String without String: In search of Cosmology Model inspired by Cosmic Christology of the Johannine Prologue

Dissertation Draft, version 1.2

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**Preface**

This dissertation draft is written with a purpose to apply for a PhD in Divinity/Theology with emphasis on the interface between Theology and Science. So far there is only one seminary which is willing to accept my proposal to submit a dissertation based on previously published papers. But if there are other seminaries/institutes willing to consider this dissertation draft, I will be really grateful.

The objective of this dissertation is to discuss and to explore a new Cosmology model which is biblically sound and scientifically acceptable, inspired by Cosmic Christology of the Johannine Prologue. Therefore I shall also discuss the idea of cosmology based on the Johannine Prologue in Chapter II.

Because this dissertation is still in on-going process and not completed yet, please do not quote it yet without permission to victorchristianto@gmail.com. But of course, you can cite four published papers which are included here.
The title is chosen as such to reflect my humble opinion that my search on mathematical cosmology model based on Cosmic Christology is still not complete yet.

This dissertation grew as a result of my reflection of personal study of quantum mechanics since 1999 until 2013, where I studied and supported wholeheartedly the entire idea of quantization and wave mechanics. But I should admit that during that period, I only focused on quantization in astrophysics, and this was reflected in several books during period 2005-2013. Around February 2014, I found several papers by Dr. George Shpenkov who claimed that the Schrodinger’s wave mechanics is deeply flawed and inconsistent with experiments. Since I was convinced by Shpenkov’s exciting result in particular his explanation on periodic table of elements based on classical wave equation, therefore I repented and then switched my position towards classical wave equation instead of (quantum) wave mechanics. Since then I wrote several papers exposing the fundamental flaws of the Schrodinger equation, and I became convinced on the plausibility of Fractal Vibrating String model as a generalization of classical wave equation.

The basic idea here is to generalize classical string/wave equation to become fractal vibrating string. Some implications include a new view of elementary particles (wave model) and also a periodic table of elements. In cosmology setting, this proposal may bring new insights to acoustic cosmology. I hope that this contribution will be found useful as an alternative to the Standard String theories which so far cannot be verified experimentally. It is known that String Theory yields prediction of cosmological constant at the order of more than $10^{10}$ times larger than the observed value, that is why some physicists like Peter Woyt call String Theories as “Not
Even Wrong.” Hopefully the proposed Fractal Vibrating String can be made more testable someday.

Not only that, I wish in this dissertation to discuss one more application of the concept of vibration and frequency, i.e. in the detection and treatment of various types of cancer. Therefore I hope that the proposed Fractal Vibrating String will make impact not only as theoretical tool but also as a practical model for cancer treatment.

With regard to experimental confirmation of this new cosmology model, I have tried to work from smaller scales first, i.e. I started with classical wave equation as the basis to explain hydrogen energy levels, periodic table of elements and also planetary orbit distance. Then I try to generalize these results by generalizing nabla operator to become fractal nabla operator. I also discuss possibility to generalize Laplace-Beltrami Operator to become fractal Laplace-Beltrami Operator, with an implication that one may expect to generalize Sachs-Wolfe Acoustic theorem to fractional surface. This may yield an observation of CMBR fluctuation caused by fractional boundary of the universe.

Of course, since this is a dissertation in Theology/Divinity so I am more concerned in how a cosmology model can be made as consistent as possible with biblical view, not just with experimental verification per se, which is more suitable for dissertation in Theoretical Physics. Therefore I hope that someday there will be physicists with suitable background in theoretical or experimental physics that will pick up some of these days and check the experimental implications of these ideas.
As a last word, I believe that someday our knowledge concerning nature, elementary particle and the Cosmos will be complete and full, and all of our knowledge will point to the glory of our Creator (God) whom we know through Jesus Christ, according to Habakkuk 2:14: “For the earth will be filled with the knowledge of the glory of the LORD, as the waters cover the sea.” (NIV) I hope that this dissertation contributes to such a better knowledge concerning GOD, our Ultimate Creator.

**Outline of dissertation**

Partly because I like great compositions by Mozart, Chopin and the likes, in this dissertation I try to follow the structure of a good composition, i.e. progression from basic theme to some variations of theme. Therefore the outline of this dissertation takes the form as follows:

i. Prelude A: Introduction
ii. Prelude B: Hermeneutics
iii. Basic theme I: Outline of cosmology model
iv. Variation A of theme I: Review of wave mechanics
v. Variation B of theme I: Proca equations in fractional space
vi. Variation C of theme I: Proca equations in Cantor Sets
vii. Variation D of theme I: London-Hirsch-Proca equations
viii. Variation E of theme I: Towards Physics of Cancer
ix. Variation F of theme I: Linearised Einstein’s field equations
x. Variation G of theme I: Sachs-Wolfe acoustic theorem

xi. Basic theme II: Quantum field theory and Creation of the Universe

xii. Concluding remarks

Acknowledgement

I would like to express my sincere gratitude to many colleagues all over the world, who have shared their ideas and knowledge with me, especially to Dr. Huping Hu (Editor-in-Chief, Prespacetime Journal) and Prof. Dr. K. Raja Rama Gandhi (Editor-in-Chief, Bull. Soc. Math. Services and Standards/BSOMASS; Bull. Math. Sciences and Appl./BMSA) who have published my papers. Many thanks go to Prof. Florentin Smarandache (UNM) who has worked together with me in some books and papers since 2005, and also to Dr. George Shpenkov (Poland) who has shared his insightful papers and books. Special thanks to Dr. Xin-an Zhang from China, who has shared his book and also his ideas on acoustic model of dark energy; to Prof. Carlos Castro Perelman (Atlanta - Georgia); and to Prof. Matti Pitkanen (Finland) who have given many insights since 2001. And thanks also go to many scholars and researchers who have discussed my questions in www.researchgate.net. Many thanks also go to Dr. Volodymyr Krashnokolovets (Ukraine), Mr. Michael Peck, Prof. Robert J. Russell (CTNS/GTU), Prof. David Wilkinson (Durham Univ.), Prof. Akira Kanda (Toronto University), Prof. Hardev Singh Virk (India), and Prof. Liek Wilardjo (Indonesia) who have written encouraging words. Meanwhile, all of these ideas presented herein are solely my responsibility.


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Select Published Papers

This dissertation draft is prepared based on select papers which were published or were submitted in several journals as follows:


Appendixes:


Dissertation Draft

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Introduction

Purpose
This dissertation draft is written with a purpose to apply for a PhD in Science and Theology Studies.

Objective
To propose a new Cosmology model which is biblically sound, based on interpretation of the Johannine Prologue.

Despite many efforts in the literature to discuss various cosmology models from biblical perspective (see for instance [1][2]), it is a common view held by many scholars that biblical view (Creation) and the scientific view (Big Bang) cannot be reconciled. Therefore most scholars simply reject biblical teaching as unscientific while most theologians simply ignore the Big Bang theories. Of course, there are also some variations of Creation hypothesis, such as the assertion that the Universe was created by God not in 6x24 hours, but in several thousand years. Another new theory is called as Intelligent Design, saying that the observed complicated structure both in microphysics (DNA, RNA etc) and macrophysics (galaxy, galaxy clusters, planets, stars) seems to point to a Supreme Creator. Therefore we need a new Cosmology model which is able to reconcile both the scientific finding and also the biblical teaching.

Question 1: Can we find a biblically sound model of Cosmology?
Traditionally the battle between theologians in one side and scientific world in another side seems to be almost irreconcilable. Even since the days of Galileo Galilei the dispute was quite harsh, with tendency of denying each other side.[3]

In modern days, the scientific finding of expanding galaxies by Edwin Hubble led to the Expanding Universe theory as suggested A. Friedman and G. Lemaitre. Lemaitre himself was a devoted Catholic priest, but he carefully distinguished between the point of beginning and the point of Creation. However, he seemed to assert that the Expanding Universe suggests a point of singularity or the beginning of time, which later it is called as the Big Bang.

In the context of scientific theories, we should admit that initially Big Bang Theory was made as a result of backward extrapolation of the Hubble law. The Hubble law itself only asserts that galaxies move away from each other. And if this law was extrapolated back to the origin of time, then we find that there should be a singularity which then was called as Big Bang.

However, the Big Bang or singularity itself is not free of criticism, both from steady state perspective and also from the rigorous theory of singularity itself. This directs us to a new question which will be discussed subsequently: Can the initial singularity be removed from cosmology models?

Provided the above question concerning initial singularity can be answered, then my answer to the first question is positive: yes, we can propose a new biblically sound Cosmology model with intention to reconcile biblical teaching with scientific findings.
**Question 2: Can the initial singularity be removed from cosmology models?**

This question has been discussed in a report by Prof. Michael Heller, a cosmologist and theologian from Warsaw, Poland. In a paper for Templeton Prize, he discusses this problem: Cosmological Singularity and the Creation of the Universe [4]. He discusses among other things, how singularity is actually model dependent, and in different cosmology models the initial singularity can be removed. In other words, the notion of Big Bang is just a special case of the chosen space-time metric.

In this regards, I have brought this issue in a question at researchgate.net forum, and there are many comments from other scholars. To summarize their views, it seems that they agree with Prof. Heller that the initial singularity can be removed in different cosmology models. Some references in this context have been cited by contributors to that forum, see [5][6].

A short summary of Dabrowski and Marosek [5] will be made here: Varying physical constant cosmologies were claimed to solve standard cosmological problems such as the horizon, the flatness and the $\Lambda$–problem. But one of the most intriguing problems in cosmology is the problem of singularities. In their paper, they suggest yet another possible application of theories suggesting varying physical constants: i.e. to solve singularity problem. [5]

In Belbruno’s paper, it is shown that dynamical flow near the big bang singularity can be reduced to a central force field, when modeled by an anisotropic Friedman equation, under a number of assumptions. Then he applies the McGehee transformation to the central force field, yielding unique branch extensions of solutions through $a=0$. [6]
If it is true that the initial singularity is model dependent, then it seems that the Big Bang can be removed too. In other words, there is a hope to describe the Universe as free from initial singularity.

**Question 3: Can we model the Universe based on classical wave equation?**

First, I shall recall a study conducted by some researchers from Observatoire de Paris – Meudon (www.obspm.fr) several years ago which suggests that vibration of early Universe can be used to determine the shape of the Universe. This study is led by Prof. Luminet from OBSPM. What is interesting here is that they solved Helmholtz equation in spherical case to find out the vibration of early Universe. And we know that Helmholtz equation implies classical wave equation, therefore by deduction we can infer that it seems also possible to use Helmholtz equation to determine the vibration of early universe, and perhaps it can be related either to CMBR oscillation or Sakharov oscillation. [7] However, we should admit that oscillation of early universe has not received much attention so far, even though Sakharov (acoustic) oscillation is well known among cosmologists. Figure 1 below depicts CMB temperature anisotropies:
Second, Hartle-Hawking wavefunction equation and Wheeler-DeWitt equation are two well-known equations for describing quantum scenario for the birth of the Universe (the quantum birth). These two equations are based on extrapolating wave mechanical arguments to the Universe scale, however both of them are lacking observability so far and they cannot explain any observation (data). Therefore it is fair enough to say that both equations are defective and useless equations for describing physical phenomena at large scales. Nonetheless, these equations indicate that it seems worth to study the wave nature of the Universe. Therefore, while we do not advocate the use of H-H or WDW equation, we still can use their approach to model the wave nature of the Universe.
Third, my own personal study since 2002 can be summarized as follows: For once in my life, I believed that Quantum Mechanics (QM) is the sought answer for almost all physics problems, not only for atomic and particle world but also for astrophysics scale. For cosmologists, there is Wheeler-DeWitt equation which is borrowing quantum mechanical concept to study early period of the Universe. But everybody knows that WDW equation does not predict anything, so I tried to find another way.

Before I continue, firstly allow me to admit something: I should admit that I was very interested in quantum theory especially the wave mechanics since I read a book published by Santa Fe Institute/Addison-Wesley and edited by Wojciech H. Zurek with title: *Complexity, Entropy and the Physics of Information* [8]. I bought that book in 1996, and then studied it in my spare time. After that, I became interested in the wave mechanical model of solar system (planetary orbits) since I found a paper by Laurent Nottale from Paris. But I found that Nottale’s Scale Relativity method is quite complicated, therefore I tried to derive his result in a simpler way (based on some quantum mechanics textbooks that I read at the time).

It took some years until I found time and energy to put my ideas in written form and then finally I can publish my first paper in Apeiron, January 2004 [9]. In that paper, I discuss quantization of planetary orbits in solar system based on Bohr’s quantization of angular momentum. I also predicted three planetoids beyond orbit of Pluto; and later on those 3 planetoids have been discovered subsequently by several astronomers including Dr. Michael Brown from Caltech I (around 2004-2005). After that, I published many more papers discussing various aspects of quantum/wave mechanics, but the basic view remains the same: that I was quite convinced that
the quantum mechanics is a wonderful theory (like what many physicists used to think nowadays), although it is perhaps incomplete. In particular I was interested in the quantized vortices model of planetary orbits, because I found that quantized vortices correspond neatly to Bohr’s quantization rule. Therefore, it would suggest that we can think that quantization in solar system is a result of quantized helium vortices.

But since 2009, I took a rather different view, which is to find possible connection between quantum mechanics and classical mechanics. That view was expressed in my 2009 paper together with Prof. Florentin Smarandache with title: *A derivation of Maxwell’s equations in quaternion space*. In that paper we managed to derive a quaternionic form of Maxwell equations, based on Dirac-Gersten’s decomposition method [10]. Since then, I sought further on how to connect classical mechanics and wave mechanics. But still, my basic view is that the wave mechanics eventually supersede classical mechanics. (During the period of 2005 until 2013, I have published no less than 9 books together with Florentin Smarandache and others, see the Appendix I: My resume and list of publications). For an introduction to the relationship between classical and quantum theory, see for instance Landsman [11].

That view I hold until March 2014, when I found some papers written by Dr. George Shpenkov from googling. He explained among other things that there are some weaknesses of wave mechanics especially Schrödinger’s equation. I sent him several emails and he emailed me back with some papers and books. After studying his papers and books, I decided that the classical wave equation can complement wave mechanics, and even they are compatible as indicated for instance by the exact correspondence between Poisson bracket and quantum commutator bracket.
In short, I am now convinced that in certain cases like planetary orbits, periodic table of elements, and energy levels of hydrogen, the classical wave equation is proved to be equal or even far better than quantum model.

Now, I think it is the right time to study whether the classical wave equation can also be generalized to describe vibration and other properties of the Universe at large scale. I propose to use a new framework called “fractal vibrating string” in order to generalize the classical wave equation. As far as I know, such a fractal vibrating string has not been discussed elsewhere before to study astrophysics and cosmology phenomena.

The proposed solution: A Cosmology model based on interpretation of the Johannine Prologue

As we know there are two main paradigms concerning the origin of the Universe: the first is Big-Bang Theory, and the other is Creation paradigm. But those two main paradigms each have their problems, for instance Big Bang Theory assumes that the first explosion was triggered by chance alone, therefore it says that everything emerged out of vacuum fluctuation caused by pure statistical chance. By doing so, its proponents want to avoid the role of the Prime Cause (God). Of course there are also other propositions such as the Steady State theory or Cyclical universe, but they do not form opinion of the majority of people in the world.[13]

On the other side, the Creation Theory says that the Universe was created by God in 6x24 hours according to Genesis chapter 1, although a variation of this theory says that it is possible that
God created the Universe in longer period of thousands of years or even billions of years. But such a proposition seems to be not supported by Biblical texts.

To overcome the weaknesses of those main paradigms, I will outline here another choice, namely that the Universe was created by Logos (Christ in His pre-existence). This is in accordance with the Prolegomena of the Gospel of John, which says that the Logos was there in the beginning (John 1:1). [13]

This famous Prolegomena of the Gospel of John may be interpreted that everything comes from the Word of God, and since Word means Voice, and Voice means sound, and sound can be related to wave, vibration and frequency, then it seems quite straightforward to think that everything in this universe consists of vibration and frequency too. While the above analogy with the Gospel of John is suggested by this writer, such a view that everything is related to wave and frequency has been proposed by George Shpenkov [12]. He wrote as follows: “A new physics paradigm that we have accepted and follow in all our works is based on: (1) Dialectical philosophy and dialectical logic; (2) The postulate on the wave nature of all phenomena and objects in the Universe.”[12, p.7]

This writer would like to propose an interpretation i.e. if Genesis 1:1-2 is interpreted according to John 1:1, then it seems we can arrive at a different picture of creation, that is the Universe was created by the Word of God (Greek: Logos, Aramaic: Memra) with the power of the Spirit of God.[13] And because the Logos is “word”, then it could mean voice or sound, and if sound can be interpreted as wave and frequency, then it seems quite logical to think that everything in the Universe are formed of wave and frequency (vibration). Therefore it is important to work on
classical wave equation (vibrating string) instead of Schrödinger equation to model wave nature of atoms and molecules, partly because the wave mechanics is unrealistic model.[15]

A theory which supports this hypothesis is George Shpenkov’s interpretation on the classical wave equation, which leads to the following conjectures: a. *shell-nodal* model of atoms and molecules; b. a periodic table of elements which is close to periodic table of Mendeleyev. And this writer proposed a further step, i.e. to extend further the classical wave equation to become *fractal vibrating string*, as mentioned briefly in his recent paper.[13]

Philosophically speaking, the fractal vibrating string has similarities with string theory, because both of them are based on the same hypothesis that particles come out of frequency and vibration, although they also have major difference that is string theorists must work with 26 dimensions: “… the universe has a total of 26 dimensions in string theory, as opposed to the four dimensions it possesses under Einstein’s special and general relativity theories”. [14] Another major difference is that so far string theory has no single prediction which can be compared with observation or experiment, while the proposed fractal vibrating string model is closer to our everyday’s experience.

Therefore, my vision can be summarized as follows: My vision is to extend Dr. George Shpenkov’s method (he uses the classical wave equation) to become fractal vibrating string. I hypothesize that many phenomena from microscale up to macroscale can be described using *fractal vibrating string*. And it should be noted here that the proposed fractal vibrating string here is different from fractal string theory of Dr. Michel Lapidus, and it is also different from the “standard” string theory (although philosophically speaking, they may have some similarities).
One of the basic differences is that in string theory, one should work with 26 dimensions, which is not necessary for studying fractal vibrating string.

To the best of our knowledge, such a proposal that the Universe was created by the Word of God (or Logos in Greek) is not in conflict with a recent review on Johannine cosmology:

“The Word is the creator of all things; the apriority; the source of sources; the origin of origins. The creation of the world is itself revelatory; the creation itself bears the stamp of the Word (1.3).”[17]

And it is also consistent with *Holman Christian Standard Bible*’s translation of Revelation 3:14 :

“The Amen, the faithful, true Witness, the **Originator** of God’s creation…”[18]

But unfortunately there are only a few studies in such a Johannine cosmology in the existing body of literature, and even more fewer is mathematical model based on such a Johannine cosmology. Therefore my proposal may be considered as one early attempt to develop such a mathematical model based on interpretation of Johannine Prolegomena. By doing so, I wish to contribute in better dialogue between theology and scientific world.

**Future works**

For the time being, there are some remaining works to be done:

a. To find exact solution of Helmholtz equation in spherical case and then compare it with observed data of Early Universe’s oscillation.
b. To explain CMBR/WMAP spectrum and anisotropy

c. To explain redshift data

d. To explain the origin of clustering formation of galaxies

e. Etc.

**Methodology**

a. Literature review: Survey of existing Literature on this subject

b. Biblical exegesis: exploring Christ in His preexistence according to Gospel of John, Colossians and other sources

c. Studying physical and cosmological applications of the proposed model

d. Deduction: Discussion of theoretical and mathematical modeling results

**Implications of the proposed research**

Implications of the proposed research include:

a. It is possible to reconcile scientific findings with biblical teaching in the context of cosmology modeling.

b. It is possible to explain CMBR spectrum from the viewpoint of classical wave equation.

c. It is possible to construct a fractal vibrating string model to study both many large scale as well as micro scale phenomena.
d. Potential implication is to apply unified wave field model governing electromagnetic and gravitational phenomena [16].

In short, if the proposed research is approved, then it can open a plethora of new approaches to study cosmology in a whole new perspective.

Concluding remarks

I have outlined here a new choice for cosmology model, namely that the Universe was created by Logos (Christ in His pre-existence). This is in accordance with the Prolegomena of the Gospel of John, which says that the Logos was there in the beginning (John 1:1).

My vision is to extend Dr. George Shpenkov’s method (he uses the classical wave equation) to become fractal vibrating string. I hypothesize that many phenomena from micro-scales up to macro-scales can be described using fractal vibrating string. And it should be noted here that the proposed fractal vibrating string here is different from fractal string theory of Dr. Michel Lapidus, and it is also different from the “standard” string theory (although philosophically speaking, they may have some similarities).

But unfortunately there are only a few studies in such a Johannine cosmology in the existing body of literature, and even more fewer is mathematical model based on such a Johannine cosmology. Therefore my proposal may be considered as an early attempt to develop such a mathematical model based on interpretation of Johannine Prolegomena. By doing so, I wish to contribute in a better dialogue between theology and scientific world.
If the proposed research is accepted, then it can open a plethora of new approaches to study cosmology in a whole new perspective.

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arxiv.org/1205.1474v2.pdf


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Chapter I: How should a scientist read the Bible?
(Or Between Hermeneutics of Suspicion and Hermeneutics of Respect)

Introduction

This is a proposal of investigation on modern hermeneutics and its relation to science. This is in no way a complete assessment of Gadamer, Ricoeur and other contemporary champions of modern hermeneutics.

I am sorry if my reading is rather subjective, because this is not yet rigorously studied.

Review of Amos Yong’s paper

A couple of weeks ago I read a very interesting paper by Amos Yong on relation between science and theology [1]. In essence he argues that evangelicals tend to blame science for making progress, leaving Bible alone with its prophets.

Yong suggests that Pentecostal’s Hermeneutics can help to solve this dichotomy. His proposal is that Holy Spirit is helping the believers now as good as people at the earliest church history, and that is the true message of the Gospel. So in short, it has nothing to do with today’s progress in science whatsoever. In other words, Yong advises that it is wrong to ask the Bible something about Creation story etc., as asked by many evangelicals. The question is: Is that true that we should not ask a scientific truth in the eyes of the Bible?
Review of Hermeneutics of Suspicion

First, I should admit that I never read (at least not yet) any book written by Paul Ricoeur. But at the very least, I obtain a good book devoted to Hermeneutics of Suspicion [6]. So I will try to tell you my perception on that issue.

Hermeneutics of Suspicion is a phrase coined by Ricoeur in order to categorize the “breakthroughs” in science brought by Marx, Freud, Darwin etc. He suggests that it is because they employed a kind of hermeneutics of suspicion that they could offer a new insight, be it in psychology, economics politics, and biology.

Regardless of the question of whether Marx’s analysis is correct, or Freud’s psychoanalysis is the best theory of mental illness or whether Darwin’s evolution theory is correct, I will focus only on the hermeneutics that they use, because modern science largely depends on two things: paradigm and hermeneutics. Especially when it comes to scientific reading on the Bible, then a hermeneutics is to be used, like it or not.

In the subsequent section, I will offer a new scheme which I prefer to call as: Spectrum of Hermeneutics. As far as I can recall, this is a new thing in this busy field of hermeneutics thinking, so I will try to describe it as patient as possible. Let us jump to the next section.
Spectrum of Hermeneutics

Let us accept the notion of Pentecostal Hermeneutics as promoted by Amos Yong and other Pentecostal scholars such as Gordon Fee [3][4]. But this is just one choice of hermeneutics among many of possible approaches. We can think of more than five other possible approaches toward the Bible.

Second, perhaps it would be helpful to be skeptic to hermeneutics of suspicion, or in better phrase: The first thing we should be suspicious about is hermeneutics of suspicion itself. In other words, although being critical is acceptable such as in historical criticism, if we employ hermeneutics of suspicion, we tend to be hypercritical towards the Bible. Of course, being hypercritical can be unhealthy, because it means that we carry our own excess baggage that is to be critical about everything.

So perhaps we can agree that Hermeneutics of Suspicion should be distinguished from Hypercritical or Radical Hermeneutics [8].

Third, Pentecostal’s reading of the Bible often put more respect on their experiences rather than correct exegesis [2]. If my interpretation of Amos Yong’s paper is correct, most of the time Pentecostal tend to read the Bible in order to get its message for their experiences, like speaking in tongue. Although such Pentecostal hermeneutics has its own advantage, we should also be cautious for a trap of being delusional, i.e. to claim that the Bible means something, when it actually does not.
In other words, perhaps we should distinguish between a healthy Pentecostal Hermeneutics and Delusional Hermeneutics.

Now, if we agree with the above distinctions, then perhaps we can think of seven categories of Hermeneutics approaches to the Bible, as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Critical</th>
<th>Believing</th>
<th>Involvement</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypercritical (Radical Hermeneutics)</td>
<td>V</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Hermeneutics of Suspicion</td>
<td>V</td>
<td>x</td>
<td>X</td>
<td>v</td>
</tr>
<tr>
<td>Hermeneutics of Neutrality</td>
<td>V</td>
<td>v</td>
<td>X</td>
<td>V</td>
</tr>
<tr>
<td>Hermeneutics of Respect</td>
<td>V</td>
<td>v</td>
<td>V</td>
<td>v</td>
</tr>
<tr>
<td>Hermeneutics of Faith</td>
<td>X</td>
<td>v</td>
<td>V</td>
<td>v</td>
</tr>
<tr>
<td>Pentecostal Hermeneutics</td>
<td>X</td>
<td>v</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Delusional Hermeneutics</td>
<td>X</td>
<td>v</td>
<td>V</td>
<td>x</td>
</tr>
</tbody>
</table>
How should a scientist read the Bible?

Taking a look at the above table, now we know that as a scientist we have seven choices to approach and read the Bible, and hermeneutics of suspicion is just an option among other options. If we are Pentecostals, then perhaps we can take Amos Yong’s receipt of Pentecostal Hermeneutics.

But there are other options, such as: Hermeneutics of Neutrality, Hermeneutics of Respect and Hermeneutics of Faith. An evangelical scientist perhaps would prefer Hermeneutics of Faith, but a scientist of modern physics perhaps can choose Hermeneutics of Respect or Hermeneutics of Neutrality.

Conclusion

As I wrote in the beginning, this is not an extensive review of many hermeneutics approaches in the literature. I just think what I have done as an independent researcher during the past 15 years, and propose something which is perhaps quite practical to discuss further. More investigations are required.

Nonetheless, I believe that the proposed scheme has practical value, especially for real scientists doing real science.
One last word of caution: we should be cautious before using Radical Hermeneutics and Hermeneutics of Suspicion for approaching the Bible, otherwise we will not grasp its messages for us in exchange of scientific precision in modern terms.

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Chapter II: An Outline of Cosmology based on Interpretation of the Johannine Prologue

Abstract

As we know there are two main paradigms concerning the origin of the Universe: the first is Big-Bang Theory, and the other is Creation paradigm. But those two main paradigms each have their problems, for instance Big Bang Theory assumes that the first explosion was triggered by chance alone, therefore it says that everything emerged out of vacuum fluctuation caused by pure statistical chance. By doing so, its proponents want to avoid the role of the Prime Mover (God). Of course there are also other propositions such as the Steady State theory or Cyclical universe, but they do not form the majority of people in the world.

On the other side, Creation Theory says that the Universe was created by God in 6x24 hours according to Genesis chapter 1, although a variation of this theory says that it is possible that God created the Universe in longer period of thousands of years or even billions of years. But such a proposition seems not supported by Biblical texts.

To overcome the weaknesses of those main paradigms, I will outline here another choice, namely that the Universe was created by Logos (Christ in His pre-existence). This is in accordance with the Prolegomena of the Gospel of John, which says that the Logos was there in the beginning (John 1:1).

I describe 3 applications of the classical wave equation according to Shpenkov, i.e. hydrogen energy states, periodic table of elements, and planetary orbit distances. For sure, Shpenkov derived many more results beside these 3 phenomena as discussed in his 3 volume books and many papers, but these 3 phenomena are selected to give clear examples of what can be done with the classical wave equation. And then I extend further the classical wave equation to fractal vibrating string.

While of course this outline is not complete, this article is written to stimulate further investigations in this direction.

1. Introduction

“In the beginning was the Word…,” says the Gospel of John 1:1. (German: “Im Anfang war das Wort”. Greek: ἐν ἀρχῇ ἦν ὁ λόγος). This famous Prolegomena of the Gospel of John may be interpreted that everything comes from the Word of God, and since Word means Voice, and Voice means sound, and sound can be related to wave, vibration and frequency, then it seems quite straightforward to think that everything in this universe consists of vibration and frequency too. While the above analogy with the Gospel of John is suggested by this writer, such a view that everything is related to wave and frequency has been proposed by George Shpenkov [1]. He wrote as follows: “A new physics paradigm that we have accepted and follow
in all our works is based on: (1) Dialectical philosophy and dialectical logic; (2) The postulate on the wave nature of all phenomena and objects in the Universe.”[1, p.7]

Shpenkov uses the classical wave equation as follows:

\[ \Delta \dot{\Psi} - \frac{1}{c^2} \frac{\partial^2 \dot{\Psi}}{\partial t^2} = 0 \]  

(1)

This wave equation is also known as the wave equation of sound. [2, p.12][3, p.111] In this paper we will discuss an outline of cosmology based on the proposed connection between vibrating string and the Logos in Prolegomena of the Gospel of John. We will also discuss some Shpenkov’s achievements using the vibrating string (classical wave equation) model, such as hydrogen energy levels, periodic table of elements and also planetary orbits prediction. Then we will extend his model to become fractal vibrating string.

