



Christology Reloaded:

Selected Papers 2010-2016

Victor Christianto

First Edition, August 2016

www.sci4God.com

Christology Reloaded: Selected Papers 2010-2016

Victor Christianto

1 *"The heavens declare the glory of God; and the firmament sheweth his handywork.*

2 *Day unto day uttereth speech, and night unto night sheweth knowledge.*

3 *There is no speech nor language, where their **voice** is not heard. "*

(Psalm 19:1-3, KJV)

Dedication

This book is dedicated for all people who have shaped my thoughts and influenced my life over these years, including:

1. Jesus Christ, my Lord and the Good Shepherd
2. My parents, Cornelis and Hartini Handriyo (RIP)
3. My elder brother and his wife: David & Denok
4. My younger brothers: Daniel and Sonny
5. My younger sister: Eva
6. Minister Dr. Benyamin Abednego (RIP), for guiding me in difficult time
7. Minister Dr. Bambang Noorsena, for many insightful discussions
8. Old friends: Sujarwo & Linda, for warm friendship over the years
9. Old colleague: Mr. Susanto Tjokrosaputro, for good advises when I was young engineer
10. Professor Dr. Florentin Smarandache, for being a good friend in difficult times
11. Minister Dr. Paskalis Edwin Nyoman Paska, for guiding me during thesis writing
12. Minister Gani Wiyono, for guiding me during thesis preparation
13. Professor Dr. Liek Wilardjo, for many good advises and friendship
14. Minister Dr. Joas Adiprasetya, for stimulating discussion at January 2015
15. Minister Dr. Yonky Karman, for stimulating discussion at August 2015
16. Professor Tuweh Gadama, for his encouraging words to continue this study
17. Mrs. Yulia Oeniyati from Yayasan Lembaga SABDA
18. All friends at Yayasan Lembaga SABDA, including Hadi, Benny, Ody, Tika, Aji, Harjono, Hilda, Santi, Gunung, Berlin, Bayu, Okti, etc.
19. All friends and colleagues at Satyabhakti Advanced School of Theology
20. All friends and ministers at Gereja Kristen Indonesia
21. All friends from SDK Cor Jesu, SMP Cor Jesu, SMAN 3 Malang

PREFACE

Yes, you are right: I am a fan of *The Matrix Trilogy* movies. And this book is inspired in part by that movie. But not only that, I am also inspired by a book written by Chris Seay, with title: *The Gospel Reloaded*. It is full of new thought provoking ideas based on The Matrix.

The basic idea of this book is that it is possible to develop a new cosmology model inspired by Cosmic Christology. In other words, Christology is not a separate matter from science. From Christology as starting point, I began to develop various approaches based on wave physics, which I call: "*fractal vibrating string*." Through this new cosmology model, I wish to offer a new path for dialogue between science and theology. Moreover, it is intended to offer a new and fresh approach to understand the Bible in this modern age.

I sincerely hope that you will like this new path, as I like it very much.

Enjoy reading! **Soli Deo Gloria.**

Version 1.0: July 24th, 2016. 23:30 WIB; Version 1.1: Aug. 2nd, 2016, 22.00WIB

Victor Christianto, <http://www.sci4God.com>

email: victorchristianto@gmail.com

Cellular phone: (62) 878-59937095

Twitter: @christianto2013

Skype: vic1043

Line: Vic1043

weChat: christianto2014

URL: http://vixra.org/author/victor_christianto

URL: <http://behurrytorepent.wix.com/myblog>

URL: <http://independent.academia.edu/VChristianto>

URL: http://researchgate.net/profile/Victor_Christianto

<https://www.facebook.com/ABiblicalTheoryofEverything>

<https://www.facebook.com/Graceforyou44Guides>

Short biography



He was born in East Java, Indonesia, and then he studied engineering in a state university in East Java from 1987-1992. Then he worked until 2008. In December 2008 he was granted a scholarship to study gravitation and cosmology at *Institute of Gravitation and Cosmology* in Peoples' Friendship University of Russia (PFUR) in Moscow until June 2009. Since October 2009, he works and dedicates his life for Jesus Christ. Then in 2011 he went to study theology. He graduated as Master in Theology in September 2014. He published more than 50 papers and 14 books. Since August 2015, he holds Doctor of Divinity and administers www.Sci4God.com.

