Reinterpreting Tlön, Uqbar, Orbis Tertius: On the Antirealism Tendency in Modern Physics

Victor Christianto*[1], Florentin Smarandache[2]

[1]Malang Institute of Agriculture (IPM), Malang, Indonesia.
http://researchgate.net/profile/Victor_Christianto
*Email: victorchristianto@gmail.com. Founder of www.ketindo.com
[2]Dept. Mathematics and Sciences, University of New Mexico, Gallup – USA.
Email: florentin.smarandache@laposte.net

ABSTRACT

Borges has a rare ability to put wild ideas into detective stories with reporting style. At least that is the impression that we got on his short stories. In particular, one of his short story is worthnoting: *Tlon, Uqbar, Orbis Tertius*. The story told us about a mysterious country called Uqbar, in apparently an unofficial reprint of *Encyclopedia Britannica*. It also tells about Tlon, a mysterious planet, created purely by imaginative minds. While this story clearly criticizes Berkeley view and may be not related to our daily reality, a reinterpretation of this story leads us to a long standing discourse in the philosophy of science: to how extent the entire modern physics follow such a Berkeley-antirealism tendency? This paper is intended to bring this subject into our attention. We will also discuss shortly on the antirealism in certain trends in theoretical physics and cosmology.

Keywords: realism-antirealism discourse, modern physics, theoretical physics, modern cosmology

1. Introduction

Some years ago, one of these authors (VC) found a copy of collected works of Jorge Luis Borges. He found the book is quite strange compared to other fiction books. But only recently, he realizes that Borges may have some hidden messages to say to his readers. In particular in his short story: *Tlön, Uqbar, Orbis Tertius* [1], Borges was probably rather anxious on certain trends in modern science, i.e. that a bunch of academic luminaries may be trying to create a new world or planet out of pure fantasy. To quote his own sentence: *"the article said that the literature of Uqbar was a literature of fantasy, and that its epics and legends never referred to reality but rather to the two imaginary realms of Mlekhnas* *and Tlön."* [1, p. 37] Those people may push the imagination up to a point that they published: "*A first encyclopaedia of Tlön. Vol. XI. Hlaer to Jangr*." [1]. Tlön is an unknown planet, it was created out of pure fantasy. The planet has presupposed idealism, just like in Berkeley's philosophy.

The problem is what will happen if hard sciences such as particle physics, mathematical physics, astronomy, and cosmology also try to put Berkeley view seriously? To how extent we can mix up cold reality with pure fantasy?[1]

At first, we are not so sure about how extent the entire modern physics has been influenced by antirealism tendency. But, then we heard that Sir Roger Penrose has just released his new book, with a quite provocative title: "*Fashion, faith and fantasy*…"[2]. We did not read yet his new book, but we have read his preface of this book. And we think: Now, we found someone, a quite authoritative figure in theoretical physics, who think in introspective mode. So, we dedicate this paper to Sir Roger Penrose.

It is our hope that our discussion here can bring you to a point where you begin to realize and consider the antirealism tendency in modern physics more seriously.

2. Tlön and the Moon

In his short story, Borges mentioned briefly about the Moon in Tlön. He wrote that there is no noun for moon in Tlön, but there are verbs which mean something like "moonate" or "enmoon."[1] Such an idealistic perception of the Moon, reminds us to a famous phrase by Mermin, while he describes quantum mechanics view: "*The moon is not there while nobody looks at*." This phrase captures the essence of one of central dogmas of the

[1] This paper is not intended to discuss realism-antirealism debates over the past few decades. We only discuss antirealism tendency which seems to plague modern physics. If the readers want to read more deeply into this subject, there are good papers such as by Nancy Cartwright [10] and also by Alvin Plantinga [11].

Copenhagen interpretation of QM, i.e. that the observer determines the outcome of the experiments. In other words, in Copenhagen's view: *the reality is observer-dependent*. The problem with this dogma is that it does not work for the Moon. Even if at certain moments in a day, all inhabitants in this Earth decide to not-looking at the Moon, there is certainty that the Moon will not cease to exist suddenly at the moment. In other words, we shall admit that objective reality does exist, regardless of the action of the observers. This simple story lead us to conclude that in this Earth, we must accept that the reality is not so idealistic, and that is the difference with an idealistic planet of Tlön, created out of pure fantasy.