2. From Logos to Vibrating String

In the context of scientific theories, we should admit that initially Big Bang Theory was made as a result of backward extrapolation of the Hubble law. The Hubble law itself only asserts that galaxies move away from each other. And if this law was extrapolated back to the origin of time, then we find that there should be a singularity which then was called as Big Bang. Many physicists have tried to explain what happened in the first minutes of the Big Bang, but so far no one can explain who triggered the Big Bang. Some physicists suggest that the Big Bang occur by chance alone out of vacuum fluctuation.\(^1\) It would mean that there is no Prime Mover of that Big Bang, except probabilistic chance. Another theory was proposed by Hawking; it is called the no boundary proposal, which means that the Universe does not need a Creator or God.

In other words, although at a first glance the Big Bang Theory is able to explain many astronomical data so far, it cannot give an answer to the philosophical question concerning who triggered the creation process in the beginning. Many physicists tried to avoid this penetrating problem. Therefore it seems that there is an open problem on how to reconcile Biblical answers with scientific explanation concerning the beginning of the Universe.

\(^1\) Bob Goette, Why talk about Creation?, *Bible and Spade* 03:2 (Spring 1990): 45-48
This writer would like to propose an interpretation i.e. if Genesis 1:1-2 is interpreted according to John 1:1, then it seems we can arrive at a different picture of creation, that is the Universe was created by the Word of God (Greek: Logos, Aramaic: Memra) with the power of the Spirit of God.² And because the Logos is word, then it could mean voice or sound, and if sound can be interpreted as wave and frequency, then it seems quite logical to think that everything in the Universe are formed of wave and frequency (vibration). Therefore it is important to work on classical wave equation (vibrating string) instead of Schrödinger equation to model wave nature of atoms and molecules, partly because the wave mechanics is unrealistic model.³ A theory which supports this hypothesis is George Shpenkov’s interpretation on the classical wave equation, which leads to the following conjectures: a. shell-nodal model of atoms and molecules; b. a periodic table of elements which is close to periodic table of Mendeleyev.⁴ And this writer proposed a further step, i.e. to extend further the classical wave equation to become fractal vibrating string, as mentioned briefly in his recent paper.⁵ Philosophically speaking, the fractal vibrating string has similarities with string theory, because both of them are based on the same hypothesis that particles come out of frequency and vibration, although they also have major difference that is string theorists must work with 26 dimensions: “… the universe has a total of 26 dimensions in string theory, as opposed to the four dimensions it possesses under Einstein’s special and general relativity theories”.⁶ Another different is that so far string theory has no single prediction which can be compared with observation or experiment, while the proposed fractal vibrating string model is closer to our everyday’s experience.

3. Memra in Targum and Christology of Colossians

According to the Bible, Davar of Jahweh (Word of God) has the creating power, for example it can give breathe of life in Ez. 37:4-5, and it has role during creation of the heavens in Ps. 33:6.

Ezekiel 37:4-5 → “Again He said unto me, Prophesy upon these bones, and say unto them, O ye dry bones, hear the word of the LORD. Thus saith the Lord GOD unto these bones; Behold, I will cause breath to enter into you, and ye shall live:” (KJV)

Psalm 33:6 → “By the word of the LORD were the heavens made; and all the host of them by the breath of His mouth.” (KJV)

The above Ps. 33:6 has parallel with the Christology in Col. 1:16.

Colossians 1:16 → “For by Him were all things created, that are in heaven, and that are in earth, visible and invisible, whether they be thrones, or dominions, or principalities, or powers: all things were created by Him, and for Him.” (KJV)

Therefore, we can conclude that everything in the Universe was created by the Logos or Christ Himself in His pre-existence. The name Word of God for Jesus Christ is also the same with the Kalimatullah title for Isa in Qur’an.

And the phrase the Logos is with God has also parallel in Targum of Gen. 31:24. See the following table:

<table>
<thead>
<tr>
<th>Targum</th>
<th>Gospel of John</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memra min qedem Alaha (Gen. 31:24)</td>
<td>Kai ho logos en pros ton theon (John 1:1b)</td>
</tr>
<tr>
<td>Memra de Alaha (Gen. 19:17)</td>
<td>John. 1:3c</td>
</tr>
</tbody>
</table>

Therefore we can conclude that there are similarity of the concept of Word of God and His role in creation from John 1:1, Ps. 33:6, and Col. 1:16.

Since theological discussions on this issue can be very deep, I will only cite several papers for further reading by interested readers [10]-[16].
4. The Classical Wave Equation and Hydrogen Energy States

In his third book, George Shpenkov explains in detail on how to derive hydrogen energy states from the Classical wave equation above (1). In this section, I give a summary of his procedure.

According to Shpenkov, the hydrogen atom represents a simplest binary proton-electron system. According to the Dynamic Model (DM), which is the wave theory of micro-objects of atomic and sub-atomic levels, the hydrogen atom is the wave system of the longitudinal-transversal structure. It is a stable wave formation of the binary spherical-cylindrical wave field.

Spherical and cylindrical wave functions satisfying the wave equation (1) have, respectively, the following form:

\[ \Psi = \hat{R}_l(kr)\Theta_{l,m}(\theta)\Phi_m(\phi)\hat{T}(\omega t), \]  

(2)

And

\[ \Psi = \hat{R}_m(k,r)\hat{Z}(k,z)\Phi_m(\phi)\hat{T}(\omega t). \]  

(3)

Radial components of spherical and cylindrical functions (2) and (3), respectively, are uniquely determined by the general structure of the following radial equations:

\[ \rho^2 \frac{d^2 \hat{R}_l}{d\rho^2} + 2\rho \frac{d\hat{R}_l}{d\rho} + (\rho^2 - l(l+1))\hat{R}_l = 0, \]  

(4)

And

\[ \frac{d^2 \hat{R}}{d(k,r)^2} + \frac{1}{k,r} \frac{d\hat{R}}{d(k,r)} + (1 - \frac{m^2}{(k,r)^2})\hat{R} = 0, \]  

(5)

Where \( \rho = kr \).

In the central spherical wave field of the hydrogen atom, amplitude of radial oscillations of the spherical shell of the proton, originated from solutions of (4), has the form:

\[ A_{sph} = \frac{A_l(kr)}{kr}, \]  

(6)

Where

---

\[ \hat{e}_j(kr) = \sqrt{\frac{\pi kr}{2}}(J_{\frac{1}{2}}(kr) \pm Y_{\frac{1}{2}}(kr)), \]  
\[ k = \frac{\omega}{c}. \]  

Here \( J(kr) \) and \( Y(kr) \) are Bessel functions; \( \omega \) is the oscillation frequency of pulsating spherical shell of the proton equal to the fundamental “carrier” frequency of the subatomic and atomic levels.

In the cylindrical wave field, the energy \( E_{cyl} \), as the sum of energies of two mutually perpendicular potential-kinetic oscillations of the orbiting electron, is equal (to the simplest case) to:

\[ E_{cyl} = h\nu, \]  

Where

\[ h = \frac{2\pi m_e c a^2}{r} = 2\pi m_e \nu A_{cyl}, \]  

And

\[ A_{cyl} = \frac{a}{\sqrt{kr}}. \]  

Since the steady equilibrium exchange (interaction) between spherical and cylindrical fields in the hydrogen atom takes place invariably, the following equality is always valid:

\[ E_{cyl} = \Delta E_{sph}. \]  

The above equation yields an equation which under condition of \( p=q=0 \) will yield the well-known elementary spectral formula of the hydrogen atom:

\[ \frac{1}{\lambda} = R \left( \frac{1}{m^2} - \frac{1}{n^2} \right), \]  

Where \( m \) and \( n \) are integers, and

\[ R = \frac{m_0 c A^2}{2\hbar r_i^2} \]  

Is the Rydberg constant.
Thus, equations (13) and (14) complete Shpenkov’s derivation of hydrogen energy states from the classical wave equation.

5. The Classical Wave Equation and Periodic Table of Elements

In his 2006 paper, Shpenkov explains a derivation from the classical wave equation to a periodic table of elements which is close to Mendeleev’s periodic table. In this section I will briefly summarize his results for convenience.

According to Shpenkov, one of the particular solutions of the 3-dimensional wave equation yields sinusoidal spherical standing waves described by Bessel functions. They are reminiscent of spherical resonant cavities having internal oscillating electric and magnetic mode fields. Their nodal structure uniquely determines the structure of matter at the atomic and molecular levels, in particular, the intra-atomic structure. On the basis of these solutions, the nature of the Periodic Law and symmetries of crystals are elucidated from a new point of view. This is based on interpretation of \( \Psi \)-function in equation (1) as the density of the potential-kinetic phase probability for the occurrence of events in the wave space.

As we know, equation (1) admits particular solutions of the form:

\[
\hat{\Psi}(r, t) = \hat{\psi}(r)e^{i\omega t}
\] (15)

Where \( \omega = kc \) and \( \hat{\psi}(r) \) is the particular solution of the corresponding Helmholtz equation

\[
\Delta \hat{\psi} + k^2 \hat{\psi} = 0
\] (16)

And \( k \) is the arbitrary constant defined from the boundary conditions.

The longitudinal component of the spherical-cylindrical field is described over a spherical realization of the wave equation (1). The separation of variables leads to one time equation:

\[
\frac{d^2 \hat{T}}{d\tau^2} = -\hat{T},
\] (17)

And three equations in spherical space:


\[9\] For more discussion on separation of variables, see for example Karl Svozil, Mathematical Methods of Theoretical Physics, arXiv:1203.4558v4 [math-ph], 25 Mar. 2014, p. 203-206
\begin{align}
\rho^2 \frac{d^2 \hat{R}_r}{d \rho^2} + 2 \rho \frac{d \hat{R}_r}{d \rho} + (\rho^2 - \ell(\ell + 1)) \hat{R}_r = 0, \\
\frac{d^2 \Theta_{\ell,m}}{d \theta^2} + \cot \theta \frac{d \Theta_{\ell,m}}{d \theta} + \left( \ell(\ell + 1) - \frac{m^2}{\sin^2 \theta} \right) \Theta_{\ell,m} = 0, \\
\frac{d^2 \Phi_m}{d \phi^2} + m^2 \Phi_m = 0,
\end{align}

Where \( \rho = kr \) and \( \tau = \omega t \).

By solving the above equations which involving the use of Bessel functions, Shpenkov arrives at a periodic table of elements which are close to Mendeleyev’s periodic law. The result is shown in Figure 1 below.
Figure 1. Generalized table of the elements from the particular solutions of the wave probabilistic equation (1), or the quasi-periodicity as a result of quasi-similarity of the nodal structure of external atomic shells.\(^\text{10}\)

I will not repeat here Shpenkov’s derivation, but those who are interested can consult his paper [18].

\(^{10}\) Shpenkov, “An Elucidation of the Nature of the Periodic Law,” 144-145.
6. The Classical Wave Equation and the Planetary Orbit Distances

In one of his papers, Shpenkov derived planetary orbit distances from the same classical wave equation (1). In his interpretation, the gravitational frequency determines the gravitational radius of elementary particles, which is also the elementary radial gravitational wave:

$$\lambda_g = \frac{c}{\omega_g} = 3.274 \times 10^{11} m = 327.4 Mkm. \quad (21)$$

The wave shell of the gravitational radius of a particle in stellar systems, which in turn are spherical objects of mega space (atoms of mega world), separates the oscillating region of a spherical field-space of a star and its wave region.

In accordance with the solutions of the wave equation (1), the gravitational wave radius (21) of elementary particles determines the radii of their wave equilibrium spherical shells by the following equation:

$$r = \lambda_g \cdot z_{m,n} = 327.4 \times 10^6 \times z_{m,n} km, \quad (22)$$

Where $z_{m,n}$ are solutions of the wave equation (1) (roots, zeros, of Bessel functions).

The solution (22) is realized in the first approximation of in a spectrum of the Keplerian shells-orbits, assuming that the gravitational shells are spherical and, therefore, the orbits are circular. Under the conditions of interplanetary gravitation interaction, the planets cannot move strictly along circular orbits, to which they naturally aspire constantly as to equilibrium. Mutual perturbations eventually have turned the circular orbits in elliptic.

According to Shpenkov, if we take as the basic, a gravitational wave shell of the Sun, e.g. on which is an orbit of the planet Mercury, we arrive at the gravitational spectrum, conditioned by the solutions of the Bessel functions of the first order (see Table 2).
Table 2. A gravitational spectrum of wave spherical shells of elementary particles\(^{12}\)

<table>
<thead>
<tr>
<th>S</th>
<th>( z_{m,n} = j_{r,s} )</th>
<th>( r_n, \text{ Mkm} )</th>
<th>Planets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.831706</td>
<td>57.91</td>
<td>Mercury</td>
</tr>
<tr>
<td>2</td>
<td>7.015587</td>
<td>106.03 (108.2)</td>
<td>Venus</td>
</tr>
<tr>
<td>3</td>
<td>10.17347</td>
<td>153.76 (149.6)</td>
<td>Earth</td>
</tr>
<tr>
<td>4</td>
<td>13.32369</td>
<td>201.36 (204.5)</td>
<td>Toro</td>
</tr>
<tr>
<td>5</td>
<td>16.47063</td>
<td>248.93 (227.9)</td>
<td>Mars</td>
</tr>
<tr>
<td>6</td>
<td>19.61586</td>
<td>296.46</td>
<td>Asteroids</td>
</tr>
<tr>
<td>7</td>
<td>22.76008</td>
<td>339.45</td>
<td>Asteroids</td>
</tr>
<tr>
<td>8</td>
<td>25.90367</td>
<td>391.49</td>
<td>Asteroids</td>
</tr>
<tr>
<td>9</td>
<td>29.04683</td>
<td>438.96</td>
<td>413.77 (1 Ceres)</td>
</tr>
<tr>
<td>10</td>
<td>32.18968</td>
<td>486.49</td>
<td>Asteroids</td>
</tr>
<tr>
<td>11</td>
<td>35.33231</td>
<td>533.99</td>
<td>Asteroids</td>
</tr>
<tr>
<td>12</td>
<td>38.47476</td>
<td>581.48</td>
<td>Asteroids</td>
</tr>
<tr>
<td>13</td>
<td>41.61709</td>
<td>628.97</td>
<td>1 Asteroid</td>
</tr>
<tr>
<td>14</td>
<td>44.75932</td>
<td>676.46</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>47.90146</td>
<td>723.95</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>51.04354</td>
<td>771.44 (778.57)</td>
<td>Jupiter</td>
</tr>
<tr>
<td>30</td>
<td>95.02923</td>
<td>1436.2 (1433.45)</td>
<td>Saturn</td>
</tr>
</tbody>
</table>

Note: semi-major axes of elliptical orbits of the planets are in brackets. For a small planet Toro, in brackets, an average distance from the Sun is indicated.

Beside the above result, Shpenkov also derives orbits of satellites of Jupiter, Saturn, and Uranus.

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\(^{12}\) Ibid, p.40
7. **Possible Extensions from The Classical Wave Equation in Fractal Vibrating String**

In this section I will give an outline of wave equation in fractal vibrating string and also wave equation on Cantor sets. These equations can be used to extend the classical wave equation discussed in the previous sections.

a. **The wave equation in fractal vibrating string**

Hu, Agarwal & Yang [21] introduce a local fractional wave equation in fractal vibrating string which is described as:

\[
\frac{\partial^{2a}u(x,t)}{\partial t^{2a}} + a^{2a} \frac{\partial^{2a}u(x,t)}{\partial x^{2a}} = 0,
\]

(23)

With some fractal boundary conditions as defined in [21, p. 2].

Now we look at the particular solutions of the form:

\[u(x,t) = \phi(x)T(t),\]

(24)

And arrive at the equations:

\[\phi^{(2a)} + \lambda^{2a}\phi = 0,\]

(25)

\[T^{(2a)} + a^{2a}\lambda^{2a}T = 0.\]

(26)

After some procedures, the solutions of these equations can be obtained. [21]

b. **The 3-D wave equation on Cantor sets**

According to Su, Yang, Jafari & Baleanu [22], 3-D wave equation on Cantor sets described by the local fractional derivative can be written as follows:

\[\frac{\partial^{2a}u(x,y,z,t)}{\partial t^{2a}} + a^{2a}\nabla^{2a}u(x,y,z,t) = 0,\]

(23)

Where local fractional Laplace operator is noted by:

\[\nabla^{2a} = \frac{\partial^{2a}}{\partial x^{2a}} + \frac{\partial^{2a}}{\partial y^{2a}} + \frac{\partial^{2a}}{\partial z^{2a}}.\]

(24)

c. **Solution of the Wave equation on Cantor sets using Local Fractional Series Expansion Method**

Yang, Yang & Li [23] describes a new method to solve the wave equation on Cantor sets. The wave equation on Cantor sets is given by:

\[\frac{\partial^{2a}u(x,t)}{\partial t^{2a}} + c \frac{\partial^{2a}u(x,t)}{\partial x^{2a}} = 0,\]

(25)

Where \(c\) is a constant and \(0 < \alpha \leq 1\). The initial condition is:

\[u(x,0) = E_{\alpha}(x^\alpha).\]

Then they obtain the solution as follows [23]:
\[ u(x,t) = E_\alpha(x^\alpha) \left[ \cosh_\alpha(ct^\alpha) + \sinh_\alpha(ct^\alpha) \right]. \]

The above three methods may be applied for cosmological and astrophysical problems.

**Some Implications and Concluding Remarks**

I outlined here a new choice for cosmology theory, namely that the Universe was created by Logos (Christ in His pre-existence). This is in accordance with the Prolegomena of the Gospel of John, which says that the Logos was there in the beginning (John 1:1).

I describe 3 applications of the classical wave equation according to Shpenkov, i.e. hydrogen energy states, periodic table of elements, and planetary orbit distances. For sure, Shpenkov derived many more results beside these 3 phenomena as discussed in his 3 volume books and many papers, but these 3 phenomena are selected to give clear examples of what can be done with the classical wave equation.

And then I extend further the classical wave equation to fractal vibrating string. I describe three different approaches to extend the classical wave equation. It can be expected that these approaches may be applied for cosmological and astrophysical problems.

While of course this outline is not complete, this article is written to stimulate further investigations in this direction.

**References:**


Chapter III: A Review of Schrödinger equation and Classical Wave equation

Abstract
In this paper, I will review some inadequacies of Schrödinger equation. Then I will discuss George Shpenkov’s interpretation of classical wave equation and two other authors’ wave equations. According to Shpenkov, the classical wave equation is able to derive a periodic table of elements—which is close to Mendeleyev’s periodic table—, and also other phenomena related to the structure of molecules. It is argued here that one may arrive at new energy methods using this classical wave equation as starting point. It is suggested that Shpenkov’s interpretation of classical wave equation can complement Schrödinger equation.

Key Words: Schrödinger Equation, classical wave equation, George Shpenkov, periodic table, element, molecule, new energy.

1. Introduction
George Shpenkov’s work is based on [1]: (1) Dialectical philosophy and dialectical logic; (2) The postulate on the wave nature of all phenomena and objects in the Universe. He uses the classical wave equation is as follows:

\[ \Delta \Psi - \frac{1}{c^2} \frac{\partial^2 \Psi}{\partial t^2} = 0 \]  \hspace{1cm} (1)

This equation is also known as the wave equation of sound or string vibration [18, 22].

In this paper, I will review the inadequacy of spherical solution of Schrödinger’s equation to say anything about the structure of molecules. It is a common fact, that the spherical solution of Schrödinger equation is hardly discussed properly in many quantum mechanics textbooks, with an excuse that it is too complicated. Then I will discuss George Shpenkov’s interpretation of classical wave equation, where he is able to derive a periodic table of elements—which is close to Mendeleyev’s periodic table—, and other phenomena related to the structure of molecules, which are elusive dreams from the viewpoint of quantum mechanics.

George Shpenkov claims that his wave equation is able to explain the following:

- a. Derive a periodic table of elements (slightly different from but close to the Mendeleyev’s periodic law) based on spherical solution of his standing wave equation [9];
- b. Give a dynamical model of elementary particles [8];
- c. Derive binding energy of deuterium, tritium, helium and carbon [10];


d. Derive the atom background radiation of hydrogen which corresponds to the observed COBE/CMBR (Cosmic Microwave Background Radiation) [7];
e. Derive the shell-nodal model of atoms and molecules [11];
f. Explain anisotropy of graphene [12];
g. Describe the shell-nodal picture of carbon and grapheme [13];
h. Describe electron “orbitals”;
i. Describe electron “spin”;
j. Derive neutron magnetic moment;
k. Derive proton magnetic moment;
l. And other things [14].

Therefore, it seems that Shpenkov’s wave model of particles and molecules may be a promising alternative to complement the standard quantum mechanics.

2. Schrödinger equation

George Shpenkov points out that there are several weaknesses associated with (spherical solution of) Schrödinger’s equation:

i. Its spherical solution is rarely discussed completely (especially in graduate or undergraduate quantum mechanics textbooks), perhaps because many physicists seem to feel obliged to hide from public that the spherical solution of Schrödinger’s wave equation does not agree with any experiment.

ii. Schrödinger equation is able only to arrive at hydrogen energy levels, and it has to be modified and simplified for other atoms. For example, physicists are forced to use an approximate approach called Density Functional Theory (DFT) in order to deal with N-body system.  

iii. The introduction of variable wave number k in Schrödinger equation, depending on electron coordinates, and the omission of the azimuth part of the wave function, were erroneous [6]. Schrödinger’s variable wave number should be questioned, because the potential function cannot influence the wave speed or consequently the wave number.

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iv. Introduction of the potential function $V$ in the wave equation, which results in dependence of the wave number $k$ on the Coulomb potential, generates divergences that do not have a physical justification. They are eliminated in an artificial way.[6, p.27]

v. Modern physics erroneously interprets the meaning of polar-azimuthal functions in Schrödinger’s equation, ascribing these functions to atomic “electron orbitals”. [1, p.5]

vi. Schrödinger arrived at a “correct” result of hydrogen energy levels using only a radial solution of his wave equation, with one major assumption: the two quantum numbers found in the solution of his wave equation were assumed to be the same with Bohr’s quantum number [2].

vii. Quantum mechanics solutions, in their modern form, contradict reality because on the basis of these solutions, the existence of crystal substances-spaces is not possible. [6, p.26]

viii. Schrödinger’s approach yields abstract phenomenological constructions, which do not reflect the real picture of the micro-world.[2]

ix. Schrödinger himself in his 1926 paper apparently wanted to interpret his wave equation in terms of vibration of string [3][4]. This is why he did not accept Born’s statistical interpretation of his wave equation until he died. Einstein and de Broglie also did not accept the statistical interpretation of quantum mechanics.

x. The interpretation and the physical meaning of the Schrödinger’s wave function was a problem for physicists, and it still remains so, although many researchers understand its conditional character [6].

In the initial variant, the Schrödinger equation (SE) has the following form [2]:

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

(2)

The wave function satisfying the wave equation (2) is represented as:

$$\Psi = R(r)\Theta(\theta)\Phi(\phi)T(t) = \psi(r, \theta, \phi)T(t)$$

(3)

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

$$\Phi_m(\phi) = C_m e^{im\phi}$$

(4)

For standard method of separation of variables to solve spherical SE, see for example [20][21].

The $\Phi$, $\Theta$ 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 $\kappa$-th term. This allowed them to obtain the radial solutions, which, as a result of the cut off operation, actually were the fictitious solutions.[2]

Furthermore, it can be shown that the time-independent SE [20]:
\[ \nabla \Psi + \frac{2m}{\hbar^2}(E - V)\Psi = 0, \quad (5) \]

Can be written in the form of standard wave equation [2]:

\[ \nabla \Psi + k^2\Psi = 0, \quad (6) \]

Where

\[ k = \pm \sqrt{\frac{2m}{\hbar^2}(E - V)}. \quad (7) \]

Or if we compare (6) and (2), then we have [2]:

\[ k = \pm \sqrt{\frac{2m}{\hbar^2}\left(W + \frac{e^2}{4\pi\epsilon r}\right)}. \quad (8) \]

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.

**4. Shpenkov’s interpretation of classical wave equation**

Now I will introduce the Shpenkov’s interpretation of classical wave equation, which can be written simply as follows:

\[ \nabla \Psi + \frac{\omega^2}{c^2}\Psi = 0, \quad (9) \]

Where the wave number \( k = \frac{\omega}{c} \), is constant, instead of variable [6]. Here, \( \omega \) denotes the fundamental carrying frequency of the wave field at the corresponding level of space, and \( c \) denotes the speed of light. In order to correct the faults of wave mechanics, it is necessary to write down the above wave equation, which meets the conditions: (a) the wave number is constant, and (b) the azimuth factor must be taken into consideration along with radial \( R(r) \) and polar factor of the wave-function [6].

In this case, the differential equation for the radial factor \( R(r) \) is:
\[
\rho \frac{d^2 R}{d^2 \rho} + 2 \rho \frac{dR}{d\rho} + \left[\rho - l(l+1)\right] R = 0
\]  
(10)

Where \( \rho = kr[6] \).

The value of the fundamental frequency \( \omega \) determines only the absolute scale of all parameters at the corresponding level of space. At the atomic and subatomic levels, it is equal to: [6, p.27]

\[
\omega = 1.86916197 \cdot 10^{18} \text{ s}^{-1}.
\]  
(11)

The wave radius corresponding to (11) is:

\[
\bar{\lambda} = \frac{c}{\omega} = 1.603886998 \cdot 10^{-8} \text{ cm}.
\]  
(12)

As we can see, \( \bar{\lambda} \) is equal to one-half of mean value of the interatomic distance in crystals (in terms of the generally accepted atomic model); therefore it is not a random coincidence. [6, p.27]

The detailed analysis to find spherical solution of equation (9) is discussed in Shpenkov’s other papers [9, 11].

Some consequences of the solution of the Shpenkov’s interpretation of classical wave equation are [6]:

a. As masses of atoms are multiple of the neutron mass (or hydrogen atom mass), following Haüy’s ideas makes it reasonable to suppose that any atom, like the elementary Haüy’s molecule, is the neutron (H-atom) molecule;

b. Therefore, atoms should be considered as neutron (H-atom) quasispherical multiplicative molecules. The word ‘multiplicative’ means that particles, constituted of these elementary molecules, must be coupled by strong bonds, which we call multiplicative bonds.

c. Potential polar-azimuthal nodes of spherical shells in stable atoms (nucleon molecules) contain by two coupled nucleons.

d. Polar potential-kinetic nodes (not filled with nucleons in the most abundant and stable atoms) are ordered along the z axis of symmetry (in spherical coordinate system) of the atoms.

e. Exchange (interaction) between completed nodes inside (strong) and outside (electromagnetic) of the atoms is realized by exchange charges of nucleon and electron on the fundamental frequency (11).

f. It is possible to get this method yielding the actual picture of distribution of nodes-extremes, corresponding to Haüy’s elementary molecules.

g. Principal azimuth nodes of the wave space of atoms are marked by ordinal numbers. These numbers coincide with the ordinal numbers of elements of Mendeleyev’s periodic table. The quantity of neutrons, localized in one node, is equal to or less than two.
h. Arranging atoms with the same or similar structure of outer shells one under another, one arrives at the *periodic-nonperiodic law of spherical spaces* that constitutes periodic table, slightly differing from the conventional one of Mendeleyev.

To be fair, Shpenkov may not be the first person who uses that the classical wave equation to study atoms and particles. There are at least two persons that I can recall here who appear to attempt similar thing: Randell L. Mills and Robert A. Close. Randell Mills calls his theory *Classical Quantum Mechanics*, while Robert Close calls his theory *The Classical Wave Theory of Matter*.