Other books by this author and his colleagues:

- a. Victor Christianto & I Made Wiryana. **Manajemen Proyek berbasis Internet**. Jakarta: Elex Media Komputindo 2002. (Internet based Project Management. In bahasa Indonesia)
- b. Victor Christianto. **Oracle JSP: Sebuah Pengantar**. Jakarta: Elex Media Komputindo 2002. (Oracle JSP: An Introduction. In bahasa Indonesia)
- c. Florentin Smarandache & Victor Christianto. **Multi-Valued Logic, Neutrosophy, and Schrödinger Equation**. USA: Hexis-Phoenix, 2006. ISBN: 1-931233-04-7, 109 p.
- d. Florentin Smarandache, Victor Christianto, Radi Khrapko, Fu Yuhua, John Hutchison. **Unfolding the Labyrinth: Open Problems in Physics, Mathematics, Astrophysics and other Areas of Science**. USA: Hexis-Phoenix, 2006. ISBN: 1-59973-013-8, 140 p. (collection of scientific papers)

- e. Florentin Smarandache & Victor Christianto (editors). **Quantization in Astrophysics, Brownian Motion and Supersymmetry**. Chennai, Tamil Nadu, India: MathTiger, 2007. ISBN: 819021909X, 516 p. (collection of scientific papers)
- f. Florentin Smarandache & Victor Christianto (editors). **Hadron Models and related New Energy issues**. USA: InfoLearnQuest, 2008. ISBN: 978-1-59973-042-4, 476 p. (collection of scientific papers)
- g. Florentin Smarandache & Victor Christianto. **Cultural Advantage for Cities: An alternative for developing countries**. USA: InfoLearnQuest, 2008. ISBN: 9-78159973-060-8, 63p.
- h. Fu Yuhua, Florentin Smarandache & Victor Christianto (editors). **Cultural Advantages in China: Tale of Six Cities**. USA: InfoLearnQuest, 2009. ISBN: 978-1-59973-068-4, 96 p. (collection of scientific papers)
- i. Florentin Smarandache & Victor Christianto. **Neutrosophic Logic, Wave Mechanics, and Other Stories: Selected Works 2005-2008**. Bucharest: Kogaion Editions, 2009. ISBN: 978-973-7609-31-1, 131 p. (collection of scientific papers)
- j. Florentin Smarandache, Victor Christianto & Pavel Pintr (editors). **Quantization and Discretization at Large Scales**. Columbus, Ohio: ZIP Publishing, 2012. (collection of scientific papers)
- k. Victor Christianto. **Some Problems of Nuclear Energy Development in Asia**. Amazon Kindle Digital Publishing, 2013. URL: <http://www.amazon.com/dp/B00B4LW5ZW> or: <http://www.amazon.co.jp/problems-nuclear-energy-development-ebook/dp/B00B4LW5ZW>
- l. Florentin Smarandache & Victor Christianto. **Clan Capitalism, Graph Distance, and Other Issues**. Bucharest: Kogaion Editions, 2013. URL: <http://www.gallup.unm.edu/~smarandache/ClanCapitalism.pdf> (collection of scientific papers)
- m. Florentin Smarandache , Victor Christianto. **A Journey into Quantization in Astrophysics: A Collection of Scientific Papers**. Gallup, New Mexico, USA: Multimedia Larga, 2013. ISBN: 978-1-599-73254-1. (collection of scientific papers)
- n. Victor Christianto. **Grace for you: 44 Guides for Living inspired by Jesus Christ**. Saarbrücken, Germany: Blessed Hope Publishing, 2013. URL: <https://www.morebooks.de/store/gb/book/grace-for-you/isbn/978-3-639-50070-7> (collection of articles on spirituality)
- o. Victor Christianto. **A.L.I.C.E. with Jesus: A Life-Changing Experience with Jesus**. Saarbrücken, Germany: Blessed Hope Publishing, 2014. Available at URL: <https://www.morebooks.de/store/gb/book/a-l-i-c-e-with-jesus/isbn/978-3-639-50080-6> (collection of articles on spirituality)
- p. Victor Christianto. **Drink the New Wine: Experience God in your daily life**. Saarbrücken, Germany: Blessed Hope Publishing, 2014. Available at <http://www.morebooks.de> (collection of articles on spirituality)
- q. Victor Christianto. **Seeking a Theory for the End of the World: Introduction to Fractal Vibrating String**. Saarbrücken, Germany: LAP Lambert Academic