3. Tlön and Relativity Theory

The idealistic-Berkeley attitude can be traced back to special relativity theory, which was often regarded as the beginning of modern physics. This theory has been criticized in our previous paper [4]. But now allow us to emphasize our message: that despite wide acceptance of relativity theory since 1905, it clearly has an anti-reality view. And only a few physicists have realized such a grave error, notably C.K. Thornhill [3]. In one of his remarkable papers, the late C.K. Thornhill wrote as follows: [1]

> "Relativists and cosmologists regularly refer to space-time without specifying precisely what they mean by this term. Here the two different forms of spacetime, real and imaginary, are introduced and contrasted. It is shown that, in real space-time (x, y, z, ct), Maxwell's equations have the same wave surfaces as those for sound waves in any uniform fluid at rest, and thus that Maxwell's equations are not general and invariant but, like the standard wave equation, only hold in one unique frame of reference. In other words, Maxwell's equations only apply to electromagnetic waves in a uniform ether at rest. But both Maxwell's equations and the standard wave equation, and their identical wave surfaces, transform quite properly, by Galilean transformation, into a general invariant form which applies to waves in any uniform medium moving at any constant velocity relative to the

reference-frame. It was the mistaken idea, that Maxwell's equations and the standard wave equation should be invariant, which led, by a mathematical freak, to the Lorentz transform (which demands the non-ether concept and a universally constant wave-speed) and to special relativity. The mistake was further compounded by misinterpreting the differential equation for the wave hypercone through any point as the quadratic differential form of a Riemannian metric in imaginary space-time (x, y, z, ict). Further complications ensued when this imaginary space-time was generalised to encompass gravitation in general relativity."

According to Thornhill [3], real space-time is a four dimensional space consisting of three-dimensional space plus a fourth length dimension obtained by multiplying time by a constant speed. (This is usually taken as the constant wave-speed c of electromagnetic waves). If the four lengths, which define a four-dimensional metric (x, y, z, ict), are thought of as measured in directions mutually at right-angles, then the quadratic differential form of this metric is:[3]

$$(ds)^2 = (dx)^2 + (dy)^2 + (dz)^2 - \bar{c}^2 (dt)^2 \quad (1)$$

When the non-differential terms are removed from Maxwell's equations, i.e. when there is no charge distribution or current density, it can easily be shown that the components (E_1, E_2, E_3) of the electrical field-strength and the components (H_1, H_2, H_3) of the magnetic field-strength all satisfy the standard *wave equation*:[3]

$$\nabla \phi = \left(\frac{1}{\bar{c}^2} \right) \frac{\partial^2 \phi}{\partial t^2} \quad (2)$$

It follows immediately, therefore, that the wave surfaces of Maxwell's equations are exactly the same as those for sound waves in any uniform fluid at rest, and that Maxwell's equations can only hold in one unique reference-frame and should not remain invariant when transformed into any other reference-frame. In particular, the equation for the envelope of all wave surfaces which pass through any point at any time is, for equation (2), and therefore also for Maxwell's equations,[3]

$$(dx)^2 + (dy)^2 + (dz)^2 = \bar{c}^2 (dt)^2 \tag{3}$$

Or

$$\frac{(dx)^2}{(dt)^2} + \frac{(dy)^2}{(dt)^2} + \frac{(dz)^2}{(dt)^2} = \bar{c}^2 \tag{4}$$

It is by no means trivial, but it is, nevertheless, not very difficult to show, by elementary standard methods, that the general integral of the differential equation (4), which passes through (x_1, y_1, z_1) at time t_1, is the right *spherical hypercone*:[3]

$$(x - x_1)^2 + (y - y\;)^2 + (z - z_1)^2 = \bar{c}^2 (t - t_1)^2 \tag{5}$$

In other words, both Maxwell equations and space itself have the *sound wave* origin.