While Randell Mills seems to argue that Maxwell's equations are capable to explain stability of hydrogen [23][24], according to Rathke [25], Mills assumes that the dynamics of the electron are described by a classical wave equation for its charge-density function, $\rho(t,x)$,

$$\left(\nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}\right) \rho(t,x) = 0$$

Which is similar to equation (1). According to Rathke [25], this equation leads to Euler differential equation which has general solution:

$$f(r) = c_1 + \frac{c_2}{r}, \quad (14)$$

But that is different from the solution given by Mills:

$$f(r) = \frac{1}{r} \delta(r - r_0). \quad (15)$$

Therefore, according to Rathke, Mills's conclusion that there are fractional energy levels of hydrogen (which he calls 'hydrino') is erroneous. [25]

Close takes a similar approach, based on the classical wave equation. Before suggesting his wave equation, he arrives at a conclusion, that if we take the curl of the third of Maxwell equations and combine it with the time derivative of the fourth equation we obtain [26]:

$$\nabla^2 E - \frac{1}{c^2} \frac{\partial^2 E}{\partial t^2} = 0$$

$$\nabla^2 B - \frac{1}{c^2} \frac{\partial^2 B}{\partial t^2} = 0$$

Each of these equations is a homogeneous wave equation. In vacuum, both E and B have zero divergence, so these equations have the same form as the conventional equation for shear waves.
Therefore, we find that there exists formal connection between classical wave equation and Maxwell’s equations. Such a connection is known as \textit{electrical-mechanical-acoustical analogy}.\textsuperscript{14}

While Close does not give an exact solution of classical wave equation, he finds some interesting points. For example, he is able to find coupled wave equation from factorization of 1-dimensional scalar wave equation [26]. For clarity, we give his factorization procedure for 1-dimensional case of equation (1), which can be written as follows:

\[ \partial^2_t a = c^2 \partial^2_z a. \quad (18) \]

This equation can be factored:

\[ [\partial_t - c \partial_z] [\partial_t + c \partial_z] a = 0 \quad (19) \]

The general solution is a superposition of forward and backward propagating waves:

\[ a(z,t) = a_F(z - ct) + a_B(z + ct) \quad (20) \]

It can be shown that we can reduce the equations for forward and backward waves into a first-order matrix equation [26, p.83]:

\[
\begin{bmatrix}
\partial + \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} c \partial_z \\
0 & -1
\end{bmatrix} \Psi = \partial_t \begin{pmatrix} \dot{a}_F(z - ct) \\ \dot{a}_B(z + ct) \end{pmatrix} - c \partial_z \begin{pmatrix} a_F(z - ct) \\ a_B(z + ct) \end{pmatrix} = 0 \quad (21)
\]

It is also worth noting that solution of wave function of Helmholtz equation has been obtained by Blackledge and Babajanov in [34]. For discussion on the theory of ordinary differential equations, see for example Coddington and Levinson [35].

4. Some possible applications of Shpenkov’s wave model

a. Application in molecular vibration

A possible test of the Shpenkov’s model of atom and molecule based on the classical wave equation is fundamental ground tone vibration of H$_2$, HD, and D$_2$. It may open new experiments on how the Shpenkov’s wave model can be compared to QED prediction.[27] It is noted here that Shpenkov is also able to derive Lamb shift of hydrogen using his wave model. [28] There also exists plenty of information on water vibration.

b. Application in cosmic microwave background radiation

Kreidik & Shpenkov [7] derive microwave background radiation of hydrogen atom based on Shpenkov’s interpretation of classical wave equation. They conclude that the Microwave Background Radiation, observed in Cosmos, apparently is the zero-level (background) radiation of all atoms in the Universe. Following their dynamic model, the H-atom is a paired dynamic system with the central spherical microobject of a complicated structure (proton) and the orbiting electron. The electron in H-atom under the wave motion exchanges the energy with the proton constantly at the fundamental frequency $\omega_e$. This exchange process between the electron and proton has the dynamically equilibrium character. It is represented by a system of radial standing waves, which define “zero level exchange” in a dynamically stable state of the atom. At $p=0$, they obtain $\lambda=0.106267$ cm, then they can find an estimate of the absolute temperature of zero level of radiation:

$$T = \frac{0.290cm \cdot K}{\lambda} = 2.7289K = \Delta K$$

Where $\Delta=2\pi lge=2.7288$ is the measure of the fundamental period (fundamental quantum measures). The temperature obtained coincides with the temperature of “relict” background measured by NASA’s Cosmic Microwave Background Explorer (COBE) satellite to four significant digits ($2.725 \pm 0.002$ K).[7] The concept of zero level radiation of H-atoms questions quantum mechanical probabilistic model, which excludes an electron’s orbital motion along a trajectory as matter of principle.[7]

c. Application in cosmology

Neven Bilić studied sound wave propagation in a relativistic perfect fluid with a non-homogeneous isentropic flow. [29] The sound wave equation turns out to be equivalent to the equation of motion for a massless scalar field propagating in a curved space-time geometry.

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Among other things, he obtained that the free classical wave equation (1) is a simplest case of the generalized wave equation [29]:

$$\frac{\partial}{\partial t} \left\{ \frac{n}{w} \sqrt{-g} \left[ g^{\mu \nu} - \left( \frac{n}{w} \frac{\partial w}{\partial n} \right)^{-1} u^\mu u^\nu \right] \right\} \partial_\mu \varphi = 0$$

(23)

The above wave equation (23) can be rewritten as [29]:

$$\partial_\mu f^{\mu \nu} \partial_\nu \varphi = 0.$$  

(24)

And then he used this form of the acoustic wave equation to construct the acoustic metric. It is known that acoustic metric may have application in astrophysics and early cosmology.

d. Application in graphene [12]

Graphene, one-atom-thick layers of graphite, having a two dimensional hexagonal lattice, gives us a new unique possibility for the direct verification of some predictions, originated from the solutions of classical wave equation (9). According to modern notions, a two dimensional hexagonal lattice of graphene is regarded as having crystallographic symmetry of a six order. Hence, electrical conductivity of graphene in a hexagonal plane perpendicular to this axis must be isotropic, in full agreement with the basic symmetry theory as having more than two-fold symmetry. This is why an examination of feasible conductivity anisotropy in pristine unstrained graphene has never been undertaken till now, and a question about such studies has never been raised among researchers. For this reason, a talk about an existence of natural conductivity anisotropy in graphene seemed nonsensical. However, according to the shell-nodal structure of the carbon atom originated from said solutions, graphene has two-fold axis of symmetry. Accordingly, it makes sense to undertake efforts (experiments) to verify that. The tests are not so complicated, but obtained result can change many things in physics.

Graphene anisotropy explains also the fact that graphene nanotubes, rolled-up form of graphene, have either conductivity, metallic or semiconducting. The rolling-up of graphene is realized mainly along two crystallographic directions: along the major axis (we called it the Z-axis) and in perpendicular to it direction. Nanotubes obtained have the minimal energy of state in these crystallographic directions. The rolling-up of graphene sheets runs spontaneously at the high temperature conditions; it is not yet controlled process. The rolling-up in other directions is thermodynamically unfavorable unstable process and, therefore, is not going on spontaneously.

e. Application in water as fuel (ultrasonic electrolysis of water) [30]

One possible application of the atomic vibration model outlined here is the ultrasonic electrolysis of water. When an electrical current passes through water, the hydrogen and oxygen become separated and escape as gasses. This process is referred to as electrolysis. You can demonstrate a simple form of electrolysis by holding the connection end of a nine-volt battery in a glass of water. Tiny bubbles will begin to form on each electrode, oxygen on one and hydrogen on the other. Higher electrical current will cause the gas to form much more rapidly. These facts indicate that it may be possible to build a motor that runs on water. A battery would be used as a source of electrical energy which would separate the hydrogen/oxygen into gases. The gasses
would then fuel an internal combustion engine, which would power a generator to continuously recharge the battery as well as deliver usable mechanical energy. If this sort of motor can be made to work, the energy crisis on this planet will be over forever.

Whether or not this device would produce more energy than that required separating the gasses, and thus produce useful work, depends upon the efficiency of the gas separation process. It has been demonstrated that in addition to electrical current passing through water, ultrasonic vibrations and radio waves are also capable of breaking the molecular bonds in water to release the hydrogen and oxygen.

The resonant frequency of water is ~42.7kHz. When water molecules vibrate at this frequency they tend to become unstable.

It should be noted that there have been reports of large explosions when water is physically disassociated using ultrasonic vibrations. The explosive force reported is substantially greater than can be accounted for by the chemical burning of the hydrogen (in one case this was 29,000 pounds of pressure from 3 drops of water). Experimenters constructing this ultrasonic electrolysis device should use appropriate caution.

f. Application in Condensed Matter Nuclear Science (CMNS)

Another possible use of resonance and vibration theory is to understand mechanism in CMNS. There are many theories which have been proposed in order to understand CMNS/Cold fusion, one of them is the Selective Resonant Tunneling Model proposed by Li et al. [31]. Selectivity of the resonant tunneling can be learnt from the electronic harmonic circuit. It is known that at the low energy, the Coulomb barrier is thick and high; hence, the incident deuteron wave in the nuclear well is very weak due to the Coulomb barrier. The amplitude of weak penetrating wave may be enhanced by the resonance effect when the phase of the reflected wave inside the nuclear well is same as that of the incident wave. This is the resonant tunneling. The damping in resonant tunneling of the Coulomb barrier is just the fusion reaction itself, because the deuteron wave function disappears due to fusion reaction. Thus, this fusion reaction rate cannot be very fast, otherwise the fast damping will stop the resonant effect.[31] It is worth mentioning here that this Li’s model is able to provide explanation of Huizenga’s three miracles of cold fusion, therefore it may be useful to look at CMNS from this viewpoint.

6. Correspondence between classical wave equation and quantum mechanics

a. Ward & Volkmer’s derivation of Schrödinger equation from wave equation

My viewpoint is that there is connection between classical and quantum mechanics, see also [17][19]. Therefore it seems possible to find theoretical correspondence between classical electromagnetic wave equation and Schrödinger equation. Such a correspondence has been
discussed by David Ward & Sabine Volkmer [32]. They give a simple derivation of the Schrödinger equation, which requires only knowledge of the electromagnetic wave equation and the basics of Einstein’s special theory of relativity.

They begin with electromagnetic wave equation (16) in one dimensional case:

$$\frac{\partial^2 E}{\partial x^2} - \frac{1}{c^2} \frac{\partial^2 E}{\partial t^2} = 0. \tag{25}$$

This equation is satisfied by plane wave solution:

$$E(x,t) = E_0 e^{i(kx-\omega t)}, \tag{26}$$

Where \( k = \frac{2\pi}{\lambda} \) and \( \omega = 2\pi\nu \) are the spatial and temporal frequencies, respectively. Substituting equation (26) into (25), then we obtain:

$$\left( \frac{\partial^2}{\partial x^2} - \frac{1}{c^2} \frac{\partial^2}{\partial t^2} \right) E_0 e^{i(kx-\omega t)} = 0 \tag{27}$$

Or

$$\left( k^2 - \frac{\omega^2}{c^2} \right) E_0 e^{i(kx-\omega t)} = 0 \tag{28}$$

Solving the wave vector, we arrive at dispersion relation for light in free space: \( k = \frac{\omega}{c} \). Note that this is similar to wave number \( k \) in equation (9).

Then, recall from Einstein and Compton that the energy of a photon is \( \varepsilon = h\nu = \hbar\omega \) and the momentum of a photon is \( p = \frac{h}{\lambda} = \hbar\nu \). We can rewrite equation (26) using these relations:

$$E(x,t) = E_0 e^{\frac{i\nu}{\hbar}(px-\varepsilon t)} \tag{29}$$

Substituting this equation into (25) we find:

$$-\frac{1}{\hbar^2} \left( p^2 - \frac{\varepsilon^2}{c^2} \right) E_0 e^{\frac{i\nu}{\hbar}(px-\varepsilon t)} = 0 \tag{30}$$

Then we get an expression of relativistic total energy for a particle with zero rest mass:

$$\varepsilon^2 = p^2 c^2. \tag{31}$$

We now assume with de Broglie that frequency and energy, and wavelength and momentum, are related in the same way for classical particles as for photons, and consider a wave equation for non-zero rest mass particles. So we want to end up with:

$$\varepsilon^2 = p^2 c^2 + m^2 c^4. \tag{32}$$
Inserting this equation (32) into equation (30), it is straightforward from (27), that we get:

$$\left( \nabla^2 - \frac{m^2 c^2}{\hbar^2} \right) \Psi = \frac{1}{\epsilon^2} \frac{\partial^2 \Psi}{\partial t^2}$$  \hspace{1cm} (33)

which is the Klein-Gordon equation for a free particle [32]. Now we want to obtain Schrödinger equation, which is non-relativistic case of (33). The first step is to approximate \( \epsilon^2 = p^2 c^2 + m^2 c^4 \), as follows:

$$\epsilon = mc^2 \sqrt{1 + \frac{p^2}{m^2 c^2}} = mc^2 + \frac{p^2}{2m} \approx mc^2 + T.$$  \hspace{1cm} (34)

After some approximation steps, then Ward & Volkmer obtained the Schrödinger equation starting from (34) and (33):

$$-\frac{\hbar^2}{2m} \nabla^2 \phi = i\hbar \frac{\partial \phi}{\partial t},$$  \hspace{1cm} (35)

Where the non-relativistic wave function \( \Phi \) is also constrained to the condition that it be normalizable to unit probability.

While we can conclude that there exists formal connection between classical wave equation and Schrödinger equation, but it still requires some assumptions and approximations. Therefore we can consider that Shpenkov’s interpretation of classical wave equation (9) is more realistic for atomic and molecular modeling.

b. Sound wave analogy with quantum mechanics

Hilbert and Batelaan [33] explores equivalence between the quantum system and the acoustic system. They find that the analytic solution to the quantum system exhibits level splitting as does the acoustic system. A simple physical system is discussed that mirrors the quantum mechanical infinite square well with a central delta well potential. They compare the acoustic resonances in a closed tube and the quantum mechanical eigenfrequencies of an infinite square well. They find that the acoustic displacement standing wave is:

$$\xi(x) = \xi_{\text{max}} \sin \left( \frac{n\pi x}{2a} \right),$$  \hspace{1cm} (36)

For the nth resonance. Equation (36) is the same shape as the quantum mechanical wave function. Their approach to find analogy between sound wave and quantum mechanics may be useful to be investigated further.
7. Concluding remarks

We have discussed some weaknesses of Schrödinger equation for description of atom and molecules. Then we discuss Shpenkov’s wave model of atom and molecules based on classical wave equation. It is shown that his model is able to arrive at a periodic table of elements which is close to Mendeleyev’s periodic law. Some possible applications of this interpretation of classical wave equation are also discussed, and future research in energy applications may be found fruitful.

While we emphasize that a wave equation should be able to model atom and molecule in realistic way, our view is that there can be possible correspondence between classical mechanics and quantum mechanics. Further investigations in this direction are recommended, in particular using Shpenkov’s interpretation of classical wave equation.

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Chapter IV: A Derivation of GravitoElectroMagnetic (GEM) Proca-type equations in Fractional Space

Abstract

In a recent paper, M. Zubair et al. described a novel approach for fractional space generalization of the differential electromagnetic equations. A new form of vector differential operator $\nabla$ and its related differential operators are formulated in fractional space. Using these modified vector differential operators, the classical Maxwell equations have been worked out for fractal media. In the meantime, there are other papers discussing fractional Maxwell equations. However, so far there is no derivation of Proca equations and GravitoElectroMagnetic (GEM) Proca-type equations in fractional space. In this paper, I present for the first time a derivation of GravitoElectroMagnetic (GEM) Proca-type equations in fractional space. Considering that Proca equations may be used to explain some electromagnetic effect in superconductor, I suggest that fractional GEM Proca-type equations may be used to explain some gravitomagnetic effects of superconductor for fractal media. It is hoped that this paper may stimulate further investigations and experiments on gravitomagnetic effects.

Key Words: fractional space, Proca equation, gravitoelectromagnetic, GEM, Maxwell equations.

1. Introduction

There have been much interests to study different physical phenomenon in fractional dimensional space during the last few decades. It is also important to mention that the experimental measurement of the dimension of real world is $3 \pm 10^{-6}$, not exactly 3 [1].

In a recent paper, M. Zubair et al. described a novel approach for fractional space generalization of the differential electromagnetic equations [1]. A new form of vector differential operator $\nabla$, and its related differential operators, is formulated in fractional space. Using these modified vector differential operators, the classical Maxwell equations have been worked out for fractal media. In the meantime, there are other papers discussing fractional Maxwell equations [2-3]. However, so far there is no derivation of Proca equations and GravitoElectroMagnetic Proca-type equations in fractional space. Therefore in this paper I present for the first time a derivation of GravitoElectroMagnetic (GEM) Proca-type equations in fractional space. Considering that Proca equations may be used to explain some electromagnetic effect in superconductor[4], then fractional GEM Proca-type equations may be expected to explain some gravitomagnetic effects of superconductor for fractal media.[5] It is our hope, that this paper may stimulate further investigation and experiments in particular with respect to gravitomagnetic effects.
The present paper is intended to be a follow-up paper of my preceding paper, reviewing Shpenkov’s interpretation of classical wave equation and its role to explain periodic table of elements and other phenomena [16].

2. A review of previous result - Maxwell equations in fractional space

I will not re-derive Maxwell equations here. For a good reference on Classical Electrodynamics, see for example Julian Schwinger et al.’s book [9]. Penrose also discusses Maxwell equations shortly in his book: The Road to Reality [10].

Zubair et al. were able to write a differential form of Maxwell equations in far-field region in the fractional space as follows [1]:

\[ \text{div}_D D = \rho_v, \]  \hspace{1cm} (1)

\[ \text{div}_D B = 0, \]  \hspace{1cm} (2)

\[ \text{curl}_D E = -\frac{\partial B}{\partial t}, \]  \hspace{1cm} (3)

\[ \text{curl}_D H = J + \frac{\partial D}{\partial t}, \]  \hspace{1cm} (4)

and the continuity equation in fractional space as:

\[ \text{div}_D J = -\frac{\partial \rho_v}{\partial t}, \]  \hspace{1cm} (5)

where \( \text{div}_D \) and \( \text{curl}_D \) are defined as follows [1]:

\[ \text{div}_D F = \nabla_D \cdot F = \frac{\partial F_x}{\partial x} + \frac{1}{2} \frac{\alpha_1 - 1}{x} \frac{\partial F_x}{\partial x} + \frac{1}{2} \frac{\alpha_2 - 1}{y} \frac{\partial F_y}{\partial y} + \frac{1}{2} \frac{\alpha_3 - 1}{z} \frac{\partial F_z}{\partial z}, \]  \hspace{1cm} (6)

\[ \text{curl}_D F = \nabla_D \times F = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \frac{\partial}{\partial x} + \frac{1}{2} \frac{\alpha_1 - 1}{x} \frac{\partial}{\partial x} & \frac{\partial}{\partial y} + \frac{1}{2} \frac{\alpha_2 - 1}{y} \frac{\partial}{\partial y} & \frac{\partial}{\partial z} + \frac{1}{2} \frac{\alpha_3 - 1}{z} \frac{\partial}{\partial z} \\ F_x & F_y & F_z \end{vmatrix}, \]  \hspace{1cm} (7)

where parameters \( 0 < \alpha_1 \leq 1, \ 0 < \alpha_2 \leq 1 \) and \( 0 < \alpha_3 \leq 1 \) are used to describe the measure distribution of space where each one is acting independently on a single coordinate and the total dimension of the system is \( D = \alpha_1 + \alpha_2 + \alpha_3 \). [1]
3. Proca Equations in Fractional Space

Proca equations can be considered as an extension of Maxwell equations, and they have been derived in various ways, see for instance [4, 6, 7]. It can be shown that Proca equations can be derived from first principles [6], and also that Proca equations may have link with Klein-Gordon equation [7]. However, in this paper I will not attempt to re-derive Proca equations. Instead, I will use Proca equations as described in [6]. Then I will derive the Proca equations in fractional space, in accordance with Zubair et al.’s approach as outlined above[1].

According to Blackledge, Proca equations can be written as follows [7]

\[ \nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0} - \kappa^2 \phi, \] \hspace{1cm} (8)

\[ \nabla \cdot \vec{B} = 0, \] \hspace{1cm} (9)

\[ \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}, \] \hspace{1cm} (10)

\[ \nabla \times \vec{B} = \mu_0 j + \varepsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} + \kappa^2 \vec{A}, \] \hspace{1cm} (11)

where:

\[ \nabla \phi = -\frac{\partial \vec{A}}{\partial t} - \vec{E}, \] \hspace{1cm} (12)

\[ \vec{B} = \nabla \times \vec{A}, \] \hspace{1cm} (13)

\[ \kappa = \frac{mc_0}{\hbar}. \] \hspace{1cm} (14)

Therefore, by using the definitions in equation (6) and (7), we can arrive at Proca equations in fractional space from (8) through (13), as follows:

\[ \text{div}_D \vec{E} = \frac{\rho}{\varepsilon_0} - \kappa^2 \phi, \] \hspace{1cm} (15)

\[ \text{div}_D \vec{B} = 0, \] \hspace{1cm} (16)

\[ \text{curl}_D \vec{E} = -\frac{\partial \vec{B}}{\partial t}, \] \hspace{1cm} (17)
\[ \text{curl}_p \vec{B} = \mu_0 j + \varepsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} + \kappa^2 \vec{A}, \]  

where:

\[ \nabla_D \phi = -\frac{\partial \vec{A}}{\partial t} - \vec{E}, \]  

\[ \vec{B} = \text{curl}_p \vec{A}, \]  

and Del operator \( \nabla_D \) can be defined as follows [1]:

\[ \nabla_D = \left( \frac{\partial}{\partial x} + \frac{1}{2} \alpha_1 \frac{1}{x} \right) \hat{x} + \left( \frac{\partial}{\partial y} + \frac{1}{2} \alpha_2 \frac{1}{y} \right) \hat{y} + \left( \frac{\partial}{\partial z} + \frac{1}{2} \alpha_3 \frac{1}{z} \right) \hat{z}. \]  

To my best knowledge so far, the above expression of Proca equations in fractional space has not been proposed elsewhere before.

Since according to Blackledge, the Proca equations can be viewed as a unified wavefield model of electromagnetic phenomena [7], then we can also regard the Proca equations in fractional space as further generalization of this unified wavefield picture.

### 4. GravitoElectroMagnetic (GEM) Proca-type Equations in Fractional Space

The term GravitoElectroMagnetism (GEM) refers to the formal analogies between Newton’s law of gravitation and Coulomb’s law of electricity. The theoretical analogy between the electromagnetic and the gravitational field equations has been first suggested by Heaviside in 1893, see for example [8]. The fields of GEM can be defined in close analogy with the classical electrodynamics. Therefore, if we can consider Proca equations as generalization and extension of Maxwell equations, then we can also find GravitoElectroMagnetic Proca-type equations.

In accordance with Demir [8], the GravitoElectroMagnetic Proca-type equations can be expressed straightforward from their electromagnetic counterpart as follows (Here I use Demir’s notations instead of Blackledge’s notations):

\[ \nabla \cdot \vec{E}_g = -\rho_e - \kappa^2 \phi, \]  

\[ \nabla \cdot \vec{H}_g = 0, \]  

\[ \nabla \times \vec{E}_g = -\frac{\partial \vec{H}_g}{\partial t}, \]
\( \nabla \times \vec{H}_g = -J_g^e + \frac{\partial \vec{E}_g}{\partial t} + \kappa_g^2 \vec{A}_g^e, \) \hspace{1cm} (25)

where the fields \( E_g \) and \( H_g \) can be defined in terms of the potentials just as given in equation (12) and (13), and the term \( \kappa_g^2 \) represents the inverse Compton wavelength of the graviton, [8]

\[ \kappa_g^2 = \frac{m_g c}{\hbar}. \] \hspace{1cm} (26)

Now I will present the Proca-type equations for GEM in fractional space using the same method as described in the previous section and equation (6) and (7), which can be written as follows:

\[ \text{div}_D \vec{E}_g = -\rho_e - \kappa_g^2 \phi, \] \hspace{1cm} (27)

\[ \text{div}_D \vec{H}_g = 0, \] \hspace{1cm} (28)

\[ \text{curl}_D \vec{E}_g = -\frac{\partial \vec{H}_g}{\partial t}, \] \hspace{1cm} (29)

\[ \text{curl}_D \vec{H}_g = -J_g^e + \frac{\partial \vec{E}_g}{\partial t} + \kappa_g^2 \vec{A}_g^e, \] \hspace{1cm} (30)

To the best of my knowledge, the above expression of Proca-type equations for GEM in fractional space has not been proposed elsewhere before.

5. Fractional Helmholtz equation and solution of classical wave equation in fractional space

It is worth noting here that Zubair et al. also wrote Helmholtz equations in fractional space for \( E \) and \( H \) field as a consequence of Maxwell equations in fractional space, as follows [1]:

\[ \nabla_D^2 E - \mu e \frac{\partial^2 E}{\partial t^2} = 0, \] \hspace{1cm} (31)

\[ \nabla_D^2 H - \mu e \frac{\partial^2 H}{\partial t^2} = 0. \] \hspace{1cm} (32)

In another paper, Zubair, Mughal & Naqvi give a solution of this kind of Helmholtz equation in fractional space [11]. The Laplacian operator in D-dimensional fractional space is defined as follows:
\[ \nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\alpha_1 - 1}{x} \frac{\partial}{\partial x} + \frac{\partial^2}{\partial y^2} + \frac{\alpha_2 - 1}{y} \frac{\partial}{\partial y} + \frac{\partial^2}{\partial z^2} + \frac{\alpha_3 - 1}{z} \frac{\partial}{\partial z}. \]  

(33)

Then they derive a solution of equation (31) with the help of Bessel equation [11].

It is also interesting to note here that Shpenkov has suggested that a classical wave equation - which is essentially the same with Helmholtz equation - can be used to derive a periodic table of elements which is close to Mendeleyev’s periodic table [12-13]. This result is in contradiction to spherical solution of Schrodinger equation which does not explain any atom, except perhaps hydrogen [14-15]. Therefore, it seems worth to study what the effect of an extension of classical wave equation in fractional space to the structure of atoms and molecules is. A review of Shpenkov’s interpretation and use of classical wave equation can be found here [16].

Since the classical wave equation as described by Shpenkov is the same with the equation of vibrating string in 3-dimension [16], it seems possible to compare the solution of equation (31) with solution of fractal vibrating string. A few papers have been written discussing this fractal vibrating string in detail, which can be found elsewhere [17-18]. It seems worthwhile to study spherical solution of this fractal vibrating string equation in order to verify Shpenkov’s results, including his periodic table of elements. One possible way to find such a solution of fractal vibrating string is by obtaining numerical solution of such an equation by a method of converting fractional differential equation to partial differential equation as proposed by He & Li [19]. After a partial differential equation (PDE) is obtained, it seems not so difficult to find its numerical solution with computer algebra packages like Mathematica, Maple, Maxima, or MatLab.

**Concluding remarks**

In a recent paper, M. Zubair et al. described a novel approach for fractional space generalization of the differential electromagnetic equations. A new form of vector differential operator Del, and its related differential operators, is formulated in fractional space. Using these modified vector differential operators, the classical Maxwell equations have been worked out for fractal media. In the meantime, there are other papers discussing fractional Maxwell equations. However, so far there is no derivation of Proca equations and Gravitoelectromagnetic Proca-type equations in fractional space. Therefore in this paper I present for the first time a derivation of Gravitoelectromagnetic (GEM) Proca-type equations in fractional space. Considering that Proca equations may be used to explain some electromagnetic effect in superconductor, then fractional GEM Proca-type equations may be expected to explain some gravitomagnetic effects of superconductor for fractal media. It is our hope, that this paper may stimulate further investigation and experiments in particular with respect to gravitomagnetic effects.

I also propose to investigate further the spherical solution of Helmholtz equation corresponding to Proca-type equations for GEM in fractional space. This kind of investigation may be useful for the study of gravitomagnetic effect and gravitational wave.
Acknowledgments: I’d like to thank Dr. George Shpenkov for sending his papers.

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Chapter VI: A Derivation of Proca equations on Cantor Sets: A Local Fractional Approach

Abstract
In a recent paper published at *Advances in High Energy Physics* (AHEP) journal, Yang Zhao et al. derived Maxwell equations on Cantor sets from the local fractional vector calculus. It can be shown that Maxwell equations on Cantor sets in a fractal bounded domain give efficiency and accuracy for describing the fractal electric and magnetic fields. Using the same approach, elsewhere Yang, Baleanu & Tenreiro Machado derived systems of Navier-Stokes equations on Cantor sets. However, so far there is no derivation of Proca equations on Cantor sets. Therefore, in this paper I present for the first time a derivation of Proca equations and GravitoElectroMagnetic (GEM) Proca-type equations on Cantor sets. Considering that Proca equations may be used to explain electromagnetic effects in superconductor, I suggest that Proca equations on Cantor sets can describe electromagnetic of fractal superconductors; besides GEM Proca-type equations on Cantor sets may be used to explain some gravitoelectromagnetic effects of superconductor for fractal media. It is hoped that this paper may stimulate further investigations and experiments in particular for fractal superconductor. It may be expected to have some impact to fractal cosmology modeling too.

Key Words: Cantor sets, fractal cosmology, gravitoelectromagnetic effect, local fractional vector calculus, Maxwell equations, Proca equations, superconductor.

1. Introduction
According to the late Benoit Mandelbrot, fractal geometry is a workable geometric middle ground between excessive geometric order of Euclid and the geometric chaos of general mathematics. It is based on a form of symmetry that had previously been underused, namely invariance, under contraction or dilation. [1] Fractal geometry has many applications including in biology, physics, geophysics, engineering, mathematics, cosmology and other fields of science and art. A rapidly growing field is to express electromagnetic wave equations in fractal media.
The present paper is intended to be a follow-up paper of my three recent papers: one paper reviews Shpenkov’s interpretation of classical wave equation and its role to explain periodic table of elements and other phenomena [16], and the second one presents a derivation of GravitoElectroMagnetic Proca equations in fractional space [19], and the third one presents an outline of cosmology based on the concept of fractal vibrating string [28].