- Publishing, 2014. <https://www.shuyuan.sg/store/gb/book/seeking-a-theory-for-the-end-of-the-world/isbn/978-3-659-58074-1> (collection of scientific papers)
- r. Victor Christianto. **A Biblical Theory of Everything inspired by the Johannine Prologue**. Saarbrücken, Germany: LAP Lambert Academic Publishing, 2015. Available at <https://www.shuyuan.sg/store/gb/book/a-biblical-theory-of-everything/isbn/978-3-659-78041-7> (collection of scientific papers)

Contents

Dedication

Preface

Short biography

Basic Concepts

1. An Outline of New Cosmology Model Inspired by Cosmic Christology of the Johannine Prologue (2016)
2. A Comparative Study of Cosmology Revealed from Christology and Trinitarian Approaches (2016)
3. An Outline of Cosmology Based on Interpretation of the Johannine Prologue, *The Bulletin of Society for Mathematical Services and Standards*, Vol. 11, pp. 4-12, 2014
4. On Hermeneutics & Its Relation to Science (2016)
5. An Adventure from Wave Mechanics to Christocentric Cosmology Model (2016)

Applications

6. A Graphic Plot for a Soliton Solution of Sine-Gordon model of DNA (2014)
7. On the Plausible Implications of Gariaev & Montagnier's Work: Omne Vivum ex Vivo via Crebritudo? (2016)
8. A review of cancer electromagnetic frequency therapy: Towards Physics of Cancer (2015)
9. Some Implications of Human Genome Research and Its Related Ethical Discourse (2010)
10. On Direct Detection of Cosmic Neutrino Background & Cosmic Singularity (2016)
11. Grand Design, Intelligent Designer, or Simply GOD: Stephen Hawking and His "Hoax" (2010)
12. Four Possible Methods to Extend Lehnert's Screw-shaped Photon (2016)
13. Exploration of a SU(2) Electrodynamics Based on Lehnert's Revised Quantum Electrodynamics (2016)
14. London-Proca-Hirsch Equations for Electrodynamics of Superconductors on Cantor Sets, *Evolving Trends in Engineering and Technology*, Vol. 4, pp. 1-7, 2015

15. A Derivation of Proca Equations on Cantor Sets: A Local Fractional Approach,
Bulletin of Mathematical Sciences and Applications, Vol. 10, pp. 48-56, 2014

Miscellaneous

16. On Quantization of Galactic Redshift & the Source-Sink Model of Galaxies (2013)
17. On Primordial Rotation of the Universe, Hydrodynamics, Vortices & Angular Momenta of Celestial Objects (2012)
18. On Astrometric Data & Time Varying Sun-Earth Distance in Light of Carmeli Metric (2010)
19. On Gödel's Incompleteness Theorem, Artificial Intelligence & Human Mind (2013)
20. An Exact Solution of Modified KdV (mKdV) Equation as a Reduction of Self-Dual Yang-Mills Theory, *The Bulletin of Society for Mathematical Services and Standards*, Vol. 12, pp. 1-3, 2014
21. From Sachs-Wolfe Acoustic Theorem to Fractal Laplace-Beltrami Operator (2015)
22. Extending Lehnert's Revised Quantum Electrodynamics to Fractal Media & Cantor Sets (2016)
23. A Derivation of GravitoElectroMagneticProca-type Equations in Fractional Space (2014)

BASIC CONCEPTS

Exploration

An Outline of New Cosmology Model Inspired by Cosmic Christology of the Johannine Prologue

Victor Christianto*

Abstract

This article discusses an outline of a new cosmology model based on my interpretation of the Johannine Prologue. The objective of this article is to propose a new cosmology model which is biblically sound and scientifically verifiable, inspired by cosmic Christology of the Johannine Prologue. Because this is only an outline, it should be obvious that this is not a complete and working cosmology model. More research is needed to develop it further and also to test this idea. New experiments may be expected in the future to verify this proposal.

Key Words: New cosmology, cosmic Christology, Johannine Prologue.

Introduction

Despite many efforts in the literature to discuss various cosmology models from biblical perspectives,¹ 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.²

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

*Correspondence: Victor Christianto, Independent Researcher. Email: victorchristianto@gmail.com.