4. Tlön and Quantum Mechanics

We admit that the Old Quantum Mechanics, i.e. Bohr's quantization rules, still kept a healthy dose of realism. But since 1926, when Erwin Schrödinger started to publish his result which then was called the Wave Mechanics, he imposed a sort of idealistic-Berkeley viewpoint, that a purely imaginary mathematical craft can explain the experiments.[6][7] We shall show here what are the errors of Schrödinger. In describing these errors of Wave Mechanics, we thank to George Sphenkov and Leonid Kreidik for their analysis of Schrödinger's work [5].

In the initial variant, the Schrodinger equation (SE) has the following form [5]:

$$\Delta\Psi + \frac{2m}{\hbar^2}\left(W + \frac{e^2}{4\pi\varepsilon_o r}\right)\Psi = 0 \tag{6}$$

The wave function satisfying the wave equation (6) is represented as:

$$\Psi = R(r)\Theta(\theta)\Phi(\varphi)T(t) = \psi(r,\theta,\varphi)T(t) \tag{7}$$

Where $\psi(r,\theta,\varphi) = R(r)\Theta(\theta)\Phi(\varphi)$ is the complex amplitude of the wave function, because

$$\Phi_m(\varphi) = C_m e^{\pm im\varphi} \tag{8}$$

For standard method of separation of variables to solve spherical SE, see for example [8-9].

The Φ, Θ and T equations were known in the theory of wave fields. Hence these equations presented nothing new. Only the R was new. Its solution turned out to be *divergent*. However, Schrödinger together with H. Weyl (1885-1955), *contrary to the logic of and all experience of theoretical physics*, artificially cut off the divergent power series of the radial function R(r) at a κ-th term. This allowed them to obtain the radial solutions, which, as a result of the cut off operation, actually were the *fictitious solutions*.[5]

Furthermore, it can be shown that the time-independent SE [6-7]:

$$\nabla\Psi + \frac{2m}{\hbar^2}(E - V)\Psi = 0, \tag{9}$$

Can be written in the form of standard wave equation [5]:

$$\nabla\Psi + k^2\Psi = 0, \tag{10}$$

Where

$$k = \pm\sqrt{\frac{2m}{\hbar^2}(E-V)}\,. \tag{11}$$

Or if we compare (10) and (6), then we have [5]:

$$k = \pm\sqrt{\frac{2m}{\hbar^2}\left(W + \frac{e^2}{4\pi\varepsilon_o r}\right)}\,. \tag{12}$$

This means that the wave number k in Schrödinger's radial wave equation is a quantity that varies continuously in the radial direction. Is it possible to imagine a field where the wave number, and hence the frequency, change from one point to another in the space of the field? Of course, it is not possible. Such wave objects do not exist in nature.

The *unphysical* nature of Schrödinger's wavefunction has created all confusing debates throughout 90 years. But such a deep problem is rarely discussed in QM textbooks, on how he arrived at his equation.

Moreover, there is also a deep *logical fallacy* made by Schrödinger:[2] It is known that Schrödinger began with Einstein's mass-energy relation then he proceeded with Hamilton-Jacobian equation. At first he came to a similar version of Klein-Gordon equation, but then he arrived to a new equation which is non-relativistic. Logically speaking, he began with a relativistic assumption and he came to a non-relativistic expression. That is *logically inconsistent* and therefore unacceptable, and Schrödinger

[2] We thank to Prof. Akira Kanda for pointing out this logical error of Schrodinger's procedure.

himself never knew where the problem lies. Until now physicists remain debating the problem of the meaning of his wavefunction, but they forget that it starts with unphysical nature of his equation. This is a common attitude of many young physicists who tend to neglect the process and logical implication of QM derivation, and they never asked whether Schrödinger equation has deep logical inconsistency or not. (The problem becomes more persistent, because most physics professors do not like such a deep philosophical question on QM. Usually they will respond: "*Shut up and calculate*.")