The idea for writing the present paper comes from George Shpenkov’s papers, where he shows that a correct interpretation of classical wave equation yields a periodic table of elements which is close to Mendeleyev’s periodic law.[13][14][15] From that result he is able to derive many results corresponding to the structure of neutron, proton, and molecules based on classical wave equation:

\[
\Delta \Psi - \frac{1}{c^2} \frac{\partial^2 \Psi}{\partial t^2} = 0
\]

This equation is also known as the wave equation of sound or string vibration. George Shpenkov’s work is based on: (1) Dialectical philosophy and dialectical logic; (2) The postulate on the wave nature of all phenomena and objects in the Universe.[12]

Now the question is: Is it possible to hypothesize that the entire Universe consists of sound wave and vibration and frequency, just like atoms and molecules? Interestingly, Leonardo Rubino puts forth that conjecture based on the same classical wave equation.[20][21] He hypothesizes that the frequency of the Universe is: [22]
One persistent question in this regard is: How to explain photon as quanta and also photoelectric effect from this wave picture? Interestingly, Xin-an Zhang has provided an outline of answer to that question, which will be described as follows.\[23\] In his approach, the electromagnetic force is regarded as deferring to the sine function, reach the highest at the position of 1/4 wavelength. At this point, if the highest force is not able to move the particle, the particle will never been moved because the succeeding force will drop down with the law of sine function. That means, the energy transmission will occur only in the front of 1/4 wavelength of the light. As shown in Figure 1, the force \( f \) that the light wave strikes on the electron is \( f = F \sin \varphi \), where \( F \) is the maximal value of force, \( \varphi \) is the phase angle.

![Figure 1](image_url) •

Figure 1. The force deferring to sine function acting on the particle \[23\]

When the displacement on the abscissa is \( l \), the phase angle will be \( 2\pi \frac{l}{\lambda} \) and \( f = F \sin(2\pi \frac{l}{\lambda}) \).

Given that \( s \) is the displacement of the particle been pushed by the light wave and \( S \) is its maximal value, then the work that the wave force to the particle will be

\[
W = \int_0^s F \sin(2\pi \frac{l}{\lambda}) ds.
\]

where the sine function can be expanded

\[
f_{\text{Univ}} = 4,047 \cdot 10^{-21} \text{Hz}
\]
\[
\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} \ldots \tag{4}
\]

In accordance with the above discussion, the energy transmission merely happens at the front 1/4 wavelength. Thus, the \( x = 2\pi \frac{l}{\lambda} \) is smaller than 1. And we get \( \sin(2\pi \frac{l}{\lambda}) \approx \frac{2\pi l}{\lambda} \), then we substitute it into Eq. (3), finishing the integral and considering the energy has been transmitted totally, then we get

\[
E = W = F \sin(2\pi \frac{l}{\lambda})S = 2\pi FS \frac{l}{\lambda} \tag{5}
\]

Designating \( c, \lambda, \nu \) and the light speed, wavelength and frequency separately, considering \( l = ct \) and setting

\[
h = 2\pi FS \frac{l}{c} = 2\pi FtS \tag{6}
\]

Hence, we get

\[
E = \nu h \tag{7}
\]

It can be concluded therefore, that the quanta of photon can be described from a wave viewpoint too. Xin-an Zhang is also able to explain Compton effect, atomic hydrogen spectrum formula, as well as the blackbody radiation from the viewpoint of wave vibration [23].

Therefore it appears interesting to generalize further the wave equation of sound, in particular considering new results in fractal geometry studies, as follows:

a. To generalize the wave equation of sound (1) to become fractal vibrating string or fractal wave equation;

b. To generalize the wave equation to become Maxwell equations and Proca equations for massive photon. Such a generalization is possible because when the non-differentiable
terms are removed from Maxwell equations, it can easily be shown that the components of electrical field-strength and the components of magnetic field-strengths all satisfy the standard wave equation: \( \nabla^2 \phi = \left( \frac{1}{c^2} \right) \frac{\partial^2 \phi}{\partial t^2} \), see Thornhill [25].

c. To generalize further Maxwell equations and Proca equations on Cantor sets.

For point a), it has been suggested in a recent paper to write down the wave equation on Cantor sets (local fractional wave equation) as follows: [24, p.2]

\[
\frac{\partial^{2\alpha} u(x,t)}{\partial t^{2\alpha}} - a^{2\alpha} \frac{\partial^{2\alpha} u(x,t)}{\partial x^{2\alpha}} = 0
\]  

(8)

where the operators are local fractional ones. For other approaches, see [17][18].

In this regard, in a recent paper Yang Zhao et al. derived Maxwell equations on Cantor sets from the local fractional vector calculus.[2] It can be shown that Maxwell equations on Cantor sets in a fractal bounded domain give efficiency and accuracy for describing the fractal electric and magnetic fields. Using the same approach, elsewhere Yang, Baleanu & Tenreiro Machado derived systems of Navier-Stokes equations on Cantor sets.[11] However, so far there is no derivation of Proca equations and GravitoElectroMagnetic (GEM) Proca-type equations on Cantor sets. Therefore, in this paper I present for the first time a derivation of Proca equations and GEM Proca-type equations on Cantor sets. Considering that Proca equations may be used to explain electromagnetic effects in superconductor, I suggest that GEM Proca-type equations on Cantor sets may be used to explain some gravitoelectromagnetic effects of superconductor for fractal media. It is hoped that this paper may stimulate further
investigations and experiments on gravitomagnetic effects in particular for superconductor. It may be expected to have some impact to fractal cosmology modeling too.

It shall be noted that the present paper is not intended to be a complete description of fractal gravitoelectromagnetic wave theory on Cantor sets. Instead, this paper is intended to stimulate further investigations and experiments related to gravitoelectromagnetic effects of superconductors in fractal media and their implications to fractal cosmology modeling.

2. A review of previous result - Maxwell equations on Cantor sets


Zhao et al. were able to write the local fractional differential forms of Maxwell equations on Cantor sets as follows [2, p.4-5]:

- Gauss’s law for the fractal electric field: $\nabla^\alpha \cdot D = \rho$, \hspace{1cm} (9)

- Ampere’s law in the fractal magnetic field: $\nabla^\alpha \times H = J^\alpha + \frac{\partial^\alpha D}{\partial t^\alpha}$, \hspace{1cm} (10)

- Faraday’s law in the fractal electric field: $\nabla^\alpha \times E = -\frac{\partial^\alpha B}{\partial t^\alpha}$, \hspace{1cm} (11)

- magnetic Gauss’s law in the fractal magnetic field: $\nabla^\alpha \cdot B = 0$, \hspace{1cm} (12)

and the continuity equation can be defined as:

$$\nabla^\alpha \cdot J = -\frac{\partial^\alpha \rho}{\partial t^\alpha},$$ \hspace{1cm} (13)
where $\nabla^\alpha \cdot r$ and $\nabla^\alpha \times r$ are defined as follows:

2.1. In Cantor coordinates [11, p. 2]:

$$
\nabla^\alpha \cdot u = \text{div}^\alpha u = \frac{\partial^\alpha u_1}{\partial x^\alpha_1} + \frac{\partial^\alpha u_2}{\partial x^\alpha_2} + \frac{\partial^\alpha u_3}{\partial x^\alpha_3},
$$

(14)

$$
\nabla^\alpha \times u = \text{curl}^\alpha u = \left( \frac{\partial^\alpha u_3}{\partial x^\alpha_2} - \frac{\partial^\alpha u_2}{\partial x^\alpha_3} \right) e^\alpha_1 + \left( \frac{\partial^\alpha u_1}{\partial x^\alpha_3} - \frac{\partial^\alpha u_3}{\partial x^\alpha_1} \right) e^\alpha_2 + \left( \frac{\partial^\alpha u_2}{\partial x^\alpha_1} - \frac{\partial^\alpha u_1}{\partial x^\alpha_2} \right) e^\alpha_3.
$$

(15)

2.2. In Cantor-type cylindrical coordinates [2, p.4]:

$$
\nabla^\alpha \cdot r = \frac{\partial^\alpha r_R}{\partial R^\alpha} + \frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} + \frac{r_R}{R^\alpha} + \frac{\partial^\alpha r_z}{\partial z^\alpha},
$$

(16)

$$
\nabla^\alpha \times r = \left( \frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} - \frac{\partial^\alpha r_\theta}{\partial z^\alpha} \right) e^\alpha_R + \left( \frac{\partial^\alpha r_R}{\partial \theta^\alpha} - \frac{\partial^\alpha r_\theta}{\partial R^\alpha} \right) e^\alpha_\theta + \left( \frac{\partial^\alpha r_\theta}{\partial z^\alpha} - \frac{r_R}{R^\alpha} + \frac{1}{R^\alpha} \frac{\partial^\alpha r_R}{\partial \theta^\alpha} \right) e^\alpha_z.
$$

(17)

It is worth noting here, that Martin Ostoja-Starzewski has derived Maxwell equations in anisotropic fractal media using a different method. [3]

3. Proca Equations on Cantor Sets

Proca equations can be considered as an extension of Maxwell equations, and they have been derived in various ways, see for instance [4, 6, 7]. It can be shown that Proca equations can be derived from first principles [6], and also that Proca equations may have link with Klein-Gordon equation [7]. However, in this paper I will not attempt to re-derive Proca equations. Instead, I will use Proca equations as described in [6]. Then I will derive the Proca equations on Cantor Sets, in accordance with Zhao et al.’s approach as outlined above [2].

According to Blackledge, Proca equations can be written as follows [7]
\[ \nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0} - \kappa^2 \phi, \quad (18) \]

\[ \nabla \cdot \vec{B} = 0, \quad (19) \]

\[ \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}, \quad (20) \]

\[ \nabla \times \vec{B} = \mu_0 j + \varepsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} + \kappa^2 \vec{A}, \quad (21) \]

where:

\[ \nabla \phi = -\frac{\partial \vec{A}}{\partial t} - \vec{E}, \quad (22) \]

\[ \vec{B} = \nabla \times \vec{A}, \quad (23) \]

\[ \kappa = \frac{mc_0}{\hbar}. \quad (24) \]

Therefore, by using the definitions in equations (14)-(17), we can arrive at Proca equations on Cantor sets from (18) through (23), as follows:

\[ \nabla^a \cdot \vec{E} = \frac{\rho}{\varepsilon_0} - \kappa^2 \phi, \quad (25) \]

\[ \nabla^a \cdot \vec{B} = 0, \quad (26) \]

\[ \nabla^a \times \vec{E} = -\frac{\partial^a \vec{B}}{\partial t^a}, \quad (27) \]

\[ \nabla^a \times \vec{B} = \mu_0 j^a + \varepsilon_0 \mu_0 \frac{\partial^a \vec{E}}{\partial t^a} + \kappa^2 \vec{A}, \quad (28) \]

where:

\[ \nabla^a \phi = -\frac{\partial^a \vec{A}}{\partial t^a} - \vec{E}, \quad (29) \]

\[ \vec{B} = \nabla^a \times \vec{A}, \quad (30) \]
and Del operator $\nabla^\alpha \phi$ can be defined as follows [11, p.2]:

$$\nabla^\alpha \phi = \frac{\partial^\alpha \phi}{\partial x_1^\alpha} e_1^\alpha + \frac{\partial^\alpha \phi}{\partial x_2^\alpha} e_2^\alpha + \frac{\partial^\alpha \phi}{\partial x_3^\alpha} e_3^\alpha.$$  

(31)

To my best knowledge so far, the above expressions of Proca equations on Cantor sets (25)-(30) have not been proposed elsewhere before.

Since according to Blackledge, the Proca equations can be viewed as a *unified wavefield* model of electromagnetic phenomena [7], therefore we can also regard the Proca equations on Cantor sets as a further generalization of Blackledge’s *unified wavefield* model.

It appears interesting to remark here, that Luke Kenneth Casson Leighton [26] recently introduces an expansion of the Rishon Model to cover quark generations. He only uses a simple assumption that all particles in effect photons phase-locked in a repeating pattern inherently obeying Maxwell equations. Therefore, it may be expected that Proca equations on Cantor sets may have some impacts on the nature of Rishon Model.

One persistent question concerning these Proca equations is how to measure the mass of the photon. This question has been discussed in lengthy by Tu, Luo & Gillies [27]. According to their report, there are various methods to estimate the upper bound limits of photon mass. In Table 1 below, some of upper bound limits of photon mass based on dispersion of speed of light are summarized.
Table 1. Upper bound on the dispersion of the speed of light in different ranges of the electromagnetic spectrum, and the corresponding limits on the photon mass. [27, p.94]

<table>
<thead>
<tr>
<th>Author (year)</th>
<th>Type of measurement</th>
<th>Limits on $m_\gamma$ (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ross et al. (1937)</td>
<td>Radio waves transmission</td>
<td>$5.9 \times 10^{-42}$</td>
</tr>
<tr>
<td>Mandelstam &amp; Papalexi (1944)</td>
<td>Radio waves transmission over sea</td>
<td>$5.0 \times 10^{-43}$</td>
</tr>
<tr>
<td>Al’pert et al. (1941)</td>
<td>Radio waves transmission over sea</td>
<td>$2.5 \times 10^{-43}$</td>
</tr>
<tr>
<td>Florman (1955)</td>
<td>Radio-wave interferometer</td>
<td>$5.7 \times 10^{-42}$</td>
</tr>
<tr>
<td>Lovell et al. (1964)</td>
<td>Pulsar observations on flare stars</td>
<td>$1.6 \times 10^{-42}$</td>
</tr>
<tr>
<td>Frome (1958)</td>
<td>Radio-wave interferometer</td>
<td>$4.3 \times 10^{-40}$</td>
</tr>
<tr>
<td>Warner et al. (1969)</td>
<td>Observations on Crab Nebula pulsar</td>
<td>$5.2 \times 10^{-41}$</td>
</tr>
<tr>
<td>Brown et al. (1973)</td>
<td>Short pulses radiation</td>
<td>$1.4 \times 10^{-33}$</td>
</tr>
<tr>
<td>Bay et al. (1972)</td>
<td>Pulsar emission</td>
<td>$3.0 \times 10^{-46}$</td>
</tr>
<tr>
<td>Schaefer (1999)</td>
<td>Gamma ray bursts</td>
<td>$4.2 \times 10^{-34}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$6.1 \times 10^{-39}$</td>
</tr>
</tbody>
</table>

From this table and also from other results as reported in [27], it seems that we can expect that someday photon mass can be observed within experimental bound.

4. GravitoElectroMagnetic (GEM) Proca-type Equations on Cantor Sets

The term GravitoElectroMagnetism (GEM) refers to the formal analogies between Newton’s law of gravitation and Coulomb’s law of electricity. The theoretical analogy between the electromagnetic and the gravitational field equations has been first suggested by Heaviside in 1893, see for example [8]. The fields of GEM can be defined in close analogy with the classical electrodynamics. Therefore, if we can consider Proca equations as generalization and extension of Maxwell equations, then we can also find GravitoElectroMagnetic Proca-type equations.
In accordance with Demir [8], the GravitoElectroMagnetic Proca-type equations can be expressed straightforward from their electromagnetic counterpart as follows (Here I use Demir’s notations instead of Blackledge’s notations):

\[ \nabla \cdot \vec{E}_g = - \rho_e - \kappa_g^2 \phi, \quad (32) \]
\[ \nabla \cdot \vec{H}_g = 0, \quad (33) \]
\[ \nabla \times \vec{E}_g = - \frac{\partial \vec{H}_g}{\partial t}, \quad (34) \]
\[ \nabla \times \vec{H}_g = - J^e_g + \frac{\partial \vec{E}_g}{\partial t} + \kappa_g^2 \vec{A}_g, \quad (35) \]

where the fields \( E_g \) and \( H_g \) can be defined in terms of the potentials just as given in equation (22) and (23), and the term \( \kappa_g \) represents the inverse Compton wavelength of the graviton, [8]

\[ \kappa_g = \frac{m_g c}{h}. \quad (36) \]

Now I will present the GEM Proca-type equations on Cantor sets using the same method as described in the previous section and with definitions in equations (14)-(17), as follows:

\[ \nabla^a \cdot \vec{E}_g = - \rho_e - \kappa_g^2 \phi, \quad (37) \]
\[ \nabla^a \cdot \vec{H}_g = 0, \quad (38) \]
\[ \nabla^a \times \vec{E}_g = - \frac{\partial^a \vec{H}_g}{\partial t^a}, \quad (39) \]
\[ \nabla^a \times \vec{H}_g = - J^e_g + \frac{\partial^a \vec{E}_g}{\partial t^a} + \kappa_g^2 \vec{A}_g, \quad (40) \]
To my best knowledge so far, the above expressions of GravitoElectroMagnetic Proca equations on Cantor sets (37)-(40) have not been proposed elsewhere before. It will be interesting to conduct experiments to measure on how extent these equations on Cantor sets differ from the GEM Proca equations [4][5].

Concluding remarks
In a recent paper Yang Zhao et al. derived Maxwell’s equation on Cantor sets from the local fractional vector calculus. It can be shown that Maxwell’s equations on Cantor sets in a fractal bounded domain give efficiency and accuracy for describing the fractal electric and magnetic fields. Using the same approach, elsewhere Yang, Baleanu & Tenreiro Machado derived systems of Navier-Stokes equations on Cantor sets. However, so far there is no derivation of Proca equations and GravitoElectroMagnetic Proca-type equations on Cantor sets. Therefore, in this paper I present for the first time a derivation of Proca equations and GravitoElectroMagnetic (GEM) Proca-type equations on Cantor sets. Considering that Proca equations may be used to explain electromagnetic effects in superconductor, I suggest that GEM Proca-type equations on Cantor sets may be used to explain some gravitoelectromagnetic effects of superconductor for fractal media. It is hoped that this paper may stimulate further investigations and experiments on gravitomagnetic effects in particular for superconductor. It may be expected to have some impact to fractal cosmology modeling too.

It shall be noted that the present paper is not intended to be a complete description of fractal gravitation wave theory on Cantor sets. Instead, this paper is intended to stimulate further
investigations and experiments related to gravitomagnetic effect of superconductors and their implications to fractal cosmology modeling. This kind of investigation may be useful for the study of gravitomagnetic effects.

Of course, any generalization and simplification have its own risk, but we should also remember that Schrödinger himself considered that everything is wave, although he failed to convince anyone else. Furthermore, there is a wave function model of universe known as Wheeler-DeWitt equation, which is quite popular in quantum cosmology study. However, it is known that WDW equation lacks observational support. Therefore we hope that using the wave equation we may obtain better results.

By suggesting that Universe can be modeled as a wave, we wish to push the boundary of observation limit. Only time will tell if this endeavor will yield something.

**Acknowledgments:** I’d like to thank Dr. George Shpenkov for sending his papers. Special thanks to Dr. Xin-an Zhang for sending his papers too. Nonetheless, the ideas presented here are my sole responsibility.

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Chapter VII: London-Hirsch-Proca equations for Electrodynamics of Superconductors on Cantor sets

Abstract

In a recent paper published at Advances in High Energy Physics (AHEP) journal, Yang Zhao et al. derived Maxwell equations on Cantor sets from the local fractional vector calculus. It can be shown that Maxwell equations on Cantor sets in a fractal bounded domain give efficiency and accuracy for describing the fractal electric and magnetic fields. However, so far there is no derivation of equations for electrodynamics of superconductor on Cantor sets. Therefore, in this paper I present for the first time a derivation of London-Proca-Hirsch equations on Cantor sets. The name of London-Proca-Hirsch is proposed because the equations were based on modifying Proca and London-Hirsch’s theory of electrodynamics of superconductor. Considering that Proca equations may be used to explain electromagnetic effects in superconductor, I suggest that the proposed London-Proca-Hirsch equations on Cantor sets can describe electromagnetic of fractal superconductors. It is hoped that this paper may stimulate further investigations and experiments in particular for fractal superconductor. It may be expected to have some impact to fractal cosmology modeling too.

Key Words: Cantor sets, Hirsch theory, London equations, local fractional vector calculus, Maxwell equations, Proca equations, electrodynamics, superconductor.

1. Introduction

According to J.E. Hirsch, from the outset of superconductivity research it was assumed that no electrostatic fields could exist inside superconductors and this assumption was incorporated into conventional London electrodynamics.[2] Hirsch suggests that there are difficulties with the two London equations. To summarize, London’s equations together with Maxwell’s equations lead to unphysical predictions.[1] Hirsch also propose a new model for electrodynamics for superconductors. [1][2]

The present paper is intended to be a follow-up paper of our four recent papers: one paper reviews Shpenkov’s interpretation of classical wave equation and its role to explain
periodic table of elements and other phenomena [11], and the second one presents a derivation of GravitoElectroMagnetic Proca equations in fractional space [12], the third one presents an outline of cosmology based on the concept of fractal vibrating string [13], and the fourth one presents a derivation of Proca equations on Cantor sets [14].

In this regard, in a recent paper Yang Zhao et al. derived Maxwell equations on Cantor sets from the local fractional vector calculus. [3] It can be shown that Maxwell equations on Cantor sets in a fractal bounded domain give efficiency and accuracy for describing the fractal electric and magnetic fields. However, so far there is no derivation of equations for electrodynamics of superconductor on Cantor sets. Therefore, in this paper I present for the first time a derivation of London-Proca-Hirsch equations on Cantor sets. The name of London-Proca-Hirsch is proposed because the equations were based on modifying London equations, Proca equations and Hirsch’s theory of electrodynamics of superconductor.

Therefore the aim of the present paper is to propose a combined version of London-Proca-Hirsch model for electrodynamics of superconductor. Then I extend further this proposed model for electrodynamics of superconductor on Cantor sets. Considering that Proca equations may be used to explain electromagnetic effects in superconductor [4]-[8], I suggest that the proposed London-Proca-Hirsch equations on Cantor sets can describe electromagnetic of fractal superconductors. It is hoped that this paper may stimulate further investigations and experiments in particular for fractal superconductor. It may be expected to have some impact to fractal cosmology modeling too.

2. Hirsch’s model to revise London’s equations
According to J.E. Hirsch, from the outset of superconductivity research it was assumed that no electrostatic fields could exist inside superconductors and this assumption was incorporated into conventional London electrodynamics. Hirsch suggests that there are difficulties with the two London equations. Therefore he concludes that London’s equations together with Maxwell’s equations lead to unphysical predictions. However he still uses four-vectors $J$ and $A$ according to Maxwell’s equations:

$$\Box^2 A = -\frac{4\pi}{c} J,$$  \hspace{1cm} (1)

And

$$J - J_0 = -\frac{c}{4\pi\lambda_L^2} (A - A_0).$$  \hspace{1cm} (2)

Therefore Hirsch proposes a new fundamental equation for electrodynamics for superconductors as follows: [1]

$$\Box^2 (A - A_0) = \frac{1}{\lambda_L^2} (A - A_0),$$  \hspace{1cm} (3a)

where

- London penetration depth $\lambda_L$ is defined as follows:[2]

$$\frac{1}{\lambda_L^2} = \frac{4\pi n_e e^2}{m_e c^2},$$  \hspace{1cm} (3b)

- And d’Alembertian operator is defined as: [1]
\[ \Box^2 = \nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}. \] (3c)

Then he proposes the following equations: [1]

\[ \Box^2 (F - F_0) = \frac{1}{\lambda_L^2} (F - F_0), \] (4)

And

\[ \Box^2 (J - J_0) = \frac{1}{\lambda_L^2} (J - J_0), \] (5)

where \( F \) is the usual electromagnetic field tensor and \( F_0 \) is the field tensor with entries \( \overline{E}_0 \) and 0 from \( \overline{E} \) and \( \overline{B} \) respectively when expressed in the reference frame at rest with respect to the ions.

In the meantime, it is known that Proca equations can also be used to described electrodynamics of superconductors, see [4]-[8]. The difference between Proca and Maxwell equations is that Maxwell equations and Lagrangian are based on the hypothesis that the photon has zero mass, but the Proca’s Lagrangian is obtained by adding mass term to Maxwell’s Lagrangian.[17] Therefore, the Proca equation can be written as follows:[17]

\[ \partial_\mu F^{\mu \nu} + m_\gamma^2 A_\nu = \frac{4\pi}{c} J^\nu, \] (6a)

where \( m_\gamma = \frac{\omega}{c} \) is the inverse of the Compton wavelength associated with photon mass. [17] In terms of the vector potentials, equation (6a) can be written as [17]:

\[ \partial_\mu F^{\mu \nu} + m_\gamma^2 A_\nu = \frac{\omega}{c} J^\nu, \] (6b)
Similarly, according to Kruglov [15] the Proca equation for a free particle processing the mass \( m \) can be written as follows:

\[
\gamma^{\nu} \partial_{\nu} \varphi(x) + m^2 \varphi(x) = 0,
\]  

(6)

Now, the similarity between equations (1) and (6b) are remarkable with exception that equation (1) is in quadratic form. Therefore I propose to consider a modified form of Hirsch’s model as follows:

\[
(\Box^2 - m^2) (F - F_0) = \frac{1}{\Lambda_L^2} (F - F_0),
\]

(8a)

And

\[
(\Box^2 - m^2) (J - J_0) = \frac{1}{\Lambda_L^2} (J - J_0).
\]

(8b)

The relevance of the proposed new equations in lieu of (4)-(5) should be verified by experiments with superconductors [16]. For convenience, the equations (8a)-(8b) can be given a name: London-Proca-Hirsch equations.
3. A review of previous result - Maxwell equations on Cantor sets

I will not re-derive Maxwell equations here. For a good reference on Maxwell equations, see for example Julian Schwinger et al.’s book: *Classical Electrodynamics* [9].

Zhao et al. were able to write the local fractional differential forms of Maxwell equations on Cantor sets as follows [3, p.4-5]:

- Gauss’s law for the fractal electric field: \( \nabla^\alpha \cdot D = \rho \),

- Ampere’s law in the fractal magnetic field: \( \nabla^\alpha \times H = J^\alpha + \frac{\partial^\alpha D}{\partial t^\alpha} \),

- Faraday’s law in the fractal electric field: \( \nabla^\alpha \times E = -\frac{\partial^\alpha B}{\partial t^\alpha} \),

- magnetic Gauss’s law in the fractal magnetic field: \( \nabla^\alpha \cdot B = 0 \),

and the continuity equation can be defined as:

\[
\nabla^\alpha \cdot J = -\frac{\partial^\alpha \rho}{\partial t^\alpha},
\]

where \( \nabla^\alpha \cdot r \) and \( \nabla^\alpha \times r \) are defined as follows:

2.1. In Cantor coordinates [10, p. 2):

\[
\begin{align*}
\nabla^\alpha \cdot u &= \text{div}^\alpha u = \frac{\partial^\alpha u_1}{\partial x_1^\alpha} + \frac{\partial^\alpha u_2}{\partial x_2^\alpha} + \frac{\partial^\alpha u_3}{\partial x_3^\alpha}, \\
\nabla^\alpha \times u &= \text{curl}^\alpha u = \left( \frac{\partial^\alpha u_3}{\partial x_2^\alpha} - \frac{\partial^\alpha u_2}{\partial x_3^\alpha} \right) e_1^\alpha + \left( \frac{\partial^\alpha u_2}{\partial x_1^\alpha} - \frac{\partial^\alpha u_1}{\partial x_2^\alpha} \right) e_2^\alpha + \left( \frac{\partial^\alpha u_1}{\partial x_2^\alpha} - \frac{\partial^\alpha u_2}{\partial x_1^\alpha} \right) e_3^\alpha.
\end{align*}
\]

2.2. In Cantor-type cylindrical coordinates [3, p.4]:

\[
\begin{align*}
\nabla^\alpha \cdot r &= \frac{\partial^\alpha r_R}{\partial R^\alpha} + \frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} + \frac{r_R}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} + \frac{1}{R^\alpha} \frac{\partial^\alpha r_\phi}{\partial \phi^\alpha}, \\
\nabla^\alpha \times r &= \left( \frac{\partial^\alpha r_\theta}{\partial \phi^\alpha} - \frac{\partial^\alpha r_\phi}{\partial \theta^\alpha} \right) e_1^\alpha + \left( \frac{\partial^\alpha r_\phi}{\partial R^\alpha} - \frac{\partial^\alpha r_R}{\partial \phi^\alpha} \right) e_2^\alpha + \left( \frac{\partial^\alpha r_R}{\partial \theta^\alpha} - \frac{\partial^\alpha r_\theta}{\partial R^\alpha} \right) e_3^\alpha.
\end{align*}
\]
\[ \nabla^a \times r = \left( \frac{1}{R^a} \frac{\partial^a r_\theta}{\partial \theta^a} - \frac{\partial^a r_\theta}{\partial z^a} \right) e^a_r + \left( \frac{\partial^a r_\theta}{\partial z^a} - \frac{\partial^a r_\theta}{\partial R^a} \right) e^a_\theta + \left( \frac{\partial^a r_\theta}{\partial R^a} + \frac{r_R}{R^a} - \frac{1}{R^a} \frac{\partial^a r_\theta}{\partial \theta^a} \right) e^a_z. \] (17)

3. London-Proca-Hirsch Equations on Cantor Sets

It can be shown that Proca equations can be derived from first principles [6], and also that Proca equations may have link with Klein-Gordon equation [7]. However, in this paper I will not attempt to re-derive Proca equations. Instead, I will use Proca equations as described in [6]. Then I will derive the London-Proca-Hirsch equations on Cantor Sets, in accordance with Zhao et al.’s approach as outlined above [3].