¹ See for instance: Willem B. Drees. *Beyond the Big Bang: Quantum Cosmologies and God*. La Salle, Illinois: Open Court Publ. Co., 1990

² George V. Coyne & Michael Heller. *A Comprehensible Universe*. New York: Springer-Verlag New York, 2008.

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.³ 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.⁴

A short summary of Dabrowski and Marosek⁵ will be made here: Varying physical constant cosmologies were claimed to solve standard cosmological problems such as the horizon, the flatness and the Λ -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.⁶

³ Michael Heller. Cosmological Singularity and the Creation of the Universe.
<http://www.templetonprize.org/pdfs/93-113.pdf>

⁴ Edward Belbruno. On the regularizability of the Big Bang Singularity (2012). arxiv.org/1205.1474v2.pdf

⁵ Mariusz P. Dabrowski & Konrad Marosek. Regularizing cosmological singularities by varying physical constants (2012). arxiv.org/1207.4038v4.pdf

⁶ Ibid.

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 $a=0$.⁷

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 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. J. Luminet.⁸ 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.⁹ 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:

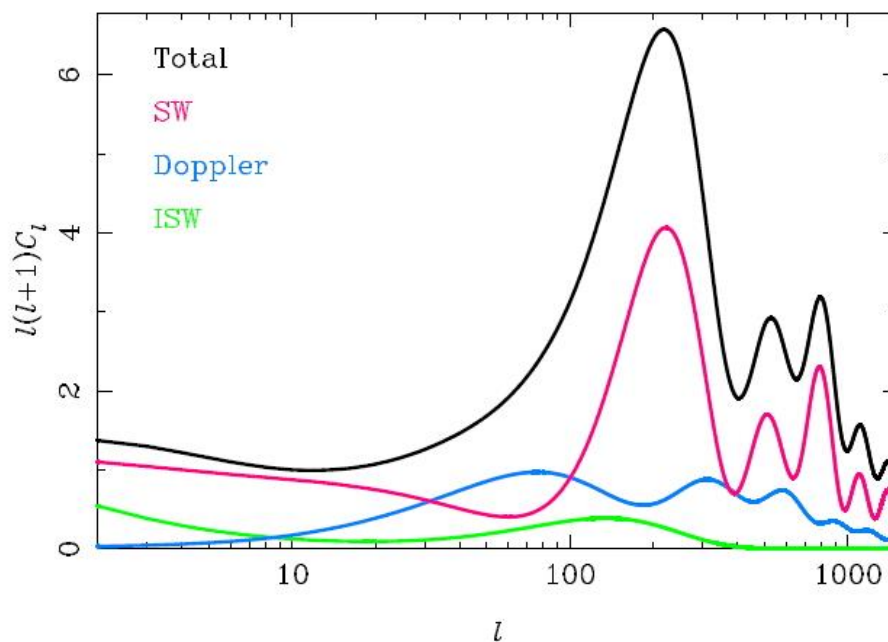


Figure 1. Various contributions to CMB temperature anisotropies [7, p.13].

⁷ Edward Belbruno. On the regularizability of the Big Bang Singularity (2012). arxiv.org/1205.1474v2.pdf

⁸ URL: <http://www.obspm.fr>

⁹ L.P. Grishchuk. Cosmological Sakharov oscillations and Quantum Mechanics of the early Universe (2011). arXiv: 1106.5205 [gr-qc]

Second, Hawking-Hartle 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*.¹⁰ 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 2004.¹¹ 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.

¹⁰ Zurek, Wojciech H. ed. *Complexity, Entropy and the Physics of Information*. Santa Fe Institute/Addison-Wesley Publ., 1990

¹¹ Christianto, V. A Cantorian Superfluid Vortex and the Quantization of Planetary Motion. *Apeiron* Vol. 11 No. 1, January 2004, URL: <http://redshift.vif.com>.

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.¹² 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.) For an introduction to the relationship between classical and quantum theory, see for instance Landsman.¹³

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 concept has not been discussed elsewhere before to study astrophysics and cosmology phenomena.

The proposed solution: A Cosmology model inspired by 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.¹⁴

¹² Christianto, V., & Smarandache, F. A derivation of Maxwell's equations in quaternion space. *Progress in Physics*, 2009. URL: <http://www.ptep-online.com>

¹³ Landsman, N.P. *Between classical and quantum* (2005). arXiv:quant-ph/0506082.