On experimental level, there are some limitations in applying Schrödinger equation to experiments, although many textbooks on QM usually overlook existing problems on how to compare 3D spherical solution of Schrödinger equation with experimental data. The contradiction between QM and experiments are never discussed publicly, and this is why most modern physicists hold the assertion that QM describes accurately "ALL" physical experiments; but that is an unfounded assumption. Alternatively, George Shpenkov began with classical wave equation and he is able to derive a periodic table of elements which is very close to Mendeleev's table. And this is a remarkable achievement which cannot be done with standard Wave Mechanics.[3]

5. Tlön and Theoretical Physics

[3] For further discussion, it is advisable to check the website of Dr. George Shpenkov, at http://shpenkov.janmax.com. See especially Shpenkov, George P. 2013. *Dialectical View of the World: The Wave Model (Selected Lectures).* Volume I: Philosophical and Mathematical Background. URL: http://shpenkov.janmax.com/Vol.1.Dialectics.pdf

Nancy Cartwright is Associate Professor of Philosophy from Stanford University. She wrote an interesting book with quite interesting title: **How The Laws of Physics Lie**. The following paragraph is a quote from the first page of her book:

> "Nancy Cartwright argues for a novel conception of the role of fundamental scientific laws in modern natural science. If we attend closely to the manner in which theoretical laws figure in the practice of science, we see that despite their great explanatory power these laws do not describe reality. Instead, fundamental laws describe highly idealized objects in models. Thus, the correct account of explanation in science is not the traditional covering law view, but the 'simulacrum' account. On this view, explanation is a matter of constructing a model that may employ, but need not be consistent with, a theoretical framework, in which phenomenological laws that are true of the empirical case in question can be derived. *Anti-realism* about theoretical laws does not, however, commit one to anti-realism about theoretical entities. Belief in theoretical entities can be grounded in well-tested localized causal claims about concrete physical processes, sometimes now called '*entity realism'*. Such causal claims provide the basis for partial realism and they are ineliminable from the practice of explanation and intervention in nature."

In other words, we can conclude from the prelude of her book that she asserts that there is a shift from traditional view, i.e. modern physics now seems to view that "explanation is a matter of constructing a model that may employ, but need not be consistent with, a theoretical framework, in which phenomenological laws that are true of the empirical case in question can be derived."

6. A few preliminary remarks on Penrose's Fashion, Faith, Fantasy

In preface of his book, Sir Roger Penrose discusses how fashion, faith and fantasy may have played their roles in the recent development of theoretical physics and cosmology. In particular he wrote as follows:[2]

"In the first three chapters, I shall illustrate these three eponymous qualities with three very well-known theories, or families of theory. I have not chosen areas of relatively minor importance in physics, for I shall be concerned with what are big fish indeed in the ocean of current activity in theoretical physics. In chapter 1, I have chosen to address the still highly fashionable string theory (or superstring theory, or its generalizations such as M-theory, or the currently most fashionable aspect of this general line of work, namely the scheme of things referred to as the ADS/CFT correspondence). The faith that I shall address in chapter 2 is an even bigger fish, namely that dogma that the procedures of quantum mechanics must be slavishly followed, no matter how large or massive are the physical elements to which it is being applied. And, in some respects, the topic of chapter 3 is the biggest fish of all, for we shall be concerned with the very origin of the universe that we know, where we shall catch a glimpse of some proposals of seeming sheer fantasy that have been put forward in order to address certain of the genuinely disturbing peculiarities that well-established observations of the very early stages of our entire universe have revealed."[2]

In other words, Sir Roger Penrose seems to argue that some of the most fashionable theories may gather followers simply because they are fashionable. And the proponents of Quantum Mechanics appear to follow strictly these procedures out of pure faith.

Penrose also suggest that there are certain experiments: "*Perhaps the results of such experiments may indeed undermine the unquestioning quantum-mechanical faith that seems to be so commonly held*."[2]

Apparently Penrose want to say that from time to time, these fashionable trends and also faith and also fantasy, need to be put under scrutiny.