According to Blackledge, Proca equations can be written as follows [7]:

\[ \nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0} - \kappa^2 \phi, \] (18)

\[ \nabla \cdot \vec{B} = 0, \] (19)

\[ \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}, \] (20)

\[ \nabla \times \vec{B} = \mu_0 j + \varepsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} + \kappa^2 \vec{A}, \] (21)

where:

\[ \nabla \phi = -\frac{\partial \vec{A}}{\partial t} - \vec{E}, \] (22)

\[ \vec{B} = \nabla \times \vec{A}, \] (23)

\[ \kappa = \frac{mc_0}{\hbar}. \] (24)
Therefore, by using the definitions in equations (14)-(17), we can arrive at Proca equations on Cantor sets from (18) through (23), as follows:

\[
\nabla^\alpha \cdot \vec{E} = \frac{\rho}{\varepsilon_0} - \kappa^2 \phi, \tag{25}
\]

\[
\nabla^\alpha \cdot \vec{B} = 0, \tag{26}
\]

\[
\nabla^\alpha \times \vec{E} = -\frac{\partial^\alpha \vec{B}}{\partial t^\alpha}, \tag{27}
\]

\[
\nabla^\alpha \times \vec{B} = \mu_0 j^\alpha + \varepsilon_0 \mu_0 \frac{\partial^\alpha \vec{E}}{\partial t^\alpha} + \kappa^2 \vec{A}, \tag{28}
\]

where:

\[
\nabla^\alpha \phi = -\frac{\partial^\alpha \vec{A}}{\partial t^\alpha} - \vec{E}, \tag{29}
\]

\[
\vec{B} = \nabla^\alpha \times \vec{A}, \tag{30}
\]

and Del operator \( \nabla^\alpha \phi \) can be defined as follows [10, p.2]:

\[
\nabla^\alpha \phi = \frac{\partial^\alpha \phi}{\partial x_1} \epsilon_1^\alpha + \frac{\partial^\alpha \phi}{\partial x_2} \epsilon_2^\alpha + \frac{\partial^\alpha \phi}{\partial x_3} \epsilon_3^\alpha. \tag{31}
\]

Since according to Blackledge, the Proca equations can be viewed as a unified wavefield model of electromagnetic phenomena [7], therefore we can also regard the Proca equations on Cantor sets as a further generalization of Blackledge’s unified wavefield model.

Now, having defined Proca equations on Cantor Sets, we are ready to write down London-Proca-Hirsch on Cantor sets using the same definition, as follows:

\[
(\nabla^2 - \kappa^2)(F - F_0) = \frac{1}{\lambda_L} (F - F_0), \tag{32}
\]
And

\[(\Box_a^2 - \kappa^2)(J - J_0) = \frac{1}{\lambda_c^2}(J - J_0),\]  

(33)

where

\[
\Box_a^2 = \nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}.
\]  

(34)

As far as I know, the above London-Proca-Hirsch equations on Cantor Sets have never been presented elsewhere before. Provided the above equations can be verified with experiments, they can be used to describe electrodynamics of fractal superconductors on Cantor sets.

As a last note, it seems interesting to remark here that Kruglov [15] has derived a square-root of Proca equations as a possible model for hadron mass spectrum, therefore perhaps equations (32)-(34) may be factorized too to find out a model for hadron masses (on Cantor sets). However, this problem is left for other paper.

**Concluding remarks**

In a recent paper Yang Zhao et al. derived Maxwell equations on Cantor sets from the local fractional vector calculus. It can be shown that Maxwell equations on Cantor sets in a fractal bounded domain give efficiency and accuracy for describing the fractal electric and magnetic fields. However, so far there is no derivation of equations for electrodynamics of superconductor on Cantor sets. Therefore, in this paper I present for the first time a derivation of
London-Proca-Hirsch equations on Cantor sets. The name London-Proca-Hirsch is proposed because the equations were based on modifying London equations, Proca equations and Hirsch’s theory of electrodynamics of superconductor.

Therefore the aim of the present paper is to propose a combined version of London-Proca-Hirsch model for electrodynamics of superconductor. Then I extend further this proposed model for electrodynamics of fractal superconductor on Cantor sets. Considering that Proca equations may be used to explain electrodynamics in superconductor, the proposed London-Proca-Hirsch equations on Cantor sets may be able to describe electromagnetic of fractal superconductors. It is hoped that this paper may stimulate further investigations and experiments in particular for fractal superconductor. It may be expected to have some impact to fractal cosmology modeling too.

Acknowledgment: I’d like to express my sincere gratitude to Dr. George Shpenkov for sending his books and papers. Nonetheless, the ideas presented here are my sole responsibility.

References


Chapter VII: A review of Cancer Electromagnetic Frequency Therapy: Towards Physics of Cancer

Abstract

It is known that conventional chemotherapy has average success rate of less than 25%, which seems to suggest that we need a better therapy for cancer. Chemotherapy and radiation employ non-specific toxic effects to inhibit the proliferation of both normal and tumor cells. In this regard, specific low frequency EMT has been reported to restore the homeostatic function of genes involved with controlling cell growth. Here I discuss possibility of a novel approach of cancer treatment using various applications of electromagnetic frequency.

Introduction: Problems with conventional cancer treatment

Cancer constitutes one of the most serious causes of death worldwide and according to WHO, it accounted for 7.6 million deaths (around 13% of all deaths) in 2008 [5]. Deaths from cancer are projected to continue rising to over 11 million in 2030 [5]. Cancer is the end result of a series of genetic alterations that modify the control of proteins that promote (i.e. oncogenesis) or inhibit (i.e. suppressor genes) cell proliferation [1].

It is known that conventional chemotherapy has average success rate of less than 25%, which seems to suggest that we need a better therapy for cancer. Chemotherapy and radiation employ non-specific toxic effects to inhibit the proliferation of both normal and tumor cells. Hence side effects include hair loss, digestive problems and immune suppression. In order to reduce toxicity, current academic and pharmaceutical investigations are focusing on identifying novel methods to reverse cancer specific alterations in oncogenes or suppressor genes.

In this regard, specific low frequency EMT has been reported to restore the homeostatic function of genes involved with controlling cell growth. An assembly of cells, as in a tissue or organ, will have certain collective frequencies that regulate important processes, such as cell division. Hence, providing the correct or “healthy” frequency that entrains the oscillations back to coherence can restore growth control.[1, p.8]

Here I discuss possibility of a novel approach of cancer treatment using various applications of electromagnetic frequency.
In vivo and clinical Study

Published studies using cancer cell cultures and animal tumor models demonstrate that EMT induces cell death (i.e. apoptosis). The correlation between cell membrane potential and cancer cell proliferation was detailed in a classic paper by Cone (1970), see [1, p.8].

In vivo: several studies come to prove that anticancer activity of certain electric fields. In one of them, low intensity, intermediate frequency (100-300 kHz), alternating electric fields were used in in vivo treatment of tumours in C57BL/6 and BALB/c mice (B16F1 and CT-26 syngeneic tumour models, respectively) and induced significant slowing of tumour growth and extensive destruction of tumour cells within 306 days.[5, p.253].

In another study of Barbault et al., it is proposed that a combination of tumour-specific frequencies may have a therapeutic effect. A total of 1524 frequencies, ranging from 0.1 to 114 kHz, were identified from 163 cancer patients, while a compassionate treatment was offered to 28 patients with advanced cancer (breast, ovarian, pancreas, colon, prostate, sarcoma, and other types). None of the patients, who received experimental therapy, reported any side effects of significance. Thus, the tumour-specific frequencies provide an effective and well tolerated treatment which may present antitumour properties in end-stage patients [3], [5].

In the meantime, the study of cancer treatment with nanoparticles in an oscillating magnetic field began in the 1950s. In the late 1970s, researchers suggest that special coatings on the magnetic nanoparticles would cause them to selectively penetrate into cancer cells. This concept would allow intravene delivery of the nanoparticles into the body, followed by natural aggregation of the cancer tumor with nanoparticles. Recent developments in biochemistry make this novel approach feasible. Once selective coatings is available, electromagnetic heating will offer the unique advantage of selective heating only the cancer tumor. [2]

Possible mathematical model

There are many models of DNA, both the linear ones and the nonlinear ones [6]. One interesting model in this regard is the sine-Gordon model of DNA as proposed by Salerno [7], see also Daniel and Vasumathi [8]. It belongs to nonlinear model of DNA which is close to realistic model. A review of physical significance of this sine-Gordon model was given in [9].

Assuming the wavefunction $\Psi$ to be a function of $x$ and $t$, then the sine-Gordon (SGE) model of DNA can be written as follows: [8, p.7]
Meanwhile, perturbed SGE come in a variety of forms. One common form is a damped and driven SGE: [10, p.17]

\[ \psi_{tt} - \psi_{zz} + \sin(\psi) = 0 \]  

(1)

\[ \psi_{tt} + \phi \psi_{t} - \psi_{zz} + \sin(\psi) = F \]  

(2)

In addition, the following two versions of the perturbed SGE have been studied in the literature, including:

a. Directly forced SGE: [10, p.19]

\[ \psi_{tt} - \psi_{zz} + \sin(\psi) = M f(\omega t) \]  

(3)

b. Damped and driven SGE:

\[ \psi_{tt} - \psi_{zz} + \sin(\psi) = M f(\omega t) - a\psi_{t} + \eta \]  

(4)

In their in-depth review of SGE, Ivancevic and Ivancevic [10] discuss potential applications of SGE solitons in DNA, protein folding, microtubules, neural impulse conduction and muscular contraction soliton.

Considering that sine-Gordon equation has been used extensively by particle physicists, then it would be interesting to study possibility to improve or alter DNA using electromagnetic field such as electromagnetic frequency or magnetic vibration. This may be considered as a method for novel cancer treatment. However, physical mechanism of such an application of electromagnetic frequency for cancer treatment should be studied carefully.

New insights may be expected in the near future in these biological fields, based on sine-Gordon equation soliton.

**Concluding remarks**
Considering that sine-Gordon equation has been used extensively by particle physicists, then it would be interesting to study possibility to improve or alter DNA using electromagnetic field/pulse such as electromagnetic frequency or magnetic vibration. This may be considered as a method for novel cancer treatment. New insights may be expected in the near future in these biological fields, based on sine-Gordon equation soliton.

However, physical mechanism of such an application of electromagnetic frequency for cancer treatment should be studied carefully.

To conclude, despite ongoing research is needed, it seems that application of electromagnetic frequency can be a promising method either as complementary or alternative cancer treatment. It is not a popular approach yet, however as listed in Appendix, there are specialists and institutes offering this treatment in USA, Europe, Asia and elsewhere.

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References:


**Appendix: Table of Clinics offering Electromagnetic Frequency Therapy**

(not limited to cancer treatment)

This list is not complete, for a complete list see [1].

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Chapter VIII: String without String:
How Linearised Einstein’s Field Equations lead to wave equation and how to generalize it to fractal case

Abstract
In this paper, I argue that it is possible to model many physical phenomena in terms of classical wave equation. I already discussed this issue for the case of Maxwell equations and Sachs-Wolfe effect, and then I shall show how linearised version of Einstein’s field equations reduce to wave equation form. The latter can be generalized further into a fractal wave equation for Cantor sets. The title “String without String” is chosen to indicate that the classical String (wave) equation can be obtained without the standard String theory. It may be expected that the classical (string) vibration equation can become an alternative model which is more testable, compared to standard String theories which lack observation or predictability so far. However, I should emphasize that the proposed model as outlined here is not complete yet. Therefore, more research is needed.

Introduction
In this paper I will discuss how linearised Einstein’s field equations reduce to a wave equation, and then how to generalize it further to fractal case, i.e. to Cantor sets. The purpose is to emphasize that many physical phenomena both at small scales and also at large scales can be reduced to some versions of classical wave equation.

Despite more than 30 years of efforts given to the String Theories (ST), many physicists think that String Theories still lack testable predictions. Of course, there are a few achievements too, such as ST is supposed to be able to yield general relativity, but apparently no more than that.
Other physicists also derived that the prediction of cosmological constant by ST yields a value that is more than $10^{10}$ times the observed value, that is why some physicists such as Peter Woit called String theories as “Not Even Wrong” theory (to quote Pauli’s remark).

In order to overcome such a predictability problem, in this paper I would like to introduce a different approach. Instead of trying to re-derive quantum mechanics and general relativity from ST, I will instead show that almost everything can be expressed in terms of classical wave equation, be it small scale phenomenon or large scale phenomenon. This philosophy can be called as “String without String”, which is a term coined to indicate that the classical String (classical wave) equation can be obtained without having to begin with the standard String theory.

It may be expected that the classical string/wave vibration equation can become an alternative model which is more testable, compared to standard String theories which lack observation or predictability so far. However, I should emphasize that the proposed model as outlined here is not complete yet. More research is needed.
By giving up wave mechanics [1][2][3][4]. I have argued in some previous papers that it is possible to model many physical phenomena in terms of classical wave equation [11][12][13][14]. I will also recall a classical wave model of electron by Guenther Poelz [8]. In his paper, Poelz presented a classical model of the electron based on Maxwell’s equations, in which the wave character is described by classical physics. His model of electron shows a wave like behavior at small distances defined in 1924 by Louis de Broglie with a wave length related to its momentum p by: \[ \lambda_{db} = \frac{2\pi \hbar}{p}. \] Poelz admitted that almost everyone is accustomed to the view that classical mechanics and wave mechanics describe two different worlds, perfectly described for the electron by electrodynamics and by quantum electrodynamics with its extensions. A wide gap between both still exists which is not closed up to now by a satisfactory classical description. Therefore, he hopes that his electron model can serve to show that the electron may be described by an electromagnetic wave also in the classical region and thus a smooth transition between classical electrodynamics and quantum mechanics can be established.[8]

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16 For more discussion concerning why we shall give up the Wave Mechanics, first we should remember that the Schrodinger equation yields an imaginary wave which cannot be compared with physical wave whatsoever. Second, the Schrodinger equation uses a variable k which yields unphysical wave. And third, the Schrodinger equation was derived by combining relativistic de Broglie equation and Hamilton-Jacobi equation; this procedure yields non-relativistic equation which is in contradiction with its basic premise. Therefore the Schrodinger equation is full of flaws either from logical viewpoint or from physical wave viewpoint. See also my paper: Victor Christianto. A Review of Schrödinger Equation and Classical Wave Equation. *Prespacetime Journal*, May 2014. URL: www.prespacetime.com. Also available at: http://vixra.org/abs/1404.0020
It is my view that Poelz’s approach can be one example where a classical description of physical reality is suitable to provide a clear window of observation. Here in this paper I shall extend it further to large case: i.e. linearised Einstein’s field equations.

**How to reduce Linearised version of Einstein’s field equations to wave equation**

In this section I shall show that the free-space solutions for the metric perturbations of a nearly-flat spacetime take the form of a wave equation propagating at the speed of light, although for simplicity we restrict our discussion to the weak-field approximation.[9, p.2]

Since spacetime is flat in the absence of a gravitational field, a weak gravitational field can be defined as one in which spacetime is “nearly” flat. What we mean by nearly here is that we can find a coordinate system in which the metric has components [9, p.47]:

\[ g_{\alpha\beta} = \eta_{\alpha\beta} + h_{\alpha\beta}, \]  

(1)

Where:

\[ \eta_{\alpha\beta} = diag(-1,1,1,1) \]  

(2)

Is the Minkowski metric of Special Relativity, and \( |h_{\alpha\beta}| \ll 1 \) for all \( \alpha \) and \( \beta \).

A coordinate system which satisfies equations (1) and (2) is referred to as a **nearly Lorentz** coordinate system.
If we can work in a nearly Lorentz coordinate system for a nearly flat spacetime this simplifies Einstein’s equations considerably, and will eventually lead us to spot that the deviations from the metric of Minkowski metric (that is the components $h_{\alpha \beta}$ in equation (1)) obey a wave equation.

It can be shown that we can contract Riemann Christoffel tensor and thus obtain an expression for the Ricci tensor in linearised form. This can be shown to take the form [9, p. 53]:

$$R_{\mu \nu} = \frac{1}{2} \left( h_{\mu \nu ; \alpha} + h_{\nu ; \mu \alpha} - h_{\mu \nu ; \alpha} - h_{\mu \nu} \right),$$

(3)

Where we have written:

$$h \equiv h_{\alpha \beta} = \eta^{\alpha \beta} h_{\alpha \beta}$$

(4)

Recalling equation (2) we see that $h$ is essentially the trace of the perturbation $h_{\alpha \beta}$.

The next step is: the rather messy expression for the Einstein tensor can be simplified a little by introducing a modified form for the metric perturbation defined by [9, p.54]:

$$\bar{h} \equiv h_{\mu \nu} - \frac{1}{2} \eta_{\mu \nu} h$$

(5)

Then the solution of the linearised Einstein field equations can be written in the form of wave equation as follows [9, p. 56]:

$$\left(-\frac{\partial^2}{\partial t^2} + \nabla^2 \right) \bar{h}_{\mu \nu} = 0,$$

(6)

Or it is often written also as follows:
\[ \square h_{\mu\nu} = 0, \] 

(7)

where \( \square \) is known as the d’Alembertian.

Remembering that we are taking \( c=1 \), if instead we write:

\[ \eta^{00} = -\frac{1}{c^2}, \] 

(8a)

Then equation (6) can be re-written as:

\[ \left( -\frac{\partial^2}{\partial t^2} + c^2 \nabla^2 \right) h_{\mu\nu} = 0. \] 

(8b)

This is an important result, because equation (8b) has the mathematical form of a wave equation, propagating with speed \( c \). Thus, we have shown that the metric perturbations – the ripples in spacetime produced by disturbing the metric – propagate at the speed of light as waves in free space [9, p.57]. In other words, if this equation can be verified with experimental, it may be an indication of cosmic sound vibration or it may be called as String without String.

**How to generalize the Nabla Operator to Cantor sets: the case of Maxwell equations**

I will not re-derive Maxwell equations here. For a good reference on Maxwell equations, see for example Julian Schwinger et al.’s book: *Classical Electrodynamics* [15].

Zhao et al. were able to write the local fractional differential forms of Maxwell equations on Cantor sets as follows [7, p.4-5]:
- Gauss’s law for the fractal electric field: \( \nabla^\alpha \cdot D = \rho \), \hspace{1cm} (9)

- Ampere’s law in the fractal magnetic field: \( \nabla^\alpha \times H = J^a + \frac{\partial^\alpha D}{\partial t^a} \), \hspace{1cm} (10)

- Faraday’s law in the fractal electric field: \( \nabla^\alpha \times E = -\frac{\partial^\alpha B}{\partial t^a} \), \hspace{1cm} (11)

- magnetic Gauss’s law in the fractal magnetic field: \( \nabla^\alpha \cdot B = 0 \), \hspace{1cm} (12)

and the continuity equation can be defined as:

\[
\nabla^\alpha \cdot J = -\frac{\partial^\alpha \rho}{\partial t^a},
\]

where \( \nabla^\alpha \cdot r \) and \( \nabla^\alpha \times r \) are defined as follows:

1. In Cantor coordinates:

\[
\nabla^\alpha \cdot u = \text{div}^\alpha u = \frac{\partial^\alpha u_1}{\partial x_1^\alpha} + \frac{\partial^\alpha u_2}{\partial x_2^\alpha} + \frac{\partial^\alpha u_3}{\partial x_3^\alpha},
\]

\[
\nabla^\alpha \times u = \text{curl}^\alpha u = \left( \frac{\partial^\alpha u_1}{\partial x_2^\alpha} - \frac{\partial^\alpha u_2}{\partial x_1^\alpha} \right) e_1^\alpha + \left( \frac{\partial^\alpha u_2}{\partial x_3^\alpha} - \frac{\partial^\alpha u_3}{\partial x_2^\alpha} \right) e_2^\alpha + \left( \frac{\partial^\alpha u_3}{\partial x_1^\alpha} - \frac{\partial^\alpha u_1}{\partial x_3^\alpha} \right) e_3^\alpha.
\]

2. In Cantor-type cylindrical coordinates [7, p.4]:

\[
\nabla^\alpha \cdot r = \frac{\partial^\alpha r_R}{\partial R^\alpha} + \frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} + \frac{r_R}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial z^\alpha} + \frac{\partial^\alpha r_z}{\partial z^\alpha},
\]

\[

\]
\[ \nabla^a \times r = \left( \frac{1}{R^a} \frac{\partial r^a}{\partial \theta^a} - \frac{\partial r^a}{\partial z^a} \right) e^a_\theta + \left( \frac{\partial r^a}{\partial z^a} - \frac{\partial r^a}{\partial R^a} \right) e^a_z + \left( \frac{\partial r^a}{\partial R^a} + r^a - \frac{1}{R^a} \frac{\partial r^a}{\partial \theta^a} \right) e^a_z. \] (17)

**How to generalize Linearised version of Einstein’s field equations to Cantor sets**

Provided we can follow the above expressions for extending Nabla operator in Cantor coordinate and also in Cantor-type cylindrical coordinates, then it is possible to rewrite equation (8b) as follows:

\[ \left( -\frac{\partial^2}{\partial t^2} + c^2 \nabla^2 \right) \bar{h}_{\mu\nu} = 0. \] (18)

We can use several advanced methods to solve such a fractal wave equation, in accordance with a paper on Maxwell equations on Cantor sets [7]. For clarity, I have used this notation for extension of Nabla operator in Cantor coordinate:

\[ \nabla_a \cdot u = \text{div}^a u = \frac{\partial^a u_1}{\partial x_1^a} + \frac{\partial^a u_2}{\partial x_2^a} + \frac{\partial^a u_3}{\partial x_3^a}, \] (19)

And also this notation for extension of Nabla operator in Cantor-type cylindrical coordinates [7, p.4]:

\[ \nabla_a \cdot r = \frac{\partial^a r_\theta}{\partial R^a} + \frac{1}{R^a} \frac{\partial r_\theta}{\partial \theta^a} + \frac{r^a}{R^a} + \frac{\partial^a r_z}{\partial z^a}. \] (20)
As far as my knowledge, extension of equation (8b) into Cantor sets has never been considered elsewhere before. Therefore this equation (18) may indicate that there exists a kind of cosmic sound wave [16] which may be called as *fractal vibrating string* in cosmology scale. Moreover, Xin-an Zhang has shown that it is possible to explain dark energy from the viewpoint of acoustic sound waves [6]. However, I should emphasize that the proposed model as outlined here is not complete yet. Therefore, more research is needed.

Further extension may be done by considering fractal time instead of linear temporal dimension. This has been discussed in some papers by Leonid Kobelev [10].

**Concluding remarks**

In this paper, I argue that it is possible to model many physical phenomena in terms of classical wave equation. I already discussed how linearised version of Einstein’s field equations reduce to wave equation form. The latter can be generalized further into a fractal wave equation for Cantor sets. The title “String without String” is chosen to indicate that the classical String (wave) equation can be obtained without the standard String theory. It may be expected that the classical (string) vibration equation can become an alternative model which is more testable, compared to standard String theories which lack observation or predictability so far.

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an Zhang has shown that it is possible to explain dark energy from the viewpoint of acoustic sound waves. However, I should emphasize that the proposed model as outlined here is not complete yet. Therefore, more research is needed.

Acknowledgement

Special thanks to Prof. Guenther Poelz for his remark on a question posted at www.researchgate.net. And also many thanks to Prof. Akira Kanda for clarifying his opinions concerning some fundamental flaws of Schrödinger equation and quantum mechanics in general. The writer would like to express his gratitude to Dr. George Shpenkov or sending his books and papers. Special thanks to Dr. Xin-an Zhang for sending his book and papers too.

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Chapter IX: From Sachs-Wolfe Acoustic Theorem to Fractal Laplace Beltrami Operator

“The heavens declare the glory of God;
The skies proclaim the work of His hands.
Day after day they pour forth speech;
Night after night they display knowledge.
There is no speech or language where their voice is not heard.
Their voice goes out into all the earth,
Their words to the ends of the world.” (Psalm 19:1-4; NIV)

Abstract

According to Czaja, Golda, and Woszczyna (2011), if one considers the acoustic field propagating in the radiation-dominated ($p=\epsilon/3$) universe of arbitrary space curvature ($K=0,\pm1$), then the field equations are reduced to the d’Alembert equation in an auxiliary static Robertson-Walker spacetime. This is related to the so-called Sachs-Wolfe acoustic theorem, which can be found useful in the observation and analysis of Cosmic Microwave Background anisotropies. In this paper I also discuss what Laplace-Beltrami operator for curved space is, and then how this operator may be extended further to become fractal Laplace-Beltrami Operator. In the last section I discuss possible implications for dark energy observation.

A. Introduction

The verses 1-4 of Psalm 19 as quoted above express clearly how the Universe propagates a set of unheard voices yet proclaiming the greatness of God. In my reading, these remind us to the Prolegomena of John (verse 1:1) where it is said that the Logos or Wisdom of God was there since the beginning and He played a prominent role in the creation of the Universe. Combining these two passages then it seems we can conclude that the Logos or Christ in His pre-existence was the mediator of creation process by the Father in Heaven.
The next thing that I would like to offer is that such an interpretation seems to agree with the idea of Sacred Voice as declared in Hinduism: it is said that the Universe was created by utterances of Brahman. Similarly, in Islamic belief, it is stated that the Universe was created as God spoke (Kun Fayakun). Therefore this line of thoughts may form a good basis for religious dialogue among different religions and cultures.

Now the question is: can this line of thought of Sacred Utterance in the Beginning be reconciled with modern cosmology? We will discuss how such a dialogue is perhaps possible through studying the Sachs-Wolfe acoustic theorem, which can be found useful in the observation and analysis of Cosmic Microwave Background anisotropies.

It is known for quite long time, that the Sachs-Wolfe effect represents the effects of variations of dark energy density to the temperature variations of CMB radiation: resulting gravitational potential wells and hills induce gravitation blue/red shift/ shift CMB photons. The d'Alembert equation for perturbation in Robertson-Walker background can be decomposed in standard manner and one ends up with eigenmodes of 3-D LaplaceBeltrami operator. In static RW background this is called the Sachs-Wolfe Acoustic Theorem.

The Sachs–Wolfe theorem ([1], pp. 76–77) contains two separate results formulated for two different equations of state: the first (i, p. 76) for pressureless matter (p=0) and the second (ii, p. 77) for an ultrarelativistic gas \( (p=\varepsilon/3) \). According to Czaja, Golda, and Woszczyna [2], the second theorem can be called as the acoustic theorem, to distinguish it with the other.

The Sachs–Wolfe acoustic theorem refers to the spatially flat (K=0), hot \( (p=\varepsilon/3) \) Friedmann–Robertson–Walker universe and the scalar perturbation propagating in it. The theorem states that with the appropriate choice of the perturbation variable, one can express the propagation equation in the form of d'Alembert's equation in Minkowski spacetime. Scalar perturbations in the flat, early universe propagate like electromagnetic or gravitational waves ([1], p. 79).

On the other hand, the wave equation for the scalar field of the dust \( (p=0) \) cosmological model can be transformed into the d'Alembert equation in the static Robertson–Walker spacetime, regardless of the universe's space curvature (see [1]). Therefore, we can suppose that the flatness assumption in the Sachs–Wolfe theorem is not needed and that the theorem is true in the general case. The proof of this fact, which has been formulated as a symbolic computation, is outlined in the first section of this paper.
B. Review of the Sachs–Wolfe acoustic theorem

In accordance with Czaja, Golda, and Woszczyna [2], I begin with Robertson–Walker metrics in spherical coordinates $x^s=(\eta, \chi, \vartheta)$:

$$\begin{pmatrix}
-1 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 \\
0 & 0 & \sin^2(\sqrt{K} \chi) / K & 0 \\
0 & 0 & 0 & \sin^2(\sqrt{K} \chi) \sin^2(\vartheta) / K
\end{pmatrix}$$

with the scale factor $a(\eta)$ appropriate for the equation of state $p=\epsilon/3$,

$$a(\eta) = \frac{\sin(\sqrt{K}\chi)}{\sqrt{K}}$$

Let us define a new perturbation variable $\Psi$ with the help of the second-order differential transformation of the density contrast $\delta$,

$$\Psi(x^s) = \frac{1}{\cos(\sqrt{K}\chi)} \frac{\partial}{\partial \eta} \left( \frac{K}{\tan^2(\sqrt{K}\chi)} \frac{\partial}{\partial \eta} \left( \frac{\tan(\sqrt{K}\chi)}{K} \cos(\sqrt{K}\chi) \delta(x^s) \right) \right).$$

The function $\Psi(x^s)$ is the solution of the d'Alembert equation

$$\frac{\partial^2}{\partial \eta^2} \Psi(x^s) - \frac{1}{3} \epsilon \Delta \Psi(x^s) = 0,$$

with the Beltrami–Laplace operator $\Delta$ acting in this space,

$$\begin{pmatrix}
1 & 0 & 0 & 0 \\
0 & \sin^2(\sqrt{K} \chi) / K & 0 \\
0 & 0 & \sin^2(\sqrt{K} \chi) \sin^2(\vartheta) / K
\end{pmatrix}$$

The Beltrami–Laplace operator $\Delta$ is defined as follows:

$$\Delta = (^{(3)}g)_{mn} \nabla^m \nabla^n.$$
And it can be considered as an extension of Laplace operator for curved space. I will discuss this operator in the following section.