¹⁴ Andrew Zimmerman Jones & Daniel Robbins. *String Theory for Dummies*. Indianapolis, Indiana: Wiley Publishing Inc., 2010. P. 169.

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).¹⁵

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.¹⁶ 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.”¹⁷

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.¹⁸ 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.¹⁹

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 Mendeleev. 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 a recent paper.²⁰

¹⁵ Victor Christianto. An Outline of Cosmology based on interpretation of The Johannine Prologue. *Bull. Soc. Math. Services and Standards*. Vol. 3 No. 3 (2014) URL: www.scipress.com

¹⁶ George P. Shpenkov. *Dialectical View of the World: The Wave Model (Selected Lectures)*. Volume I: Philosophical and Mathematical Background (2013). URL: <http://shpenkov.janmax.com/Vol.1.Dialectics.pdf>

¹⁷ Ibid, p.7.

¹⁸ Christianto, V. An Outline of Cosmology based on interpretation of The Johannine Prologue. *Bull. Soc. Math. Services and Standards*. Vol. 3 No. 3 (2014) URL: www.scipress.com

¹⁹ Christianto, V. A review on Schrödinger equation & classical wave equation. *Prespacetime Journal* Vol.5 No. 5, May 2014. URL: <http://www.prespacetime.com> or http://www.vixra.org/author/Victor_Christianto

²⁰ Christianto, V. An Outline of Cosmology based on interpretation of The Johannine Prologue. *Bull. Soc. Math. Services and Standards*. Vol. 3 No. 3 (2014) URL: www.scipress.com

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".²¹ 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 the 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)."²²

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..."²³

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:

²¹ Jones, Andrew Zimmerman & Daniel Robbins. *String Theory for Dummies*. Indianapolis, Indiana: Wiley Publishing Inc., 2010. P. 169.

²² Klink III, Edward W. "Light of the World: Cosmology and the Johannine Literature," Chapter 5 in Jonathan T. Pennington & Sean M. McDonough (eds.) *Cosmology and the New Testament Theology*. London: T&T Clark, 2008. p. 74-89

²³ Holman Christian Standard Bible, Free edition obtained at OliveTree BibleStudy App.

- 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.

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.²⁴

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.

Conclusion

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 proposal 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).

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.

²⁴ Christianto, V. A derivation of Gravitoelectromagnetic (GEM) Proca-type equations in Fractional Space. *Prespacetime Journal* Vol. 5 No. 5 May 2014, www.prespacetime.com or http://www.vixra.org/author/Victor_Christianto

Acknowledgement: I would like to thank many colleagues all over the world, who have shared their ideas and knowledge with me over these years. Many thanks go to Prof. Florentin Smarandache (UNM) who has worked together with me in some books and papers, 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 ideas on acoustic model of dark energy, and to Prof. Carlos Castro Perelman (Atlanta - Georgia) and Prof. Matti Pitkanen (Finland) who have given many insights since 2001. And special thanks also go to many scholars and researchers who have discussed my questions in www.researchgate.net. Many thanks also go to Dr. Volodymyr Krashnoholovets (Ukraine), Michael Peck (USA), 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.

