to be no role of human consciousness in the problem of complexity (Sanduk, 2019). As we found, there is no need to consider a subjective view or to introduce consciousness in the interpretation of the microscopic world.

The theoretical predictions are the results of a theoretical model, which is based on the observable world. When the observable world is different from the external world, a problem arises. As we mentioned above, the observation problem makes a barrier, which will then lead to significant errors and inconsistencies between the experimental results and the theoretical predictions. We think the problems, those described by Hossenfelder as lost in mathematics (Hossenfelder, 2018a) or as the non-normal stagnation in the present phase in the foundations of physics (Hossenfelder, 2018b), are related to the observation problem.

4 Strings or circles

At the end of the 1960s, there were a lot of efforts devoted to trying to construct a theory of the strong nuclear force in the framework of an approach called S matrix theory. In 1968, Gabriele Veneziano proposed formulas that gave a consistent set of scattering amplitudes for a theory with an infinite spectrum of particles including ones with arbitrarily high spin (Veneziano, 1968). This theory was called dual resonance theory. At that time, Y. Nambu (Nambu, 1969,1970)), H. Nielsen (Nielsen, 1969) and L. Susskind (Susskind, 1970) independently discovered that Veneziano's formulation could be derived from particles being strings rather than points, and Susskind used the terms "rubber bands" or "elastic strings" (Susskind, 2013). The strings could stretch and contract and also vibrate. With the development of the theory "(M) many things happened…But nothing has changed the basic picture of hadrons as quarks bound by 'rubber bands'" (Susskind, 2013). The infinite spectrum was identified as the various different normal modes of vibration of the string.

4.1 The observation problem of string theory

In quantum field theory the elementary particles are mathematical points, whereas in perturbative string theory the fundamental objects are one-dimensional loops (of zero thickness). Strings have a characteristic length scale, which can be estimated by dimensional analysis. Since string theory is a relativistic quantum theory that includes gravity, it must involve the fundamental constants such as the speed of light, Planck's constant, and Newton's gravitational constant and from these, one can form the Planck length and Planck mass.

The Planck length is an assumed constant length. It is a limit of observation, where, the energy far below the Planck energy cannot *resolve* distances as short as the Planck length. Thus, at such length, strings can be approximated by point particles. From the viewpoint of string theory, this explains why quantum field theory has been so successful (Schwarz, and Schwarz, 2004).

Particle wave duality is a fundamental base of quantum mechanics. According to string theory, the particle feature is owing to the problem of resolution, whereas the wave is a property of the string, where it vibrates and the wave property has no relation with the resolution problem.

4.2 Criticism

String theory faced a lot of criticisms. Here is just a small sample from three Nobelists:

- Sheldon Glashow (Glashow, 1988)**:** "...superstring theory... is, so far as I can see, totally divorced from experiment or observation. ...string theorists... will say, "We predicted the existence of gravity." Well, I knew a lot about gravity before there were any string theorists, so I don't take that as a prediction. ...There ain't no experiment that could be done nor is there any observation that could be made that would say, "You guys are wrong." The theory is safe, permanently safe. I ask you, is that a theory of physics or a philosophy?"
- Richard Feynman (Feynman, 1988):" I do feel strongly that this is nonsense! ...I think all this superstring stuff is crazy and is in the wrong direction. ...I don't like it that they're not calculating anything. ...Why are the masses of the various particles such as quarks what they are? All these numbers...have no explanations in these string theories – absolutely none!"
- Phil Anderson (Haisch, 2010): "Is string theory a futile exercise in physics as I believe it to be? It is an interesting mathematical specialty and has produced and will produce mathematics useful in other contexts, but it seems no more vital as mathematics than other areas of very abstract or specialized math, and doesn't on that basis justify the incredible amount of effort expended on it.

In this present work we raise these logical points.

- String theory has adopted quantum mechanics. When we go deeper from our macroscopic level which is about $\sim 10^{-4}\ m$ (a smaller observable length) into the atomic scale which is about $\sim 10^{-10}\ m$, the ratio of penetration is about $\sim 10^{6}$ times. In this penetration, the physics is changed from classical to quantum. Now if we work with the scale of the Planck length which is $\sim 10^{-35} m$, the ratio with the atomic scale is$\sim 10^{32}$. In addition to that, there is a large number of unsolved problems in the quantum scale. In spite of that big ratio and the unclear path for the mechanics of this level, string theory adopted the same logic of quantum mechanics.