\textit{Sachs-Wolfe Acoustic Theorem.}

Scalar perturbations in the hot (p=\epsilon/3) Friedmann–Robertson–Walker universe of arbitrary space curvature (K=0,\pm1) expressed in terms of the perturbation variable (3) obey the wave equation (4) in the static Robertson–Walker spacetime g=diag(−1,\text{g}).

Proof of this theorem has been performed with Mathematica by Czaja, Golda, and Woszczyna [2].\footnote{The commands can be downloaded from http://drac.oa.uj.edu.pl/usr/woszcz/kody/acoucticRWcode.nb}

It should be noted that this acoustic theorem may be proved useful in the study and simulation of CMBR anisotropies [3][4][5].

\textbf{C. What is Laplace-Beltrami Operator?}\footnote{Source: http://en.m.wikipedia.org/wiki/Laplace-Beltrami_operator}

In differential geometry, the Laplace operator can be generalized to operate on functions defined on surfaces in Euclidean space and, more generally, on Riemannian and pseudo-Riemannian manifolds. This more general operator goes by the name Laplace-Beltrami operator, after Pierre-Simon Laplace and Eugenio Beltrami. Like the Laplacian, the Laplace-Beltrami operator is defined as the divergence of the gradient, and is a linear operator taking functions into functions. The operator can be extended to operate on tensors as the divergence of the covariant derivative. Alternatively, the operator can be generalized to operate on differential forms using the divergence and exterior derivative. The resulting operator is called the Laplace-de Rham operator (named after Georges de Rham).

The Laplace-Beltrami operator, like the Laplacian, is the divergence of the gradient:
\[ \nabla^2 f = \nabla \cdot \nabla f. \]  \hspace{1cm} (7)

An explicit formula in local coordinates is possible.

Combining the definitions of the gradient and divergence, the formula for the Laplace-Beltrami operator applied to a scalar function \( f \) is, in local coordinates

\[ \nabla^2 f = \frac{1}{\sqrt{|g|}} \partial_i \left( \sqrt{|g|} g^{ij} \partial_j f \right). \]  \hspace{1cm} (8)

D. Towards Laplace-Beltrami Operator for Fractional Brownian Surface

In this section, I will suggest that perhaps we should generalize Laplace-Beltrami Operator to become fractal Laplace-Beltrami Operator for fractional Brownian Surface. The latter will permit us to verify whether our basic hypothesis of smooth surface in Riemannian geometry is still valid, or whether we could expect to observe further effect in CMBR anisotropies caused by surface imperfection of the boundary of the Universe. In order to do that, first we should define rigorously what is Laplace-Beltrami Operator for fractional Brownian Surface, and how to derive eigenvalues in this case.

In their recent paper, Gelbaum and Titus [7] simulate fractal surfaces as random series of eigenfunctions, using the spectral decomposition of the Laplace-Beltrami operator. This approach allows them to generate random fields over smooth manifolds of arbitrary dimension, generalizing previous work with fractional Brownian motion with multidimensional parameter.

According to them, the Spectral Theorem and the functional calculus associated with it then yield [7]:

\[ -\Delta(f) = \sum_{k=1}^{\infty} \lambda_k \langle f, \phi_k \rangle \phi_k. \]  \hspace{1cm} (9)

Moreover, since the integrated Sachs-Wolfe effect can be related to dark energy observation, then it seems that we can also expect some kind of zigzagging in dark energy caused by fractional Brownian surface of the boundary of the Universe (See [8]).

There are some questions worth to explore further, for example:

(1) How the random surface is identified?
    As a first guess, random surface could be for instance graph of map from surface to 1-D space (think of plane deformed randomly in vertical direction) and that the value
of field at given position and as function of time is random variable say given by Brownian motion. I understood than one starts from Laplace-Beltrami operator and adds a random source term to it representing noise represented in terms of the correlation function, which is typically that for Laplacian. This noise could correspond to fluctuations in dark energy. The formula (8) represents this kind of alternative but does not specify what kind of noise the function f represents, that is its correlation function.

(2) What one means with randomness?
The article of Gelbaum et al. suggests that randomness should be described as a random source term in d'Alembert equation for which correlation function is known. One can consider various kinds of noises. This would give rise to a response in the observable involved, say acoustic wave or density fluctuation.

(3) Is randomness induced by the randomness of the 3-D metric due to dark energy fluctuations?
Could a perturbation of RW metric give an inhomogeneity to the d'Alembertian? Einstein's equations govern the evolution of cosmological for density perturbations in slowly varying RW metric. In accordance with the idea what S-W effect is the cosmological term in Einstein’s equations.

This issue concerning how to define rigorously what is Laplace-Beltrami Operator for fractional Brownian Surface remains an open question, as I cannot find a good paper or books except [7]. Therefore further research is recommended.

E. Concluding remarks
I have discussed a number of ideas in this paper related to the Sachs-Wolfe acoustic theorem. I also suggest that perhaps we should generalize Laplace-Beltrami Operator to become fractal Laplace-Beltrami Operator for fractional Brownian Surface. The latter will permit us to verify whether our basic hypothesis of smooth surface in Riemannian geometry is still valid, or whether we could expect to observe further effect in CMBR anisotropies caused by surface imperfection of the boundary of the Universe. In order to do that, first we should define rigorously what Laplace-Beltrami Operator for fractional Brownian Surface is, and how to derive eigenvalues in this case. This issue concerning how to define rigorously what is Laplace-Beltrami Operator for fractional Brownian Surface remains an open question, as I cannot find a good paper or books except [7]. Therefore further research is recommended.

Moreover, since integrated Sachs-Wolfe effect can be related to dark energy observation, then it seems that we can also expect some kind of zigzagging in dark energy caused by fractional
Brownian surface of the boundary of the Universe. These issues are, however, left for future investigation.

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References


Chapter X: Does Quantum Field Theory allow the Universe to emerge from nothing?

Abstract

This paper is a summary of discussion in www.researchgate.net on a question concerning whether QFT allows the Universe to emerge from nothing. Because there are many comments posted by experts in cosmology and other fields of physics, I think this summary will be useful for general readers. The purpose of this paper is of course not to say the last word on this question, but to points to new direction of investigation in this field.

Introduction

As we know, many cosmologists argue that the Universe emerged out of nothing, for example Hawking-Mlodinow (Grand Design, 2010), and Lawrence Krauss. Most of their arguments rely on conviction that the Universe emerged out of vacuum fluctuations.

While that kind of argument may sound interesting, it is too weak argument in particular from the viewpoint of Quantum Field Theory. In QFT, the quantum vacuum is far from the classical definition of vacuum ("nothing"), but it is an active field which consists of virtual particles. Theoretically, under special external field (such as strong laser), those virtual particles can turn

http://www.wall.org/~aron/blog/a-universe-from-nothing/
to become real particle, this effect is known as Schwinger effect. See for example a dissertation by Florian Hebenstreit.\(^{20}\)

Of course, some cosmologists argue in favor of the so-called Cosmological Schwinger effect, which essentially says that under strong gravitational field some virtual particles can be pushed to become real particles.

Therefore, if we want to put this idea of pair production into cosmological setting, we find at least two possibilities from QFT:

a. The universe may have beginning from vacuum fluctuations, but it needs very large laser or other external field to trigger the Schwinger effect. But then one can ask: Who triggered that laser in the beginning?

b. In the beginning there could be strong gravitational field which triggered Cosmological Schwinger effect. But how could it be possible because in the beginning nothing exists including large gravitational field? So it seems like a tautology.

Based on the above two considerations, it seems that the idea of Hawking-Mlodinow-Krauss that the universe emerged from nothing is very weak. What do you think?

Answers:

[1] **Vikram Zaveri**

There are certain things in the universe, the existence of which no one can deny. At the same time, no one can prove their physical existence experimentally. The fundamental substance of the universe has this property. There is nothing in the universe that is not in a state of motion. Motion is one of the basis for experimental detection. The second basis for experimental detection is the interaction. The empty space does not have any motion nor does it interact with anything that is in motion. This is also the property of the fundamental substance of the universe which is summed up as existence, without motion and no interaction. So when this fundamental substance begins to move it gets detected as pairs of particle anti-particle. Gravity does not exist within the fundamental substance but it comes into existence between particle anti-particle pair when it is created. When the particle pair annihilate, the gravity disappear. This happens at Planck energy scale. At low energy same thing happens when matter anti-matter annihilate. When electron positron annihilate the charge between them disappear. Given below is a link to a quantum gravity theory which is based on these ideas and it generates entire table of standard model particles from a single formula. Therefore the idea of Hawking-Mlodinow-Krauss that the universe emerged from nothing is very weak.

[2] **Arno Gorgels**

Quantum field theory doesn't allow the universe to emerge from nothing, but space quanta theory as proposed within an ether structure like Cantor's continuum does.
Neither Quantum Field Theory (QFT) nor Quantum Space Time (QST) should be interpreted as saying that universe emerged out of nothing. Nothing in itself is just a projection or a hologram of a larger perspective or energy structures. Nothing by Nothingness creates infinite energy potentials and will result in mass energy equivalence or ungoverned energy transformation states.

The prime objective or direction of both QFT and QST should be not to dig into our primordial origin of universe rather to see the rate at which the universe is expanding in one end and condensing in the other end and the bidirectional velocities and how these hyperspace interact and interpolate in fields. Thus in the topological transformation fields, space times generate new energy structures. These will be measurable in terms of entropy and randomness and the photons, neutrinos and the intermittent quarks that traverse and transpose through these entropy matrices in nature.

Look at the phrase: "...the Universe emerged out of vacuum fluctuations". The verb 'emerged' means some kind of action, the word 'fluctuations' means another kind of action for a concept entitled nothing, thus 'nothing' has attributes (that allow it to fluctuate), so the whole argument is, at least, not well defined.
[5] Christina Munns

I do not believe that QFT allows the universe to arise from the state of Nothing. This is because the quantum state itself consists of particles. Particles are something, not nothing. My Unified Field Theory, as written in *Principia Unitas* explains that the causal field of Field 12 is a privileged reference frame. Field 12 acts as an inertial frame of reference that is beyond the laws of conventional physics. It is the cosmic inertial observer that is capable of observing all other 11 frames of reference of the cosmos simultaneously. Field 12 is simply connected to all other 11 reference frames with Field 12 being able to reduce Itself to a point.

Field 12 is the state of Absolute Zero or Pure Consciousness. Field 12 is the Cosmic Observer - the Cosmic Subject, beyond, time, space, gravity, materiality (i.e. beyond quantum state). It is the state of Absolute Rest. It is a highly mysterious state and I do not have space to write about this fully here....It is the state of the entire cosmos in latency. It is the state that is both the cause as well as the effect of the cosmos. Like a spider weaving a web from itself, Field 12 or the state of Absolute Zero or Cosmic Nothingness allows Itself to become "something" - i.e. an object. This primordial object or "something" is Field 11 which represents the Cosmic Object. Fields 12 and 11 exist in a state of unity with the other 10 fields of the cosmos. In these two fields, there is no materiality - just Pure Consciousness - symmetrical, pure (i.e. without admixture), infinite, all-pervading and all-knowing.
It is from the union of Field 12 and Field 11 that creates a CP violation of Pure Consciousness and the universe begins to move (rotate) as the primordial form of Field 10 arises. This is the state of the first materiality, which also ushers in the state of decay, rotation, separation & the discrete state. It is the state of the Perturbation Principle. Field 10 is the first quantum state. With the arrival of materiality (SU(2)) also comes asymmetry. Field 10 is the state of 5D.

I hope the above explanation is sufficient to demonstrate that the Hawking-Mlodinow-Krauss version of Nothing is incorrect. The topic of "Nothingness" is very subtle and I believe is the most esoteric subject that can be discussed. The fascinating thing is that since Field 12 is simply connected (i.e. it is path-wise connected to the rest of the cosmos) then everything in the cosmos is also Pure Consciousness or Absolute Zero. This means that contrary to what Lawrence Krauss says that "we are all more insignificant than we could possibly imagine"... I say that "we are all more significant than we could possibly imagine" since each human being contains within its core the state of Absolute Zero or Field 12 or Cosmic Subject. I am aware that what I am saying is highly unconventional & rocks the very nature of conventional science... but the truth must be told and I am here to tell it! :)

Lawrence Krauss also states: "because every atom in your body was once inside a star that exploded"..... I replace that comment with " .... because every atom in your body was once inside a star that exploded, which itself arose from the unitary symmetry breaking event of the Big Bounce or Perturbation Principle at Field 10, which
itself arose from the union of the Cosmic Subject and Cosmic Object or Field 12 and Field 11 respectively”.


"Does Quantum Field Theory allow the Universe to emerge from nothing?"

In spite of this vague and non-technical question in QFT, if the "Nothing" could be interpreted as "vacuum" or "ground state" in physical sense, then in a mathematical physics language, the creation operators as one of the mainstay in QFT allows to "create" fermions (as building blocks of matter i.e. world), from vacuum or in your words nothing. Hence after these corrections the answer is yes.

[7] Daniel Pfenniger

This question is like "Does God exists" without defining first what is meant by "God" and "exists". Define first "universe" and "nothing". If "Universe" is everything then it cannot be created by something including it, it would be a circular contradiction. If "nothing" is really nothing, it has no property so cannot create anything.

[8] Graeme Smith

To get something from nothing you would have to have something like limited Spontaneous Generation where something very simple could come out of nothing. But once you had that effect, there is nothing stopping it from happening again and again. This would break
energy conservation because it would mean that energy could be created not destroyed which would mean that the Universe was expanding and the amount of energy in the Universe was increasing. I have been playing with an idea of this called Unit Field Theory for a number of years but the mathematics involved are beyond me.


Does Quantum Field Theory allow the Universe to emerge from nothing?

Plain answer is NO. To say that nothing created something is simply illogical philosophically speaking. To say that creation operators acting on the vacuum may "create" fermions (matter) is misleading as far as QFT is concerned because this vacuum cannot and should not be equated to nothingness in the first place. Our QFT vacuum has an internal structure out of which when one operates on with appropriate operators (either fermion creation operators or boson creation operators) particles of certain mass and energy can be "created". This concept that nothing created something (or everything for that matter...) is simply a mythological nonsense that some people try to put on people with the subtle disguise of "scientific" leverage. As an addendum: "vacuum fluctuations" are impossible to happen without some kind of external perturbing agent to make it fluctuate. In other words, absolute vacuum is absolutely stable if left by itself.

[10] Manouchehr Amiri

The "creation" operation in QFT make sense when we impose second quantization, e.g. quantized harmonic oscillator to get both statistics and quantized presentation of energy and
momentum representation, this operation is just a **mathematical tool** as well as the "addition operation" of simple numbers. However this mathematical tool may be reflected in some minds as "creation" of the world! so the question is ill posed and no one can equate the "nothing" with "vacuum" unless there was a misinterpretation.


To Victor: The two possibilities (a) and (b) described by you for pair production can be replaced by following alternative. Imagine a unified field underlying the entire universe which does not have any boundary and which is motionless and does not interact with anything that moves. Since it does not have any boundary, the numbers zero and infinity does not have any meaning here. Before the beginning of the creation, the geometry did not exist because geometry is a part of creation. Similarly, gravity or any other force did not exit but there was one force which did exist about which later. We will call this unified field the unmanifest. Nothing can destroy this unmanifest because it does not interact with anything. It has existed through eternity and will exist through eternity to come. The minds of all living creatures become conscious because of the presence of the unmanifest. As the one sun illumines the whole world even so does this unmanifest illumine all bodies, sentient and insentient. When for some reason a mind of a creature loses its ability to absorb the life from this unmanifest, it becomes unconscious. So the unmanifest is a concept which is much higher than the consciousness. This unmanifest has another property which is called the WILL which is of the nature of a force. This property is also
observed in the living beings on a much smaller scale. It is this force of WILL that is the cause of the motion in the motionless unmanifest which the physicists call vacuum fluctuation. At Planck energy level these vacuum fluctuations generate very cold particle pairs called Savitons each particle having energy of the order $10^{19}$ GeV. There are $10^{62}$ saviton pairs generated simultaneously with in a very small sphere of size $10^{-14}$ meter and travelling at velocity of light. Each Saviton is like Grandfather photon which is massless kinetic energy. Each Saviton is of size $10^{-35}$ meter which is like a cold particle of consciousness. These particles make up such a powerful (cold) Laser that our world has not seen anything like this. Immediately after creation, these $10^{62}$ cold particles collide with each other and create an inferno which is the Big Bang followed by inflation.

[12] Jürg Martin Frohlich

Quantum Field Theory by itself does not explain how the Universe came into existence, more precisely how the Big Bang was triggered. Unfortunately, we do not have a complete theory encompassing gravitation and quantum phenomena, yet. For this reason, there are no good answers, yet, to questions of the sort "what was before the Big Bang", "how did the Universe come into existence", etc.
[13] **Demetris Christopoulos**

My contribution on cosmological questions is at researchgate.net plus references therein.²¹

QFT is just another linear tool and, since our local universe seems to be locally flat (thanks Euclid!), all linear tools work fine for a wide range of the parameters involved. If you go below the Planck scale, all fail. Thus we have to declare our ignorance and not claim that a linear tool can answer such a general class of questions.

[14] **Mohsen Khodadi**

Almost all scriptures presuppose that God began the universe. The fact of the universe’s beginning points strongly to a Creator consistent with the scriptures God. Some atheists, following Hume, have asserted that something can begin without a cause, but this is not only unreasonable, it is arguably inconceivable. The ‘New Atheists’ have resorted to quantum bluffing to claim that something really can come from nothing.

²¹ [https://www.researchgate.net/publication/264537258](https://www.researchgate.net/publication/264537258)
But they must equivocate about the word ‘nothing’. This really should mean nothing—no properties. However, their proposed quantum vacuum is not nothing; it must be something, with properties—e.g. the quantum vacuum, which is being bound by the laws of quantum physics, so that it can ‘fluctuate’.

[15] David Vasak

Why not looking at it this way: The fact that "nothing" is not the QFT vacuum is exactly the reason why the universe could emerge from that. The QFT vacuum |QFT> has lower energy than "nothing" (|o>), hence the phase transition from (o> to |QFT> would liberate large amounts of energy that in turn would populate spacetime with matter - by pair production.

[16] Hidezumi Terazawa

In 1983, we first succeeded in explaining the origin of the Big Bang as a phase transition of the space-time from the pregeometric phase to the physical one in the
quantum field theory of pregeometry. The pregeometric phase is defined as the phase of the space-time in which the space-time metric vanishes or diverges. See the details in K.Akama and H. Terazawa.\textsuperscript{22} Therefore, quantum field theory does allow the Universe to emerge from nothing since neither the physical space-time in which the space-time metric is finite nor the physical matter was there before the Big Bang. See also my recent review.\textsuperscript{23}

Hidezumi Terazawa

Center of Asia and Oceania for Science, Tokyo, Japan, and Midlands Academy of Business and Technology, Leicester, U.K.


It is obvious that the "phase transition of the space-time from the pre geometric phase to the physical one in the quantum field theory of pre geometry" does not qualify for the assertion that our space-time came out from nothing. First, there can be no phase transition without some kind of energy input; second, the quantum field theory of pregeometry is not the same as "nothing".

\textsuperscript{22} K.Akama and H. Terazawa, Gen.Rel.Gravit.15(1983)201
[18] **Mahsa Mehrangiz**

I want to answer to your question by the definition of energy:

What will be your answer if somebody asks you about the "meaning of energy"?

certainly you'll answer: "A source which never disappeared or appeared suddenly but only convert from one form to another form". this is the answer that everybody knows and learned it in physics. By this definition we're not able to say that we didn't have any energy at a special time now the strike up of the Quantum is, with the meaning of "particle" and also try to discuss its differences from its definition in classical physics, in Quantum we define particle in this way: "A group of electromagnetic waves" and every one knows waves HAVE energy besides all of us which means: "the humans, the plants, the animals ... (the whole world)". is made of a lot of particles which means "full of energy", therefore we can declare that the whole world is "energy" and every part of this world is "A" part of this energy by Quantum, as a result by this definition, how can we say that "Our universe has been emerged from nothing?"

this universe never ever emerged from nothing because of the **continual existence** of "energy".

[19] **Hidezumi Terazawa**
1) The phase transition from the pregeometric phase to the physical one could occur as a quantum fluctuation without any need of energy. See the details in our paper.\textsuperscript{24}

2) The quantum field theory of pregeometry is not the same as "nothing" but a more fundamental theory of gravitation in which Einstein theory of general relativity can be taken as an approximate and effective theory at low energies or at long distances. See the details in my recent review.\textsuperscript{25}


Yes, I can agree wholeheartedly that the main point is to recognize that although a phase transition in that case may happen without the concourse of energy input, the quantum field theory of pregeometry cannot be equated to "nothing". It is impossible that nothing can generate something. QFT of pregeometry could be viewed as a more fundamental underlying structure of the universe from where other structures may have emerged.

[21] Victor Christiano

To Prof. Hidezumi Terazawa:

You wrote: "In 1983, we first succeeded in explaining the origin of the Big Bang as a phase transition of the space-time from the pregeometric phase to the physical one in the quantum field theory of pregeometry."

My requests:

a. Would you mind to send me your 1983 paper?

b. Do you mean that pregeometric phase transition is something like self-organized criticality? Yes, I have heard that some physicists argue that self-organized criticality can be triggered without any cause.

c. You also wrote that pregeometric quantum field theory also assumes that vacuum is not the same with "nothing". Please clarify.

[22] Hidezumi Terazawa

To Victor Christiano,

a. You may be able to have an access to any one of my papers by putting "find a terazawa, h" in inspirehep.net.

b. Suppose that it had been over-cooled before the Big Bang, and the phase transition of the space-time occurred due to a quantum fractuation, which is somehow different from "self-organized criticality".
c. The vacuum is not the same as "nothing" in a sense that it is virtually filled with matter-antimatter pairs, which is the origin of all the fundamental forces including gravity in the quantum field theory of pregauge and pregeometry. See the details in my recent review.  

[23] Asher Klatchko

What is "nothing" is a philosophical trick question or maybe even metaphysical... (see for example Heidegger's “What is Metaphysics?”).

I believe that what Krauss and Hawking have in mind is that you do not need a Deus ex machina to 'contrive' the universe. To the champions of QFT I would remind a comment I've heard on Philosophy Talk by John Perry which amounts to saying that if QFT has existed before the universe then we are dealing with theologies (rather than sciences). In my mind we could subject the 'universe from nothing' theory -- especially as it hinges on fluctuations and uncertainties, to the Gettier problem test by challenging it as a

JTB. Personally, I'd rather have the universe pop out of some Pregeometric Origins than handed down from a devious deity

[24] Victor Christianto

To Prof. Jurg Frohlich: you are right that Quantum field theory by itself does not give explanation on how the Universe come into existence. But there are scientists such as Andrey Grib who works on early universe based on quantum field theory.28

Back in 2009, i read at a glance a book by Grib, Mamayev, and Mostepanenko discussing Vacuum quantum effect in the strong field (St. Petersburg, 1994). Hopefully this information will help anyone interested.

[25] Shalender Singh

Actually the "Vacuum" can also be described as each point as a equal cancellation of positive energy and negative energy electrons with one going below the speed of light

27 http://www.ditext.com/gettier/gettier.html
and one above the speed of light canceling energies of each other. The equation of energy for particles above light can be found\(^29\) and a correction and improvement here.\(^30\)

As the vacuum can be represented as cancelling particles above the speed of light and below the speed of light, a slight perturbation in this equilibrium can lead of positive energy photons and a greater perturbation to an electron-positron pair. If the space-time is modeled as photon trajectories as in other paper.\(^31\) Then the whole space-time and matter can arise out of slight natural perturbation from a perfectly balanced Vacuum/Universe.

A 0 or vacuum is not a mere zero but a perfect balance of canceling energies, which have an automatic tendency to get perturbed (because the phase of the matter wave cannot perfectly cancel) and generate non-zero matter and space-time.

[26] **Rajat Pradhan**

Thank you Victor for posting this question which has led to so many interesting answers and so much worthwhile information. I certainly do not at all agree with the one

\(^{29}\) [http://rspa.royalsocietypublishing.org/content/468/2148/4174.abstract](http://rspa.royalsocietypublishing.org/content/468/2148/4174.abstract)


who started sermoning you on what RG is meant for and that you were asking something that was metaphysics and all that. How narrow and biased people can be!

Please keep asking such questions.

[27] Victor Christiano

To Rajat: thank you for your appreciation. I also learned many new perspectives that I never thought of before, such as pregeometry model of Prof. Terazawa.

[28] Richard Gauthier

Victor, Nothing can come from nothing. The universe may have begun from a cosmic quantum, which emerged from a cosmic quantum field, which emerged from...

[29] Nadeem Haque

Victor you have hit the nail on the head concerning the problem of infinite regress. I go into detail in dealing with this question. See: Chapter 1 of my co-authored book.

__________________________

32 http://www.superluminalquantum.org/cosmicquantum
[30] **Manuel Morales**

"Nothing can come from nothing."

Correction. The **unambiguous** empirical evidence confirms that something (existence) does indeed come from nothing (non-existence). An "act" is not a state and so it does not come to exist until it does. Infinite regress applies to states of existence, not to the acts that cause them to exist.

By applying the second cause logic of placing cause second to effects, i.e., effects (existence) causing effects (existence), we are blind to cause (non-existence) and effect (existence). We therefore think in terms of reality being effectual without realizing that we have placed the cart before the horse.

**Concluding remarks**

While this discussion may not give a satisfactory answer, perhaps we can agree that the idea of quantum vacuum in QFT is not the same with “vacuum” (nothing) in classical physics. Therefore, it is misleading to say that the Universe emerged from nothing, if what we

---

meant is: the Universe probably emerged from vacuum fluctuations. Nonetheless, we should also add that Pregeometry and Pre-BigBang theories are still in their infancy. Hopefully this discussion will encourage further investigations in this direction.

Acknowledgement

Many thanks to all contributors to discussion in researchgate.net forum, including Profs. Hidezumi Terazawa, Alfredo T. Suzuki, Jurg Martin Frohlich, and also Vikram Zaveri, Arno Gorgels, Gokul Baby Alex, Demetris Christopoulos, Christina Munns, Manouchehr Amiri, Daniel Pfenniger, Graeme Smith, Mohsen Khodadi, David Vasak, Mahsa Mehrangiz, Asher Klatchko, Shalender Singh, Rajat Pradhan, Richard Gauthier, Nadeem Haque, Manuel Morales, and others. Special thanks to Sergey Ershkov who has suggested improvements to the first draft of this article.

Version 1.0: October 14th, 2014, Version 1.1: October 20th, 2014

VC, email: victorchristianto@gmail.com

References:


relativity_beyond_speed_of_light_and_a_method_to_push_particles_beyond_the_speed
_of_light


Chapter XI: Concluding Remarks

Despite more than 30 years of efforts given to the String Theories (ST), many physicists think that String Theories still lack testable predictions. Of course, there are a few achievements too, such as ST is supposed to be able to yield general relativity, but apparently no more than that. Other physicists also derived that the prediction of cosmological constant by ST yields a value that is more than $10^{10}$ times the observed value, that is why some physicists such as Peter Woit called String theories as “Not Even Wrong” theory (to quote Pauli’s remark).

In order to overcome such a predictability problem of ST, in this dissertation I would like to introduce a different approach. Instead of trying to re-derive quantum mechanics and general relativity from ST, I will instead show that many physical phenomena can be expressed in terms of classical wave equation, be it small scale phenomenon or large scale phenomenon. This philosophy can be called as “String without String”, which is a term I coined to indicate that the classical String (classical wave) equation can be obtained without having to begin with the standard String theory.

The basic idea here is to generalize classical string/wave equation to become fractal vibrating string. Some implications include a new view of elementary particles (wave model) and also a periodic table of elements. In cosmology setting, this proposal may bring new insights to acoustic cosmology. I hope that this contribution will be found useful as an alternative to the Standard String theories which so far cannot be verified experimentally. Hopefully the proposed
Fractal Vibrating String can be made more testable compared to Standard String Theories. In my opinion, this can be an improvement and simplification of ST which often require 26 dimensions to work with. It may be expected that the proposed fractal string/wave vibration equation can become an alternative model which is more testable, compared to standard String theories which lack observation or predictability so far. However, I should emphasize that the proposed model as outlined here is not complete yet. More research is needed.

Not only that, I wish in this dissertation to discuss one more application of the concept of vibration and frequency, i.e. in the detection and treatment of various types of cancer. Therefore I hope that the proposed Fractal Vibrating String will make impact not only as theoretical tool but also as a practical model for cancer treatment.

With regard to experimental confirmation of this new cosmology model, I have tried to work from smaller scales first, i.e. I started with classical wave equation as the basis to explain hydrogen energy levels, periodic table of elements and also planetary orbit distance. Then I try to generalize these results by generalizing Nabla operator to become fractal Nabla operator. I also discuss possibility to generalize Laplace-Beltrami Operator to become fractal Laplace-Beltrami Operator, with an implication that one may expect to generalize Sachs-Wolfe Acoustic theorem to fractional surface. This may yield an observation of CMBR fluctuation caused by fractional boundary of the universe.

Of course, since this is a dissertation in Theology/Divinity so I am more concerned in how a cosmology model can be made as consistent as possible with biblical view, not just with experimental verification per se, which is more suitable for dissertation in Theoretical Physics.
Therefore I hope that someday there will be physicists with suitable background in theoretical or experimental physics that will pick up some of these ideas and check the experimental implications of these ideas.