References

- [1] Willem B. Drees. *Beyond the Big Bang: Quantum Cosmologies and God*. La Salle, Illinois: Open Court Publ. Co., 1990
- [2] David Wilkinson, *Christian Eschatology and the Physical Universe*. London: T&T Clark Intrl., 2010
- [3] George V. Coyne & Michael Heller. *A Comprehensible Universe*. New York: Springer-Verlag New York, 2008.
- [4] Michael Heller. Cosmological Singularity and the Creation of the Universe. <http://www.templetonprize.org/pdfs/93-113.pdf>
- [5] Mariusz P. Dabrowski & Konrad Marosek. Regularizing cosmological singularities by varying physical constants (2012). arxiv.org/1207.4038v4.pdf
- [6] Edward Belbruno. On the regularizability of the Big Bang Singularity (2012). arxiv.org/1205.1474v2.pdf
- [7] L.P. Grishchuk. Cosmological Sakharov oscillations and Quantum Mechanics of the early Universe (2011). arXiv: 1106.5205 [gr-qc]
- [8] Zurek, Wojciech H. ed. *Complexity, Entropy and the Physics of Information*. Santa Fe Institute/Addison-Wesley Publ., 1990
- [9] Christianto, V. A Cantorian Superfluid Vortex and the Quantization of Planetary Motion. *Apeiron* Vol. 11 No. 1, January 2004, URL: <http://redshift.vif.com/JournalFiles/V11NO1PDF/V11N1CHR.pdf>.
- [10] Christianto, V., & Smarandache, F. A derivation of Maxwell's equations in quaternion space. *Progress in Physics*, 2010. URL: www.ptep-online.com/index_files/2010/PP-21-06.PDF
- [11] Landsman, N.P. *Between classical and quantum* (2005). arXiv:quant-ph/0506082.
- [12] George P. Shpenkov. *Dialectical View of the World: The Wave Model (Selected Lectures)*. Volume I: Philosophical and Mathematical Background (2013). URL: <http://shpenkov.janmax.com/Vol.1.Dialectics.pdf>
- [13] Christianto, V. An Outline of Cosmology based on interpretation of The Johannine Prologue. *Bull. Soc. Math. Services and Standards*. Vol. 3 No. 3 (2014) URL: <https://www.scipress.com/BSMaSS.11.4.pdf>
- [14] Jones, Andrew Zimmerman & Daniel Robbins. *String Theory for Dummies*. Indianapolis, Indiana: Wiley Publishing Inc., 2010. P. 169.
- [15] Christianto, V. A review on Schrödinger equation & classical wave equation. *Prespacetime Journal* Vol.5 No. 5, May 2014. URL: <http://prespacetime.com/index.php/pst/article/view/625> or http://www.vixra.org/author/Victor_Christianto
- [16] Christianto, V. A derivation of GravitoElectroMagnetic (GEM) Proca-type equations in Fractional Space. *Prespacetime Journal* Vol. 5 No. 5 May 2014, <http://prespacetime.com/index.php/pst/article/view/624> or http://www.vixra.org/author/Victor_Christianto

- [17] Klink III, Edward W. "Light of the World: Cosmology and the Johannine Literature," Chapter 5 in Jonathan T. Pennington & Sean M. McDonough (eds.) *Cosmology and the New Testament Theology*. London: T&T Clark, 2008. p. 74-89
- [18] Holman Christian Standard Bible, Free edition obtained at OliveTree BibleStudy App.

Essay**A Comparative Study of Cosmology Revealed from Christology and Trinitarian Approaches**

Victor Christianto*

Abstract

In this essay, the author will compare cosmology models revealed from Christology and Trinitarian approaches. Although there are differences, both Trinitarian and Christological approaches can be a starting point for developing a biblical approach to cosmology. Cosmological models which are built from Trinitarian or Christology have practical-ethical implications, while contrasting big bang cosmology or its derivatives which tend to put a man in a position of helplessness at the cosmic stage. Both approaches may be potentially developed further into a dialogue of religious pluralism.

Keywords: Cosmology, Christology, Trinity, comparative study, religious pluralism.

Introduction

In this essay, I will discuss cosmology as a conceptual framework of the universe, not necessarily these concepts should be confirmed empirically (6). Current mainstream cosmological theories do not mention God and this has been a particular challenge for many Christians (3). However, some Christian thinkers assumed that modern cosmological theories such as the Big Bang are quite close to the biblical doctrine of creation, but not a few who think that the big bang actually replaces the role of God in creation with a random chance process triggered by fluctuations in vacuum. Others argue that the singular point where the universe began to expand need not be equated with the point of creation. Presumably these issues are more in depth than just maintaining the idea of six-day creation, like what most Creationists told us.

The situation with somewhat similar dilemma also arises in the question of the origin of life on Earth, where the classical view, as was proven by Louis Pasteur through experimentation, stating that the origin of life is life (biogenesis), while the latest scientific developments tend to

*Correspondence: Victor Christianto, Independent Researcher. Email: victorchristianto@gmail.com.

support the idea that life occurs spontaneously from simple chemical reactions, even cutting-edge theory explains the existence of a common ancestor called the Last Universal Common ancestor (LUCA).

Then how should our attitude as Christians in addressing the various dilemmas? This article is an expression of perceived concerns with respect to the direction of the authors of modern cosmology and dilemmas faced by Christians who want to uphold their faith, therefore the writer will try to look at cosmology from the perspective of the Trinity and Christology.