- String theory used the concept of resolution to transfer from the concept of string to the point particle. But that means that there are two different worlds (as in the previous point): the string world and point particle world. In this case, what are the other effects of that transformation? What is the effect on the vibrating motion of the string that forms the particle–wave duality?
- String theory claims to be for a deeper description as in Witten's words, "String theory is an attempt at a deeper description of nature by thinking of an elementary particle not as a little point but as a little loop of vibrating string" (Witten, 2003). At the same time, it is a relativistic quantum theory, and in other words, it is based on the relativistic quantum mechanics and tries to unify the general relativity with quantum mechanics. But, if it proposes a deeper level, then it should show a different approach starting from that deeper level to derive the relativistic quantum mechanics before unifying the theory of general relativity with quantum mechanics. It is the approach from deeper to higher.

- String theory has been built on a foundation that is not clear enough (mysterious) and is still in need for more understanding of the quantum world.

4.3 Circles as units

The vibrated string is the source of the wave property in string theory. The circular motion is the source of the wave motion in circles theory. Thus, strings and circles constitute the building units in each theory. These building units may be the atoms of the universe.

The concept of the atomic theory of the universe has been proposed by the ancient Greek pre-Socratic philosopher Democritus (c. 460–c. 370 BC). The concept was adopted scientifically in 1803 by John Dalton to formulate the first modern description of the fundamental building block of chemical structures.

In the second half of the ninetieth century, the concept of aether has been revived with the development of electromagnetic theory. The æther is "regarded as possessing properties that might justify it being described as a gaseous; fluid, composed of atoms almost indefinitely small as compared with recognised chemical atoms". Again, "Æther is a fluid whose ultimate particles, or atoms, are so small that they pass into the minute crevices of spaces in the most solid bodies"(Woods, 1906).

In the nineteenth century, there were many models for electromagnetic æther. These models were mechanical and consisted of wheels or cogwheels. In 1861, Maxwell imagined the electromagnetic æther as a fluid made of cells separated by a layer of small idle wheels. These wheels were also considered capable of rotating between the cells (Maxwell, 1861) with an idle wheel to prevent friction. Fig.6 shows this model.

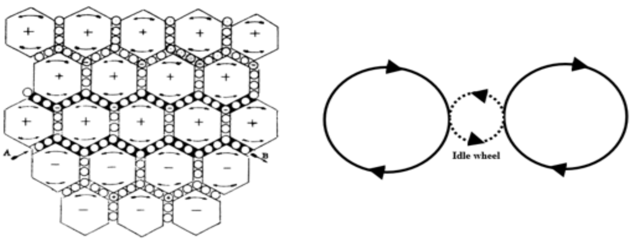

Fig.6 Maxwell's vortex æther model. The æther is shown as a fluid of cells. The cells are separated by small circles. These circles act as idle wheels (Maxwell, 1861).

In 1885, George FitzGerald proposed another mechanical model. The system composed of wheels and was connected to their neighbours by rubber bands (FitzGerald, 1885). Oliver Lodge had already speculated in 1879 that the æther was made of wheels of positive and negative electricity geared to one another. Ten years later, he published an improved version of this model in his book *Modern views in Electricity* (Lodge, 1889). Lodge's model was the cogwheels model, shown in Fig.7. This model is a *planetary system.*

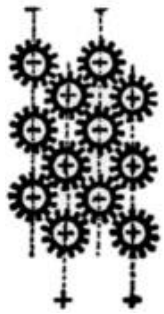

Fig.7 Lodge mechanical æther (Lodge, 1889).

The circular model returned to be a model for a chemical atom by Niels Bohr in 1913 (Fig.8). This model had been developed then to be an abstract model in quantum mechanics (1925–1926).

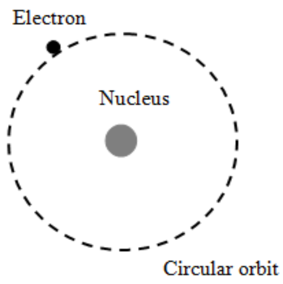

Fig.8 Bohr's model

It is worth mentioning that the circles combination as in Fig. 4B is similar to a pair of cogwheel or circles in Figs. 6, 7 and 8. The circle combination of Fig. 4B is influenced by TWH.

4.4 Circles or strings

String theory is a relativistic quantum mechanics theory. In other words, it accepts quantum mechanics without explanation of the complex form of quantum mechanics. Circles theory is not a theory of quantum mechanics and is not based on quantum mechanics, and do not claim to be a deeper description of nature. But, its result shows a good agreement with relativistic quantum mechanics. This approach may lead to assume that there may be circles in deeper levels of the particle–wave duality. The circles are in the real world and the complex vibration is no more than a result of the problem of the partial observation. *Now, since there is no experimental investigation for the circles theory, its derivation of the forms similar to the relativistic quantum mechanics may justify the theory.*

The concept of the circles combination with the optical resolution limit that does not depend on Planck length may be more logical for explaining the complex harmonic behaviour and more fundamental than the string concept.

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