As a last word, I believe that someday our knowledge concerning nature, elementary particle and the Cosmos will be complete and full, and all of our knowledge will point to the glory of our Creator (God) whom we know through Jesus Christ, according to Habakkuk 2:14: “For the earth will be filled with the knowledge of the glory of the LORD, as the waters cover the sea.” (NIV) I hope that this dissertation contributes to such a better knowledge concerning GOD, our Ultimate Creator.
APPENDIXES
Appendix I: Resume and list of publications

1. **Birth place and date:** Malang (INDONESIA), 1969

2. **Present Address:** INDONESIA

3. **Cellular Phone:** (62) 878-59937095

4. **Email:** victorchristianto@gmail.com

5. **Interests:** Cosmology, Astrophysics, Classical Physics, Electrodynamics, (Renewable) Energy, Theology, History of Early Christianity, Dead Sea Scrolls, Missiology, Entrepreneurship

6. **Education history:**
   a. SDK Cor Jesu, Malang, 1977-1981
   b. SMPK Cor Jesu, Malang, 1981 – 1984
   c. SMA Negeri 3 Malang, 1984 – 1987
   e. Institute of Gravitation and Cosmology at Peoples’s Friendship University of Russia (PFUR), Moscow. MSc in gravitation and cosmology (not completed). Desember 2008-Juni 2009.

7. **Awards and Recognitions:**
a. Scholarship awarded by Russian Ministry of Education to study at the Institute of Gravitation and Cosmology in Peoples’s Friendship University of Russia (PFUR), Moscow. Dec. 2008-Juni 2009 (not completed)


8. Activities:
   a. Lecturer Institut Pertanian Malang (Malang Institute of Agriculture) since May 2013 - now.
   b. Founder and administrator of social network site for renewable energy development in Asia and the World. www.sciprint.org. Since February 2014, it has more than 30,000 active members.
   c. Member of Editorial Board of International Society of Frontier Science (ISFS) based in India. See www.isfs.org.in
   d. Co-Founder of GISS with Prof. Hardev Singh Virk, and administrator of social network site dedicated for Global Institute of Science and Spirituality (www.giss.co.nr)
   e. Administrator of social network site dedicated for the Institute of Syriac Christian Studies (ISCS), see www.iscs.co.id
   f. An elder and Sunday school teacher in a local church.
   g. Independent researcher and book author.


k. V. Christiano (2013) *Some Problems of Nuclear Energy Development in Asia* (2013), Amazon KDP. URL: [http://www.amazon.com/dp/B00B4LW5ZW](http://www.amazon.com/dp/B00B4LW5ZW) or: [http://www.amazon.co.jp/problemsnuclearenergydevelopmentebook/dp/B00B4LW5ZW](http://www.amazon.co.jp/problemsnuclearenergydevelopmentebook/dp/B00B4LW5ZW)


10. Published scientific papers in Journals:


11. List of publications until 2014:

available in http://www.vixra.org/author/Victor_Christianto:


Appendix II: An Exact Solution of a Coupled ODE for Wireless Energy Transmission via Magnetic Resonance

Victor Christianto*1 & Yunita Umniyati2

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2Swiss German University, Tangerang - Indonesia

ABSTRACT

In the present paper we argue that it is possible to find an exact solution of coupled magnetic resonance equation for describing wireless energy transmission. We also make an analogy between the graphical plot of this problem with the spiral galaxies.

Key Words: coupled ODE, wireless, energy transmission, magnetic resonance.

Introduction

*Correspondence: Victor Christianto, Malang Institute of Agriculture, Malang – Indonesia. URL: http://researchgate.net/profile/Victor_Christianto. Email: victorchristianto@gmail.com
There are some interests in the literature on possible methods to transmit energy wirelessly. While it has been known for quite a long time that this method is allowed theoretically (since Maxwell and Hertz), until recently there is slow progress in this direction.

For instance, Karalis et al. [1] and Kurs et al. [2] have presented their experiments with coupled magnetic resonance, and they reported that the efficiency rate of this method remains low. However, we do believe with that progress in material science research will someday bring new applications to the proposed concept.

In the present paper we argue that it is possible to find an exact solution of coupled magnetic resonance equation for describing wireless energy transmission, as discussed by Karalis [1] and Kurs et al.[2]. We also make an analogy between the graphical plots of this problem with the spiral galaxies.

This paper is a follow up paper of our 2008 paper [3].

A matrix model of coupled magnetic resonance

Kurs et al. [2] argue that it is possible to represent the physical system behind wireless energy transmit using coupled-mode theory. The simplified version of the system of two resonant objects is given by Karalis et al. [1, p.2] as follows:

\[
\frac{da_i}{dt} = -i(\omega_i - i\Gamma_i) a_i + i\kappa a_{2i},
\]

(1)

and

\[
\frac{da_2}{dt} = -i(\omega_2 - i\Gamma_2) a_2 + i\kappa a_1
\]

(2)
Therefore we can write the above two equations in matrix coupled ODE as follows:

\[
\dot{\mathbf{a}} = [C][\mathbf{a}],
\]  

(3)

where:

\[
\dot{\mathbf{a}} = \begin{bmatrix}
\dot{a}_1 \\
\dot{a}_2
\end{bmatrix},
\]  

(4)

\[
[\mathbf{a}] = \begin{bmatrix}
a_1 \\
a_2
\end{bmatrix},
\]  

(5)

\[
[C] = \begin{bmatrix}
-i\alpha & i\kappa \\
 i\kappa & -i\beta
\end{bmatrix},
\]  

(6)

and

\[
\alpha = (\omega_1 - i\Gamma_1),
\]  

(7)

and

\[
\beta = (\omega_2 - i\Gamma_2).
\]  

(8)

or in Mathematica expression, the above matrix ODE (3)-(8) can be expressed as follows:

\[
\begin{align*}
A &= \{-i\alpha, i\kappa\}, \{i\kappa, -i\beta\}; \\
B &= \{0, 0\}; \\
Eigenvalues[A] \\
X[t_] &= \{x[t], y[t]\}; \\
system = X'[t] &= A.X[t] + B; \\
sol = DSolve[system, \{x, y\}, t] \\
particularsols = Partition[Flatten[Table[{x[t], y[t]}/.sol/.(C[1] \to 1/i, C[2] \to 1/j), \{i, -20, 20, 6\}, \{j, -20, 20, 6\}], 2]]; \\
\end{align*}
\]

The solution is given by:
\[
\left\{ \frac{1}{2} i(-\alpha - \beta - \sqrt{\alpha^2 - 2\alpha\beta + \beta^2 + 4\kappa^2}), \frac{1}{2} i(-\alpha - \beta + \sqrt{\alpha^2 - 2\alpha\beta + \beta^2 + 4\kappa^2}) \right\}
\]

\[
\text{y} \to \text{Function}[[t]], \frac{(e^{2it(-a-b-v(-\alpha^2+2a\beta+\beta^2+4\kappa^2)}) \alpha - e^{2it(-a-b+v(-\alpha^2+2a\beta+\beta^2+4\kappa^2)}) \beta + e^{2it(-a-b-v(-\alpha^2+2a\beta+\beta^2+4\kappa^2)}) \beta + e^{2it(-a-b+v(-\alpha^2+2a\beta+\beta^2+4\kappa^2)}) \beta}{(2\sqrt{\alpha^2 - 2\alpha\beta + \beta^2 + 4\kappa^2}) \alpha - e^{2it(-a-b-v(-\alpha^2+2a\beta+\beta^2+4\kappa^2)}) \beta + e^{2it(-a-b+v(-\alpha^2+2a\beta+\beta^2+4\kappa^2)}) \beta + e^{2it(-a-b+v(-\alpha^2+2a\beta+\beta^2+4\kappa^2)}) \beta}} \times \text{C}[1] \times \text{C}[2]
\]

\textbf{Comparison with other similar problem of coupled ODE}

Now we would like to compare the above problem with a coupled ODE of the form:

\[
[a]\ = \ [C][a], \tag{9}
\]

Where:

\[
[a] = \begin{bmatrix} \dot{a}_1 \\ \dot{a}_2 \end{bmatrix}, \tag{10}
\]
\[ [a_i] = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix}, \quad \text{(11)} \]

\[ [C] = \begin{bmatrix} 7 & -8 \\ 5 & -5 \end{bmatrix}, \quad \text{(12)} \]

The solution is given by Mathematica as follows:

```mathematica
A = {{7, -8}, {5, -5}};
B = {0, 0};
Eigenvalues[A]
X[t_] = {x[t], y[t]};
system = X'[t] == A.X[t] + B;
sol = DSolve[system, {x, y}, t]
particularsols = Partition[Flatten[Table[{x[t], y[t]}/.sol/.{C[1] -> 1/i, C[2] -> 1/j}, {i, -20, 20, 6}, {j, -20, 20, 6}]], 2];
ParametricPlot[Evaluate[particularsols], {t, -35, 35}, PlotRange -> All, PlotPoints -> 70, Method -> {Compiled -> False}]
```

\[ \{1 + 2i, 1 - 2i\} \]

\[ \{x \to \text{Function}[(t), -4e^t C[2] \text{Sin}[2t] + e^t C[1](\text{Cos}[2t] + 3 \text{Sin}[2t])), y \to \text{Function}[(t), e^t C[2](\text{Cos}[2t] - 3 \text{Sin}[2t))] + \frac{5}{2} e^t C[1] \text{Sin}[2t]]\} \]

The result can be plotted graphically as follows:
It is interesting to remark here that the graphical plot seems to be analogous to spiral arms of spiral galaxies. Provided that both equations of coupled ODE (6) and (12) have similar values, then it may be possible to suppose that the spiral galaxies can be modeled as a coupled-magnetic problem. This possibility may be worth exploring further, both numerically and also as physical model.

Conclusion

There are some interests in the literature on possible methods to transmit energy wirelessly. While it has been known for quite a long time that this method is allowed theoretically (since Maxwell and Hertz), until recently there is slow progress in this direction.

In the present paper we argue that it is possible to find an exact solution of coupled magnetic resonance equation for describing wireless energy transmission, as discussed by Karalis [1] and
Kurs et al.[2]. We also make an analogy between the graphical plot of this problem with the spiral galaxies.

It is interesting to remark here that the graphical plot of a coupled ODE seems to be analogous to spiral arms of spiral galaxies. Provided the both equations of coupled ODE (6) and (12) have similar values, then it may be possible to suppose that the spiral galaxies can be modeled as a coupled-magnetic problem.

References


Appendix III: A Review of Soliton Solution of sine-Gordon model of DNA

Victor Christianto and Yunita Umniyati

Abstract

There are many models of DNA, both the linear ones and the nonlinear ones. One interesting model in this regard is the sine-Gordon model of DNA as proposed by Salerno. It belongs to nonlinear model of DNA which is close to realistic model. Here we discuss a graphical plot of soliton solution of such a sine-Gordon model of DNA.

Introduction

There are many models of DNA, both the linear ones and the nonlinear ones [1]. One interesting model in this regard is the sine-Gordon model of DNA as proposed by Salerno [2], see also Daniel and Vasumathi [3]. It belongs to nonlinear model of DNA which is close to realistic model. A review of physical significance of this sine-Gordon model was given in [6].

Here we discuss a graphical plot of soliton solution of such a sine-Gordon model of DNA.

Soliton solution of a sine-Gordon model of DNA

34 Email: victorchristianto@gmail.com, URL: http://www.sciprint.org or http://www.researchgate.net/profile/Victor_Christianto
35 Swiss German University – Tangerang, Indonesia
Assuming the wavefunction $\Psi$ to be a function of $x$ and $t$, then the sine-Gordon model of DNA can be written as follows: [3, p.7]

$$\Psi_{tt} - \Psi_{xx} + \sin(\Psi) = 0 \quad (1)$$

Or in Mathematica expression:

$$\Psi = U[x - c \cdot t];$$
$$pde = D[\Psi, x, x] - D[\Psi, t, t] - \sin(\Psi) = 0$$

Now we will use Mathematica 9.0 to simplify and give graphical plot. [3, p.443] To simplify with Mathematica:

$$-\sin[U[z]] + U''[z] - c^2 U''[z] == 0 \quad (2)$$

The result is known as kink soliton wave: [3, p.444]

$$\Phi = 4 \arctan[c \sinh[x/\sqrt{1 - c^2}]/\cosh[ct/\sqrt{1 - c^2}]] \quad (3)$$

Or in Mathematica:

$$4 \arctan[c \text{sech} \left(\frac{ct}{\sqrt{1 - c^2}}\right) \sinh \left(\frac{x}{\sqrt{1 - c^2}}\right)]$$

Differentiating for $t$, it yields:

$$\partial_t \left(4 \arctan \left[c \text{sech} \left(\frac{ct}{\sqrt{1 - c^2}}\right) \sinh \left(\frac{x}{\sqrt{1 - c^2}}\right)\right]\right)$$
Simplifying the above result, it yields:

\[
\frac{4c^2 \text{Sech}\left[\frac{ct}{\sqrt{1-c^2}}\right] \text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right] \text{Tanh}\left[\frac{ct}{\sqrt{1-c^2}}\right]}{\sqrt{1-c^2} (1 + c^2 \text{Sech}\left[\frac{ct}{\sqrt{1-c^2}}\right]^2 \text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]^2)}
\]

\[
\frac{8c^2 \text{Sinh}\left[\frac{ct}{\sqrt{1-c^2}}\right] \text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right] \text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]}{\sqrt{1-c^2} (1 - c^2 + \text{Cosh}\left[\frac{2ct}{\sqrt{1-c^2}}\right] + c^2 \text{Cosh}\left[\frac{2x}{\sqrt{1-c^2}}\right])}
\]

The 3D plot is given below for \(c=0.72\)

![Graphic 1. Mathematica plot of soliton solution on sine-Gordon equation for c=0.72](image)
Perturbed SGE

Perturbed SGE come in a variety of forms. One common form is a damped and driven SGE: [7, p.17]

\[ \psi_{tt} + \Phi \psi_t - \psi_{xx} + \sin(\psi) = F \]  

(4)

In addition, the following two versions of the perturbed SGE have been studied in the literature, including:

c. Directly forced SGE: [7, p.19]

\[ \psi_{tt} - \psi_{xx} + \sin(\psi) = Mf(\omega t) \]  

(5)

d. Damped and drived SGE:

\[ \psi_{tt} - \psi_{xx} + \sin(\psi) = Mf(\omega t) - \alpha \psi_t + \eta \]  

(6)

In the meantime, (2+1)D SGE with additional spatial coordinate (y) is defined as: [7,p.21]

\[ \psi_{tt} = \psi_{xx} + \psi_{yy} - \sin(\psi) \]  

(7)

In their in-depth review of SGE, Ivancevic and Ivancevic [7] discuss potential applications of SGE solitons in DNA, protein folding, microtubules, neural impulse conduction and muscular contraction soliton. New insights may be expected in the near future in these biological fields, based on sine-Gordon equation soliton.
Concluding remarks

There are many models of DNA, both the linear ones and the nonlinear ones [1]. One interesting model in this regard is the sine-Gordon model of DNA as proposed by Salerno [2]. It belongs to nonlinear model of DNA which is close to realistic model. Here we discuss a graphical plot of soliton solution of such a sine-Gordon model of DNA.

Considering that sine-Gordon equation has been used extensively by particle physicists, then it would be interesting to study possibility to improve or alter DNA using electromagnetic field/pulse such as laser. This may be considered as a DNA enhancement method. New insights may be expected in the near future in these biological fields, based on sine-Gordon equation soliton.


VC & YU
References:


Appendix IV: 50 Questions in the fields of Cosmology, Astrophysics, Climate and other issues

Abstract
This article consists of 50 questions related to astrophysics, climate, and other issues. These questions were posted in www.researchgate.net since Aug. 24, 2013 until June 11, 2014. Hopefully these questions can motivate further investigations.

Questions:

[1] Does the universe have a core?

Recently, Michael Peck suggests that the universe has a core, see http://vixra.org/abs/1305.0138. His theory was based on a revised version of general relativity. (Aug. 24, 2013)

[2] Does the Universe work like a human brain? Is there data supporting this hypothesis?

This question may relate to complex network, cognitive science and quantum physics. See an article:

http://www.livescience.com/25027-universe-grows-like-brain.html and also

http://vixra.org/abs/1309.0011 (Sep. 6, 2013)

[3] Can we extend Silberstein bivector to become quaternion vector to generalize further Maxwell equations?

[4] **How can we explain Tifft's quantization of galaxy redshift?**

The reports by Tifft on quantization of galactic redshift are well-known to astronomers. Read for example [http://www.vixra.org/abs/1309.0011](http://www.vixra.org/abs/1309.0011). See also a recent review on redshift theories by Marmet at [http://www.marmet.org/cosmology/redshift/mechanisms.pdf](http://www.marmet.org/cosmology/redshift/mechanisms.pdf) (sep. 20, 2013)

[5] **Does Godel's incompleteness theorem limit Artificial Intelligence?**

Gödel’s incompleteness theorems have their own limitations, but so do Artificial Life (AL)/AI systems. Based on our experiences so far, human mind has incredible abilities to interact with other part of human body including heart, which makes it so difficult to simulate in AI/AL. However, it remains an open question to predict whether in the future AI research including robotics science can bring this gap closer or not. See for example [http://vixra.org/abs/1303.0072](http://vixra.org/abs/1303.0072) (sep. 27, 2013)

[6] **Are there alternatives to dopamine hypothesis in order to explain schizophrenia?**

Traditional models of schizophrenia have emphasized dopaminergic dysfunction. Over the last 20 years, however, Limitations of the dopamine model have become increasingly apparent, necessitating development of alternative models. One of these alternative models are glutamatergic models, proposed by Daniel C. Javitt. See his 2010 paper in [http://doctorsonly.co.il/wpcontent/uploads/2011/12/2010_1_2.pdf](http://doctorsonly.co.il/wpcontent/uploads/2011/12/2010_1_2.pdf) (Oct. 9, 2013)
[7] **Will there be a massive hyperinflation soon in the USA because the FRB has already printed too much money out of thin air?**

According to the news, a number of large investors have sold their stocks massively. See http://www.moneynews.com/MKTNews/billionaires-dump-economist-stock/2012/08/29/id/450265?PROMO_CODE=1393F-1. I agree with one thing from this news, that perhaps the Fed has printed too much money in recent years, so its full effect will take place in the form of massive hyperinflation. In other paper, we have reported that the Fed has issued no less than fifteen trillion of us dollars to several banks. See our paper in http://vixra.org/abs/1307.0097. What do you think? Is that hyperinflation possible to happen? (Oct. 15, 2013)

[8] **Is it possible to control gravitation using an electromagnetic field?**

American interest in 'gravity control propulsion research' intensified during the early 1950s. Literature from that period used the terms anti-gravity, anti-gravitation, barycentric, counterbary, electrogravitics (eGrav), G-projects, gravitics, gravity control, and gravity propulsion. Their publicized goals were to develop and discover technologies and theories for the manipulation of gravity or gravity-like fields for propulsion.

Although general relativity theory appeared to prohibit anti-gravity propulsion, several programs were funded to develop it through gravitation research from 1955 to 1974. The names of many contributors to general relativity and those of the golden age of general relativity have appeared among documents about the institutions that had served as the theoretical research components of those programs.

This question is intended to explore possibilities to control gravitation using an electromagnetic field. See also: http://en.wikipedia.org/wiki/United_States_gravity_control_propulsion_research (Nov. 22, 2013)
[9] **Is Frank Tipler's Omega Point hypothesis supported by observation?**

Caution: I am not sure about this topic, and I never read Tipler's papers and books except for one paper, but it seems that his ideas are quite interesting to ponder.

An interesting page to begin with is [http://www.aleph.se/Trans/Global/Omega/](http://www.aleph.se/Trans/Global/Omega/). It is mentioned there that according to Frank Tipler it is possible for intelligent beings to process and store an infinite amount of information in the universe, if certain conditions are fulfilled. His definition of Omega Point is essentially a future c-boundary which is a single point and an Aleph state, where information processing continues indefinitely along at least one world-line gamma all the way to the future cboundary of the universe. i.e. Life never dies out.

Tipler himself describes his own Omega Point here: [http://129.81.170.14/~tipler/why.html](http://129.81.170.14/~tipler/why.html). He cited other scientists, like MacCallum, Barrow, Yorke etc. MacCallum has shown that a three-sphere closed universe with a single point future c-boundary is of measure zero in initial data space. Yorke has shown that a chaotic physical system is likely to evolve into a measure zero state if and only if its control parameters are intelligently manipulated. Thus life (which near the final state, is really collectively intelligent computers) almost certainly must be present arbitrarily close to the final singularity in order for the known laws of physics to be mutually consistent at all times.

In the meantime, I searched today in arxiv.org to find clues on this question, and only found 13 papers by Tipler, two of them are seemingly quite related to this question: [http://arxiv.org/abs/gr-gc/0003082](http://arxiv.org/abs/gr-gc/0003082) and [http://arxiv.org/abs/0704.0058](http://arxiv.org/abs/0704.0058).

While his ideas seem interesting from philosophical or theological viewpoint, as far as I know, they lack support from observation/astronomical data. So, what is your opinion? Thank you and best wishes. (Dec. 13, 2013)

[10] **Why does there exist similarity between brain cells and the Universe? Is it just a coincidence or Pareidolia?**
The universe may grow like a giant brain, according to a new computer simulation.

The results, published Nov. 16, 2012, in the journal Nature's Scientific Reports, suggest that some undiscovered, fundamental laws may govern the growth of systems large and small, from the electrical firing between brain cells and growth of social networks to the expansion of galaxies.

"Natural growth dynamics are the same for different real networks, like the Internet or the brain or social networks," said study co-author Dmitri Krioukov, a physicist at the University of California San Diego. See the complete papers by Dmitri Krioukov in arxiv.org (http://arxiv.org/pdf/1203.2109.pdf and also http://arxiv.org/pdf/1310.6272.pdf), or summary in http://www.livescience.com/25027-universe-grows-like-brain.html. Nonetheless, it is also possible that such a similarity is caused by merely coincidence or a psychological effect called Pareidolia, see for instance: http://en.wikipedia.org/wiki/Pareidolia. (Dec. 16, 2013)

[11] Is it possible to convert gravitational energy directly into electrical energy?

There is an interesting paper by Fran de Aquino available at http://vixra.org/abs/1205.0119, which suggests that it is possible to convert gravitational energy directly into electrical energy. The abstract of his paper is as follows: "We show that it is possible to produce strong gravitational accelerations on the free electrons of a conductor in order to obtain electrical current. This allows the conversion of gravitational energy directly into electrical energy. Here, we propose a system that can produce several tens of kilowatts of electrical energy converted from the gravitational energy."

Considering that there is formal analogy between gravitational theory and electromagnetic theory, then it seems that such a proposition is possible, at least theoretically. But I am not sure yet if his "theory" can be turned into a practical technology. And if it is indeed possible to convert gravitational energy into electrical energy, will it imply potential destruction of natural gravitational field? My curiosity is on possible damage caused by the use of Earth gravitational energy. (Dec. 20, 2013)
[12] Are there scientific proofs of the existence of God?

It is very interesting for me to ask this question. I asked this question first to a professor in a seminar while I was a young college student back in 1990. Then I forgot about this question for years. Then yesterday (12/29/2013) a midnight dream reminded me to this old question again. Then I searched in google for some clues. It is interesting to find out that there are new interests on ontological proof written by Godel around 70s. One article says as follows:

"That is where Christoph Benzmüller of Berlin's Free University and his colleague, Bruno Woltzenlogel Paleo of the Technical University in Vienna, come in. Using an ordinary MacBook computer, they have shown that Gödel's proof was correct -- at least on a mathematical level -- by way of higher modal logic. Their initial submission on the arXiv.org research article server is called "Formalization, Mechanization and Automation of Gödel's Proof of God's Existence." "


Another interesting source is of course wikipedia:

[13] Is the Universe a computer or Turing machine?

There are many scientists who suggest that the Universe behaves like a computer. For example, John Archibald Wheeler suggests that "Its are from Bits", which means that all entities come from computer bits. Wolfram also worked from the same inspiration: The universe seems to behave like a vast cellular automaton. (see this article: http://www.wired.com/wired/archive/10.12/holytech_pr.html).
But many other physicists do not agree with such a hypothesis, such as Steven Weinberg (see his 2002 article in http://www.nybooks.com/articles/archives/2002/oct/24/is-the-universe-a-computer/?pagination=false).

In this regard, J.D.Barrow has claimed that if our universe is a computer program, then all the laws of physics must involve computable functions (Barrow 1991, p205). A computable function is defined to be a function whose value can always be calculated by performing a finite sequence of well-defined steps, often called an ‘effective procedure’. (URL: http://philsci-archive.pitt.edu/1891/1/UniverseCreationComputer.pdf). (Jan. 2, 2014)

[14] Has global cooling taken place now instead of global warming?

Yesterday i saw a news in television that says in U.S.A. the temperature in many regions go down as low as minus 51 degree celcius, and the bad weather has caused about 2,500 flights have been cancelled. I don,t know whether such bad weather also happens in europe, russia, and other countries.

My question is: does it mean that what happens in the world nowadays is global cooling rather than global warming? For an introduction to global cooling, see an article by Frum at http://edition.cnn.com/2013/11/19/opinion/frum-global-cooling-impact/. I have also read some articles by Dr. David Hathaway (from NOOA) who says that global cooling is caused by low solar activity in recent years. (Jan. 7, 2014)

[15] Is fine structure constant related to Shannon information entropy?

As we know there are many papers in literature trying to derive or explain fine structure constant from theories. Two of interesting papers are by Gilson and by Stephen Adler (see
http://lss.fnal.gov/archive/1972/pub/Pub-72-059-T.pdf), other papers are mostly based on speculation or numerology.

In this regards, in December 2008 i once attended a seminar in Moscow State University, Moscow. The topic of that seminar is relation between fundamental constants. Since the seminar was presented in russian language which i don’t understand, i asked a friend about the presenter. And my friend said that the presenter was Prof. Anosov. I only had a glimpse of his ideas, he tried to describe fine structure constant from Shannon entropy. I put some of his ideas in my note book, but today that book is lost.

I have tried to search in google and arxiv.org to find out if there is paper describing similar idea, i.e. to derive fine structure constant from Shannon entropy, but i cannot find any paper. So if you know that paper by Anosov or someone else discussing relation between fine structure constant and Shannon entropy, please let me know. Or perhaps you can explain to me the basic ideas. (Jan. 7, 2014)

[16] Can an organic battery be a cheap renewable energy solution?

A team of Harvard scientists and engineers has demonstrated a new type of battery that could fundamentally transform the way electricity is stored on the grid, making power from renewable energy sources such as wind and sun far more economical and reliable, as reported two days ago in Nature (January 9th, 2014).

The Harvard team reports that the battery, which they say can be applied on a power-grid scale, uses naturally abundant and small organic compounds called quinones rather than electrocatalysts from costly precious metals such as platinum.

Quinones would be inexpensive to obtain and can be found in green plants or synthesized from crude oil. The battery designed by Harvard scientists and engineers used a quinone molecule that's almost identical to one that's found in rhubarb. The quinones in the Harvard team's battery
are dissolved in water, which also prevents them from catching fire. These hydroquinones would perform a similar function to metal electrocatalysts such as platinum, because the molecules can store electrical energy efficiently.

My question: Can this new discovery of organic battery be cheap renewable energy solution? Your comments are welcome

For more info, see:

(a) http://www.cbc.ca/m/news/#!/content/1.2489300; and

(b) http://news.harvard.edu/gazette/story/2014/01/renewable-energy-breakthrough/; and also

(c) http://www.seas.harvard.edu/news/2014/01/organic-mega-flow-battery-promises-breakthrough-forrenewable-energy (Jan. 11, 2014)

[17] Can gravitation be expressed as information? Is there evidence for it?

First, we can recall a phrase coined by the late John Archibald Wheeler: "It from bit." That phrase seems to indicate that physics has the origin in information bit, be it gravitation or particle physics.

Second, in 2010 a dutch physicist Erik Verlinde proposed that gravitation has an entropic origin. His paper is On the Origin of Gravity and the Laws of Newton (http://arxiv.org/pdf/1001.0785.pdf), and the abstract goes as follows: "Starting from first principles and general assumptions Newton's law of gravitation is shown to arise naturally and unavoidably in a theory in which space is emergent through a holographic scenario. Gravity is explained as an entropic force caused by changes in the information associated with the positions of material bodies."
I think there are other papers suggesting the plausible connection between gravitation and entropy, but Verlinde's paper seems one interesting example.

So, can gravitation be expressed as information? Is there evidence for it? And is there limitation for this relation? What is your opinion? Your comments are welcome.


[18] Is Lorentz-invariant gravitation theory a valid alternative to general relativity?

Krogdahl in his critique to general relativity suggests that we should better consider Lorentz-invariant cosmology (see http://arxiv.org/pdf/0711.1145.pdf).