Penrose also criticizes the faith in supra-dimensionality in string and superstring theories, as he noted: "*Such supra-dimensionality is a central contention of almost all of modern string theory and its major variants. My critical arguments are aimed at the current string-motivated belief that the dimensionality of physical space must be greater than the three that we directly experience*."[2]

7. Concluding Remarks

We admit that the general tone of this paper may sound a bit too critical to some readers. But what we want to achieve with this paper is quite simple: Allow us to remind all fellow physicists and cosmologists to become more aware of antirealism tendency, which may be caused by too much abstractions in developing physical theories. Yes, theoretical abstraction is necessary in almost every case, but it also healthy to keep in mind a good advice by Prof. Murray Gell-Mann. He often reminded younger physicists to keep a balance between Scylla and Charybdis, i.e. in developing theories one should maintain a healthy dose of realism beside (pure) abstractions.

We observe that many advanced physical theories which have been proposed during the last few decades have become increasingly too "*baroque*", i.e. they tend to use too many mathematical abstractions, while they seem to discard a healthy dose of realism.

Does it mean that an idealistic-Berkeley tendency of so many modern physical theories, such as string/superstring theories, M-theory et al., imply that they have no physical meaning? We do not pretend to know all the answers, nor we pretend to have mastery over these very difficult subjects.

All we can say is that perhaps now is the time to distinguish fashion, faith and fantasy in modern physics (as advocated by Sir Roger Penrose). And it will be quite healthy to remind ourselves from time to time the so-called *Ockham's razor* principle, which can be reformulated as follows: "the least complicated explanation (read: physical theories) may have a good chance to be the correct answer."

Acknowledgment

We dedicate this paper to Sir Roger Penrose, a prolific author and a very insightful mathematical-physicist.

Document history:

- version 1.0: 31st october 2017, pk.20:02. (On 500th anniversary of Reformation Movement, initiated by Martin Luther in 31st October 1517.)

References:

[1] Jorge Luis Borges. Tlön, Uqbar, Orbis Tertius. In *Collected Fictions*, Translated by Andrew Hurley. USA: Penguin Putnam Inc., 1998. (Originally published under the title: *The Garden of Forking Paths*, 1941).

[2] Sir Roger Penrose. Are Fashion, Faith, or Fantasy relevant to Fundamental Science? Preface to book volume: *Fashion, Faith, Fantasy in the New Physics of the Universe*. Copyright at Princeton University Press.

[3] C.K. Thornhill. Real or imaginary space-time? Reality or Relativity? *Hadronic Journal Suppl*. 11, 3, (1996) 209-224

[4] Victor Christianto, Florentin Smarandache, Yunita Umniyati. From Acoustic Analog of Space to Acoustic Sachs-Wolfe Theorem: A Model of the Universe as a Guitar. Published in *Prespacetime Journal*, March 2017. http://www.prespacetime.com

[5] Shpenkov, George P. & Kreidik, Leonid G. 2005. Schrödinger's error in principle. *Galilean Electrodynamics* Vol. 16, No. 3, 51-56 URL: http://shpenkov.janmax.com/Blunders.pdf

[6] Schrödinger, Erwin. 1926. Quantisation as a Problem of Proper Values. Part I. In *Collected papers in Wave Mechanics*. (Providence, Rhode Island: AMS Chelsea Publishing). URL: http://einstein.drexel.edu/~bob/Quantum_Papers/Schr_1.pdf

[7] _______. 1926. An Undulatory Theory of the Mechanics of Atoms and Molecules. *The Physical Review*. Second series.Vol. 28, No. 6. (Dec. 1926): 1049-1070.

[8] Anonymous, *Atomic Spectra*, p.19-21, URL: http://astrowww.phys.uvic.ca/~tatum/stellatm/atm7.pdf

[9] Fowler, Michael. 2007. *Classical Wave Equations*, p.10-12. URL: http://galileo.phys.virginia.edu/classes/252/Classical_Waves/Classical_Waves.pdf

[10] Nancy Cartwright. *How the Laws of Physics Lie*. E-book format, 147 pp.

[11] Alvin Plantinga. How to be an Anti-Realist. *Proceedings and Addresses of the American Philosophical Association,* Vol. 56, No. 1. (Sep. 1982), pp. 47-70.