I tried to search on this issue and only find few articles discussing Lorentz invariant gravitation theory, one of them from wikiversity, see http://en.wikiversity.org/wiki/Lorentzinvariant_theory_of_gravitation. Then i can only locate few papers discussing Maxwell-like Lorentz-invariant gravitation theory, one of them is perhaps worth mentioning here that is by Jeffrey Kaplan, David Nichols and Kip Thorne from Caltech. They summarize DSX paper, their paper can be found at http://arxiv.org/pdf/0808.2510.pdf. (Jan. 27, 2014)

[19] Is the General Theory of Relativity equivalent to the Ginzburg-Landau theory of superconductivity?

There is a quite recent paper (2011) by Santiago-German which says that the Einstein's general theory of relativity is formally equivalent to the Ginzburg-Landau theory of superconductivity (http://arxiv.org/pdf/1112.1179v1.pdf). He further wrote that this fact lead us to suspect that the superconductivity of gravitation ought to be a real physical process occurring in the outskirts of
galaxies.

Such a proposition seems to support previous articles by Horowitz (you can search at google.com), suggesting connection between General Relativity and superconductivity. There is also a paper sometime ago by Kholodenko and Ballard, saying that in dimensions three and higher the famous Ginzburg-Landau equations used in theory of phase transitions can be obtained (without any approximations) by minimization of the Riemannian-type Hilbert-Einstein action functional for pure gravity in the presence of cosmological term. See their paper at http://arxiv.org/abs/gr-qc/0410029.

If such a proposition is correct, then perhaps we can view some problems in cosmology from new angle. Not only dark matter but perhaps the solar system and planets can be viewed as superconductors too. Other possible analogy is between cosmology and condensed matter phenomena such as superfluidity. This analogy has been explored for instance by G. Volovik et al. (Jan. 29, 2014)

[20] Has >60C room temperature superconductivity been discovered?

Today I read a news that 65C room temperature superconductivity has been achieved by increasing dielectric constant. You can read that news (19/01/2014) at http://www.superconductors.org/65C.htm.

The experiment uses titanium instead of silicon.


[21] Are we shifting towards a new Little Ice Age starting from this year?
I just read some comments that the temperature of the world is declining, see
http://iceagenow.info/2012/, and that the world is shifting towards a new Little Ice Age soon.

For a background story on Little Ice Age, see wikipedia for example.

There is also a prediction since 2010 by Dr. Habibullo Abdussamatov, head of space research in
St.Petersburg-Russia, who said that the new Little Ice Age will start from 2014. See:

With regards to extreme low temperature in various regions in North America since january this
year, perhaps this prediction is becoming reality.

However, there is recent paper by Dr. Morner, who writes that the new Little Ice Age will take
place within 15 years from now. See his paper at http://www.pattern-recogn-

[22] Are herbal remedies safe for cancer treatment?

I once had a colleague in a university, he was a professor of postgrad studies. About three years
ago he suffered a bladder cancer, see for example: http://www.cancer.org/cancer/bladdercancer/.
Then he took a surgery abroad, but it seemed that the cancer was spreading. So he decided to
take herbal remedies besides taking chemotherapy.

I am not sure what happened then, except the fact that two years ago he passed away. I dont
know exactly if his condition worsened because of cancer grew or not. But this story makes me
ask about the safety and effectiveness of herbal remedies. Some people think that herbal
remedies have better credibility over other alternative medicines.

So do you agree that herbal remedies are safe for cancer treatment? Do you have experience.
Thank you.
For a background on herbal use for cancer, see for instance:

[23] **Can Proca equations explain electrodynamics in superconductors?**

Martin Tajmar wrote a paper in 2008 with title: Electrodynamics in superconductors explained by Proca equations (see http://arxiv.org/abs/0803.3080). In his paper he tried to describe electrodynamics of superconductors using Proca equations and massive photon.

My question is: considering the complexity of superconductors, can they be explained by Proca equations, in particular the room temperature superconductors? (Feb. 13, 2014)

[24] **Can quantum mechanics be derived from Boltzmann equation?**

Two weeks ago I asked to Prof. Friedwardt Winterberg about his 1995 paper, where he derived quantum mechanics from Boltzmann equation (Z. Naturforsch. 50a). This paper is interesting because it seems to be more consistent compared to Nelson's derivation of QM. Furthermore Winterberg's paper starts with Planck aether assumption.

In physics, specifically non-equilibrium statistical mechanics, the Boltzmann equation or Boltzmann transport equation (BTE) describes the statistical behavior of a thermodynamic system not in thermodynamic equilibrium. It was devised by Ludwig Boltzmann in 1872. See http://en.wikipedia.org/wiki/Boltzmann_equation.

Therefore it appears very interesting to find theoretical connection between Boltzmann equation and quantum mechanics. Other paper which discusses link between Boltzmann equation and quantum relativistic kinetic theory, is Escobedo et al., EJDE, 2003. See:
[25] **Is it possible to explain gravitation from the Higgs boson?**

It is known that Higgs mechanism is right but the theory does not fully explain mass and gravitation (see for instance [http://www.higgs-boson.org/](http://www.higgs-boson.org/)).

In the meantime, there is a rather old paper by M. Consoli where he tries to make connection between Newtonian gravity and Higgs condensate (Url: [http://cds.cern.ch/record/404050/files/9910372.pdf](http://cds.cern.ch/record/404050/files/9910372.pdf)).


For more recent reference, see for example Dejan Stojkovic ([http://arxiv.org/abs/1305.6960](http://arxiv.org/abs/1305.6960)) who discusses implications of the Higgs discovery for gravity and cosmology. The abstract goes as follows: "The discovery of the Higgs boson is one of the greatest discoveries in this century. The standard model is finally complete. Apart from its significance in particle physics, this discovery has profound implications for gravity and cosmology in particular. Many perturbative quantum gravity interactions involving scalars are not suppressed by powers of Planck mass. Since gravity couples anything with mass to anything with mass, then Higgs must be strongly coupled to any other fundamental scalar in nature, even if the gauge couplings are absent in the original Lagrangian." (Feb. 18, 2014)

[26] **Is DME a viable alternative to diesel fuel?**

DME (Dimethyl ether) is a clean, colorless gas that is easy to liquify and transport. Chemically speaking, DME is the simplest ether compound, with a chemical formula of C2H6O. DME can be derived from many sources, including renewable materials for example biomass. See [https://www.ceremade.dauphine.fr/~mischler/articles/18BQRelectronic.pdf](https://www.ceremade.dauphine.fr/~mischler/articles/18BQRelectronic.pdf) (Feb. 15, 2014)
Considering these advantages, some scientists suggest that DME can be an alternative for diesel fuel in the future. See for example:


Other scientist suggests that DME can be produced from natural gas. See for example:


[27] Are there natural treatments for schizophrenia?

Dr. Maureen Roberts describes how one can withdraw from psychiatric drugs. See

http://jungcircle.com/schiznatural.htm. Other useful reference is :

http://www.schizophrenia.com/treatments.php.

I have one friend who suffers schizophrenia but he has experienced bad dreams and anxiety frequently even after he takes the medication. So do you think he can take natural treatment besides the prescribed psychiatric drug? And if yes, then what kind of natural treatment? And is it safe to take such natural treatment? (Feb. 20, 2014)

[28] Is there an aether? If yes, then what are its implications?

On November 24th, 1951, Dirac published a letter in Nature, asking: Is there an aether? He argued based on his new electrodynamics theory that aether is necessary. He concluded his letter with the following words: "Thus with the new theory of electrodynamics we are rather forced to have an aether." See:

http://www.fisicateorica.me/repositorio/howto/artigoshistoricosordemcronologica/1951b
Before Dirac, Einstein himself remarked in his Leiden lecture (1920) that: "According to the general theory of relativity, space without ether is unthinkable..." (see http://www.spaceandmotion.com/Physics-Albert-Einstein-Leiden-1920.htm). Therefore it seems worth to reconsider aether, for instance there is a theory known as Einstein-aether gravity. An entry in wikipedia reads as follows: "...is a generally covariant modification of general relativity which describes a spacetime endowed with both a metric and a unit timelike vector field named the æther. The theory has a preferred reference frame and hence violates Lorentz invariant." (ref: http://en.wikipedia.org/wiki/Einstein_aether_theory)

However we know that Einstein-aether theory has limitations. For review of Einstein-aether theory, see: http://arxiv.org/abs/gr-qc/0410001. (Feb. 21, 2014)

[29] Can time be viewed as scalar temporal field?

According to I.B. Pestov (2004), time can be viewed as scalar temporal field. In his paper with title New Concept of Time and Gravity, he wrote: "A new concept of internal time (viewed as a scalar temporal field) is introduced which predicts the existence of matter outside the time and allows one to solve the energy problem in General Relativity. It is demonstrated that introduction of the temporal field as an objective property of physical systems permits one to derive the physical laws of the electromagnetic field (the general covariant four-dimensional Maxwell equations for the electric and magnetic fields) from the geometrical equations of this field. It means that the fundamental physical laws are in full correspondence with the essence of time. On this ground, from the geometrical laws of the gravitational field the physical evolution equations of this field are derived. Two characteristic solutions of these equations are obtained (including the Schwartzschild solution)." See his paper at:

http://www1.jinr.ru/Preprints/2004/105%28E2-2004-105%29.pdf. His other paper is:

While his theory may lack observability so far, I think his new concept of time seems worth to consider further, especially considering some puzzles in cosmology such as dark matter.

Btw, I met Pestov once around 2009 while he was giving a lecture on "Self-organization and gravity" (in Moscow), but at the time I only asked him some questions which are not related to his suggestion that time is scalar temporal field. I think his 2004 paper is more relevant with the question above. (Feb.22, 2014)

[30] **Is Sarah Becker's fully renewable US electricity system a realistic plan?**

Sarah Becker et al. just released a new paper (arXiv: 1402.2833) where she and her colleagues including Mark Jacobson suggest a new plan for fully renewable US electricity system. Their title is: Features of a fully renewable US electricity system: Optimized mixes of wind and solar PV and transmission grid extensions. The abstract goes as follows: "Wind and solar PV generation data for the entire contiguous US are calculated, on the basis of 32 years of weather data with temporal resolution of one hour and spatial resolution of 40x40km2, assuming site-suitability-based as well as stochastic wind and solar PV capacity distributions throughout the country. These data are used to investigate a fully renewable electricity system, resting primarily upon wind and solar PV power. We find that the seasonal optimal mix of wind and solar PV comes at around 80% solar PV share, owing to the US summer load peak. By picking this mix, long-term storage requirements can be more than halved compared to a wind only mix. The daily optimal mix lies at about 80% wind share due to the nightly gap in solar PV production.

Picking this mix instead of solar only reduces backup energy needs by about 50%." (Feb 24, 2014)

[31] **Does fine structure constant vary with direction of space?**
Over the years, many physicists have wondered whether the fundamental constants of nature might have been different when the universe was younger. If so, the evidence ought to be out there in the cosmos where we can see distant things exactly as they were in the past.

One thing that ought to be obvious is whether a number known as the fine structure constant was different. The fine structure constant determines how strongly atoms hold onto their electrons and is an important factor in the frequencies at which atoms absorb light.

If the fine structure were different earlier in the universe, we ought to be able to see the evidence in the way distant gas clouds absorb light on its way here from even more distant objects such as quasars.

That debate pales in comparison to new claims being made about the fine structure constant. In 2010, John Webb at the University of South Wales, one of the leading proponents of the varying constant idea, and a few coppers said they have new evidence from the Very Large Telescope in Chile that the fine structure constant was different when the universe was younger.

While data from the Keck telescope indicate the fine structure constant was once smaller, the data from the Very Large Telescope indicates the opposite, that the fine structure constant was once larger. That’s significant because Keck looks out into the northern hemisphere, while the VLT looks south. This means that in one direction, the fine structure constant was once smaller and in exactly the opposite direction, it was once bigger. And here we are in the middle, where the constant as it is (about 1/137.03599…) 

So, do you think that fine structure constant varies with direction in space?

For further reading on this issue, see http://www.technologyreview.com/view/420529/fine-structureconstant-varies-with-direction-in-space-says-new-data/.

Refs:

arxiv.org/abs/1008.3907: Evidence For Spatial Variation Of The Fine Structure Constant

Included here you can also find a 2004 ApJ paper by John Bahcall, who is a proponent of varying fine structure constant. (URL: http://www.sns.ias.edu/~jnb/Papers/Preprints/Finestructure/alpha.pdf) (Feb 26, 2014)

[32] Can quantum nonlocality be explained using (complex) Maxwell equations?

Quantum nonlocality belongs to one puzzling feature of quantum mechanics, which some people think as unexplained using classical theories. But there seems a possibility to explain quantum nonlocality using Maxwell equations or complex Minkowski approach.

See for instance, Wheeler-Feynman absorber theory, which is an interpretation of electrodynamics derived from the assumption that the solutions of the electromagnetic field equations must be invariant under time-reversal symmetry, as are the field equations themselves. Ref. http://en.wikipedia.org/wiki/Wheeler%E2%80%93Feynman_absorber_theory. This theory is related to Transactional Interpretation of Quantum Mechanics suggested by John G. Cramer, see http://en.wikipedia.org/wiki/Transactional_interpretation.

[33] **Are there vortices associated with the wave function of a single electron?**

There is a recent publication in PRL (Feb. 2014) by Schmidt et al., which says that there are vortices associated with the wave function of a single electron. Their abstract is as follows: "We present measurements and calculations of the momentum distribution of electrons emitted during the ion-atom collision ... which show rich structures for ion scattering angles above 2 mrad arising dominantly from two-electron states. Our calculations reveal that minima in the measured distributions are zeros in the electronic probability density resulting from vortices in the electronic current." (ref. [http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.112.083201](http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.112.083201), or see: [http://arxiv-web3.library.cornell.edu/pdf/1402.6853.pdf](http://arxiv-web3.library.cornell.edu/pdf/1402.6853.pdf)). This paper reminds me to Kobayashi and Shimbori’s paper (2001) suggesting that there is vortex solution of Schrodinger equation. (ref. [http://arxiv.org/pdf/cond-mat/0103209.pdf](http://arxiv.org/pdf/cond-mat/0103209.pdf)). (Mar 4, 2014)

[34] **Does the Sun's core consist of iron instead of hydrogen? And what is its implication to solar energy sources?**

For years, scientists have assumed that the sun is an enormous mass of hydrogen. Galileo was the first to propose that the sun is filled with gas. But Dr. Oliver Manuel says iron, not hydrogen, is the sun's most abundant element. IF his suggestion is true then it may imply that the source of solar energy is different of the presently held theory of hydrogen fusion.


Reference to Dr. Oliver Manuel's papers:

Others:

www.omatumr.com/archive/XenonInCarbonaceousChondrites.pdf


3. “Solar abundances of the elements,” Meteoritics 18, 209-222 (1983);
http://tinyurl.com/224kz4


6. A Journey to the Core of the Sun: Chapter 2 - Acceptance of Reality (Jan 2014)

[35] Is there formal correspondence between Poisson brackets and commutators using complex coordinate?
In a 1966 paper, Strocchi shows that there exists formal correspondence between Poisson brackets and commutator brackets using complex coordinate. His paper was published in Rev. Mod. Phys. 38, 36 (URL: http://journals.aps.org/rmp/abstract/10.1103/RevModPhys.38.36). His abstract goes as follows: "By introducing complex canonical coordinates, classical and quantum mechanics may be embedded in the same formulation. In such a way, the connection between Poisson brackets and commutators, canonical transformations and unitary transformations, etc., become apparent. This formulation is also particularly suitable for discussing the classical limit of quantum mechanics and for quantum-statistical mechanics." (Mar 20, 2014)

[36] Are virtual particles really constantly popping in and out of existence? Can laser make them real?

Virtual particles are indeed real particles. Quantum theory predicts that every particle spends some time as a combination of other particles in all possible ways. These predictions are very well understood and tested.

Quantum mechanics allows, and indeed requires, temporary violations of conservation of energy, so one particle can become a pair of heavier particles (the so-called virtual particles), which quickly rejoin into the original particle as if they had never been there. (see Scientific American, Oct 9 2006, http://www.scientificamerican.com/article/are-virtual-particles-real/)

Recent methods claim that lasers will be able to make virtual particles real:

"Next-generation lasers will have the power to create matter by capturing ghostly particles that, according to quantum mechanics, permeate seemingly empty space."

The uncertainty principle of quantum mechanics implies that space can never be truly empty. Instead, random fluctuations give birth to a seething cauldron of particles, such as electrons, and their antimatter counterparts, called positrons.
These so-called "virtual particles" normally annihilate one another too quickly for us to notice them. But physicists predicted in the 1930s that a very strong electric field would transform virtual particles into real ones that we can observe. The field pushes them in opposite directions because they have opposite electric charges, separating them so that they cannot destroy one another." (see New Scientist 2010, http://www.newscientist.com/article/dn19327-lasers-could-make-virtualparticles-real.html) (Apr. 1, 2014)

[37] **Is mind-reading real or fake phenomenon?**

According to an experiment led by Stanford neuroscientist, Josef Parvizi, one can see what others think, at least under special conditions. See http://scopeblog.stanford.edu/2013/10/15/mind-reading-inreal-life-study-shows-it-can-be-done-but-theyll-have-to-catch-you-first/

Such mind reading phenomenon has been debated for a long time, where some people believe in mind reading possibility while others think that it is a fake phenomenon. Some physicists believe that mind reading can be related to biological effect of quantum reality.

I have several friends who believe they can read the others's mind. Most of those friends are women. Or perhaps some women do have such mind reading ability?

Personally i don't think that psychic mind reading is real. I think it is something more related to psychological guess rather than mind reading, just like what you do while you play chess or bridge or poker, you try to 'read' what other people's think, but that does not mean you can do mind reading. A good movie discussing mind reading is perhaps Red Lights. (Apr 12, 2014)

[38] **Are there simple proofs of Fermat's last theorem?**
Beside rigorous proofs of Fermat's last theorem, there are relatively simple approaches to arrive at the same conclusion. One of the simple proofs is by Pogorsky, available at http://vixra.org/abs/1209.0099.

There is also a website called www.fermatproof.com which gives an alternative proof, and also a review paper by P. Schrorer at: http://www.occampress.com/fermat.pdf.

Another numerical experiment was performed by me around eight years ago (2006), which showed that if we define \( k = (a^n + b^n)/c^n \), where \( a, b, c \) are triplets corresponding to Pythagorean triangle (like 3,4,5 or 6,8,10), then \( k = 1 \) if only if \( n = 2 \). It seems that we can generalize the Fermat's last theorem not only for \( n > 2 \) but also for \( n < 2 \). But of course my numerical experiment is not intended to be a rigorous proof. Our paper is available at http://vixra.org/pdf/1404.0402v1.pdf, based on 2006 version article. (Apr 21, 2014)

[39] Can Schumann resonance be used to improve human brain's function?

Schumann resonance can be loosely defined as resonant frequency of earth and ionosphere if they are modeled as waveguide. The frequency can be written as: \( f = 7.5n \) Hz, where 7.5 Hz is defined as fundamental frequency \( (n=1) \). See http://www.hese-project.org/heseuk/en/papers/schlegel_schumann.pdf

Some people think that Schumann resonance may be used to improve human brain's healthy function, because it corresponds to alpha state of brain. (May 8, 2014)

[40] Does anyone have a clue about the present location of the original Menorah?
It is well known that there are three symbols of ancient Israel, i.e. the Ark of the Covenant, the original Menorah of Tabernacle, and the tablets of stone from Sinai where the Ten Commandments were supposedly written. All of these three symbols were lost since the Shlomo's First Temple was destructed by the Babylonian army. See http://www.torah.org/features/holydays/templemenorah.html.

And perhaps the first Menorah was lost even since the Israeli crossed the Jordan river.

But considering a report by Bob Cornuke (History channel) that the Ark of the Covenant is probably located in the Church of Mary from Sion, in Ethiopia, then it seems quite possible to also find a clue on the present location of the ancient Menorah. Some years ago, I even read a fiction book suggesting that the original Menorah, made of a single block of gold, is located somewhere in an underground temple in an old city in Egypt.

I think the original Menorah is one of the most iconic symbols of archaeology, so if anyone knows possible locations of that piece of ancient Israel please kindly share here.

[41] Is it possible to find an exact model of an electron based on the solution of the wave equation?

Today I found an interesting paper by G. Poelz (retired from Hamburg University) which suggests that electrons have wave character, see http://arxiv.org/pdf/1206.0620.pdf. Basically he describes an electron model based on the solution of the wave equation in spherical coordinates (see Appendix 6.2 in his paper). This would need the use of spherical Bessel functions of the first kind (see for instance: http://mathworld.wolfram.com/SphericalBesselFunctionoftheFirstKind.html).

Interestingly, I found that George Shpenkov also uses a similar method to describe not only electrons but other atoms as well, based on the solution of the wave equation in spherical coordinates. See his page at this www.researchgate.net or at http://shpenkov.janmax.com.
Shpenkov asserts that his method is different from the electron cloud model based on the Schrodinger equation.

While of course this kind of electron model may be different from the standard picture, it seems to be able to fulfill Louis de Broglie's vision in his Nobel lecture: Wave nature of electrons. (see http://www.nobelprize.org/nobel_prizes/physics/laureates/1929/broglie-lecture.pdf)

[42] **Is there a good PHP textbook for scientific applications?**

For some months I have been looking for a good textbook on how we can use the PHP language for scientific and engineering applications, but so far I have not found any. For example, I'd like to know how to solve differential equations using PHP code. So if somebody knows any good PHP textbooks on this topic (downloadable ebook is preferable), please kindly let me know.

[43] **Is it possible to describe solar system (planetary orbits) using self-organized criticality theory?**

It is known that solar flares show power law characteristics, so it may also be related to critical self organization (see Guido Boffetta et al., PRL, 1999, http://personalpages.to.infn.it/~boffetta/Papers/bcgvv99.pdf). SOC is a concept introduced by Per Bak, Tang et al. (BTW) to explain complex dynamics of various phenomena, and this concept has been used to explain many phenomena like earthquakes, economic fluctuations, etc.

My hypothesis is that SOC can be used to explain the origin of the solar system too, especially planetary orbits, alas so far I do not find any equation yet which is based on SOC and can be used to derive numerical predictions of planetary orbit distances in solar systems. We know that
planetary orbit distances in solar systems can be explained by many models such as Titius-Bode law, wave mechanics, wave equation and Lane-Emden equation.

[44] **Is it really true that the Universe experiences accelerating expansion?**

According to Standard Model cosmology, the universe experiences accelerating expansion, which creates the need for dark energy models.

But I read other possible theories, for example Lemaitre-Tolman-Bondi (LTB) model which suggests that there are large structures (void) which introduce inhomogeneity in the Universe. See for instance: [http://arxiv.org/abs/0709.2044](http://arxiv.org/abs/0709.2044).

Therefore it seems that the homogeneous-isotropic assumption of the Standard Model is questionable.

Another possible explanation is Kashlinsky-Tsagas's dark flow model. Basically it says that the observed accelerating expansion is a mere illusion. See [http://www.nbcnews.com/id/44690771/ns/technology_and_science-science/t/accelerating-universecould-be-just-illusion/#.U4vYcvFhiK1](http://www.nbcnews.com/id/44690771/ns/technology_and_science-science/t/accelerating-universecould-be-just-illusion/#.U4vYcvFhiK1)

[45] **Is there a connection between self-organized criticality and human cognition?**

In a rather old paper, Wagenmakers, Farrell and Ratcliff (2005) suggest that it is difficult to introduce Self-Organized Criticality and nonlinear dynamics to explain human behavior. They write: "the absence of a specific model for how self-organized criticality produces the observed behavior makes it very difficult to derive testable predictions. The authors conclude that the proposed paradigm shift is presently unwarranted." See the paper included here or find their paper in this link: [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1404501/pdf/nihms2267.pdf](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1404501/pdf/nihms2267.pdf).

However, in a more recent paper, Ramos, Sassi & Piqueira (2011) argue that SOC can be used to

Therefore, it seems that there are two different opinions, i.e.: (a) SOC cannot be used in the field of human cognition and psychology and general, (b) SOC is useful to predict human behavior. In this regards, perhaps we can also consider that there are special circumstances where human being can experience critical phenomena, for example there are some people who can jump on high fences or walls when they are in danger (for example running from fire or dogs etc). So it seems that in certain circumstances, it is possible to use SOC to explain human behavior.

[46] **Is the Sun primarily comprised of condensed matter?**

According to conventional paradigm, the sun is assumed to consist of hot gaseous plasma. But that assumption is not supported by direct astronomical evidence.

Another idea is suggested by Dr. Oliver Manuel, who proposed that the Sun's core consist mainly of iron and the source of energy in the sun is not fusion but neutron repulsion.

But Prof. Pierre-Marie Robitaille has different idea. He suggests that the Sun is primarily comprised of condensed matter. In a recent report, he argues that there are 40 evidences supporting his hypothesis.


If Robitaille's hypothesis holds true, then it could imply that the process inside the Sun may be modeled as Condensed Matter Nuclear Science.

[47] **Is modern pharmacy a remedy or more like a poison?**

According to Fritjof Capra in his book: The Turning Point, modern medicine and pharmacy suffer from Cartesian dualism.
But I think the problem goes back in time to ancient Greek. For example, etymologically the word "pharmakos" means a human sacrificed to the gods. And "pharmakon" has ambivalent and paradoxical meaning of both remedy and poison (see http://flutuante.wordpress.com/2009/08/01/pharmakon-the-cure-or-the-poison/). And it seems this mythology has legacy too to the present time. For instance, drugs like cocaine can be used for anesthetic purpose, but in larger dose it can be lethal. Vaccination was often made of bacteria, which sometimes it can be lethal for infants (although such incidents were often neglected statistically). And sting of bees has been found to have healing effect for some types of illness, while it can also be harmful.

Another paradoxical example of modern medicine is overall low contribution of chemotherapy to cancer survival. According to a report, chemotherapy makes a minor contribution to cancer survival (around 2.3% in Australia and 2.1% in USA), although the situation also depends on the type of cancer in question (see http://weeksmd.com/2009/01/success-rate-of-chemotherapy-21-hunh/). This seems to indicate that there is much room for improvement with cancer treatment.

Furthermore, the language of warfare and battle are often used in medicine world, such as "attack" the HIV causes, "eradicate" polio etc. Such languages indicate that human illness are viewed as enemies. At the other side, in Eastern medicine, various illnesses are viewed as imbalance of the body. A healthy human body is a result if all organs function in harmony. Therefore, the purpose of medicine is to return that harmony instead of attacking the illnesses.

[48] Can entropic force explain dark energy properly?

Since Verlinde's proposal that gravitation is related to entropy, there are many papers discussing or extending his hypothesis. In a recent paper, Basilakos and Sola reconsidered entropic-force dark energy (http://arxiv.org/pdf/1402.6594v3.pdf). They wrote: "We reconsider the entropic-force model in which both kind of Hubble terms appear in the effective dark energy (DE) density affecting the evolution of the main cosmological functions, namely the scale factor, deceleration
parameter, matter density and growth of linear matter perturbations. However, we find that the entropic-force model is not viable at the background and perturbation levels due to the fact that the entropic formulation does not add a constant term in the Friedmann equations."

[49] **Why is success rate of chemotherapy very low? And is it possible to improve that?**

According to 2004 report by Morgan, Ward, and Barton: "The contribution of cytotoxic chemotherapy to 5-year survival in adult malignancies. ... survival in adults was estimated to be 2.3% in Australia and 2.1% in the USA." (see http://www.ncbi.nlm.nih.gov/pubmed/15630849, or https://www.burtongoldberg.com/home/burtongoldberg/contribution-of-chemotherapy-to-five-year-survival-rate-morgan.pdf).

Although such conditions may vary for different types of cancer, it is commonly held that 80% of oncologists will not take chemotherapy if they suffer cancer themselves.

Another possible approach is perhaps herbal chemotherapy, which according to another report may yield 85% success rate. (see http://breastcancerconqueror.com/85-success-rate-with-herbal-chemo/)

[50] **Is it possible to include indeterminacy into definition of differentiation?**

In the attached paper from Gauge Institute (see attachment), the definition of differential in e-calculus is (see page 8):

\[
F'(x) = \frac{f(x+e) - f(x)}{e}
\]  

(1)
where $e$ is defined as an infinitesimal (i.e. it should be smaller than any number but greater than zero). From this definition in (1) it should be clear, that as $e$ approaching zero, it is assumed that the function of $f'(x)$ has the form of a slope (linear). But this assumption has problem in real data of many phenomena, i.e. when the observation scale goes smaller and smaller then it behaves not as a linear slope but as brownian motion. Other applications such as in earthquake data, stock market price data etc. indicate that each data includes indeterminacy (I).

I just thought that perhaps we can extend the definition of differentiation to include indeterminacy (I), perhaps something like this:

$$F'(x) = \frac{f(x+e)+2I-f(x)}{e}. \quad (2)$$

The I parameter implies that the geometry of differential is not a slope anymore. The term $2I$ has been introduced to include unpredictability/indeterminacy of the brownian motion. And it can split into left and right differentiation. The left differential will carry one I, and the right differential will carry one I.

Another possible way is something like this:

$$F'(x) = (1+I) \frac{f(x+e)-f(x)}{e} \quad (3)$$

Where I represents indeterminacy parameter, with range from 0.0-0.5.

Other possible approaches may include Nelson's Internal Set Theory, Fuzzy Differential Calculus, or Non-smooth Analysis.
That is my idea so far, you can develop it further if you like. This idea is surely far from conclusive, it is intended to stimulate further thinking.