Basically the author agrees with Norris, Jr., that it is necessary to develop a new cosmological paradigm which can provide a response to the modern cosmology (3, p. 185). Dialogue between cosmology and the Bible (Scripture) is possible and necessary, particularly if we cite the thinking of 6th century Christologists such as St. Maximus the Confessor. According to Paul M. Blowers, Maximus's theology enables us to do: *"scripturalizing" of the cosmos and "cosmologizing" of the Scripture.* (3, p. 199)

Trinitarian Approach to Cosmology

First of all, it must be recognized that there is no well-established concept of Trinitarian cosmology, let alone that has reached the stage of empirical confirmation. Neville also wrote that the idea of the Trinity is always rooted in revelation and speculation at the same time (1). The starting point of the concept of the Trinity is Christology, and a Christology thesis is rooted in the belief that Jesus is the Son of God because He is the Word made flesh (1, p.9). From this it can be drawn a basic idea that the doctrine of the Trinity was originally stems from Christology, particularly the New Testament Christology.

Thus, if we read the Old Testament from the New Testament lens, we see that since in Gen. 1: 1- 2 already called about the role of God (the Father), the Spirit of God was hovering and also the word of God with power (dabar YHWH). If only we can ignore that Genesis was written by a monotheistic Jews, then the mention of these three actors is sufficient for us to say that the forerunner of the Trinitarian cosmology has existed since Genesis. 1. According to the St.

Basil, God the Father is the "primordial cause of everything that has been made," the Son is "the operative cause," and the Holy Spirit is "the perfecting cause." see (2) p. 250.

Indeed, since the fathers of the church, including Irenaeus and Aquinas, Christians generally assumed that the creation of the Bible is the creation of nothing (creation ex nihilo). Irenaeus for example, writes that there is one God the Father is one God, who created everything from nothing through his Word. He repeatedly wrote about the Father who has created with His two hands (29). Of course, what is meant by the two hands are the Word and the Holy Spirit.

Although Irenaeus explains these concepts to read Gen. 1: 1-4, 26-27 but of course the views were rooted in the apostolic teachings of the risen Christ. In other words, the trinitarian view of Irenaeus actually stems from Christology. One more thing that should be noted, that the term Trinity itself is not yet known in the second century AD (Irenaeus period), because the term was emerging around the third and fourth centuries. So presumably not appropriate for reading Irenaeus from the standpoint of the development of thinking one or two centuries later (34).

In a later development, few people distinguish between social and Latin Trinitarianism, which essentially are as follows: (35):

- a. Social Trinitarianism: "three distinct and discrete persons." But this may be more suitable called tritheism, although there are some theologians who see this concept remains as monotheism. For example: Plantinga, (?)
- b. Latin Trinitarianism: "three persons in one substance." This model is further developed into a model of psychology by Augustine of Hippo in his *De Trinitate* (37).

Just for a side note, in a modern version of this psychology model can be linked with the theory of "plural self" (38). Plural self-concept has been studied seriously in modern psychology (39). That is, the human being as God's image also has a complex identity (plural), and that fact is an indirect hint that monotheism complex (Trinity) is more relevant than the simple monotheism.

However, Karl Rahner has addressed some of the problems that exist with the psychological model of the Trinity, and he prefers to use the term "hypothesis." See (38a). Furthermore, for a discussion of modern thinking about the Trinity in relation to postmodernism, see for example (18).

Back to the biblical narrative of creation, the actual theory of creation out of nothing is not the only possibility, because there are several possible alternative interpretations of the Genesis 1 narrative. See for example (13):

- creation from 'primordial chaos': if "tohu wa bohu" can be interpreted as chaotic and formless
- creation from a kind of primordial fluid
- continuous creation (creatio continuans): Robert Millikan
- cyclic universe: Roger Penrose
- continuously expanding universe since infinite time: Fred Hoyle
- and one more possibility: creation without singularity.

Some Problems with the Big Bang Model

If one can develop a theory in accordance with cosmological observation data but without involving the singularity hypothesis, then it means the big bang (big bang) become irrelevant. From a theological perspective, Aquinas argued that the existence of God does not implicitly suggest that the age of the universe is limited, and this position is supported for example by Arthur Peacocke and Ian Barbour, see (6). In other words, the big bang theory is not a necessary condition for evidence of the presence of God.

The author also found the idea of the Big Bang bit corny, even if Georges Lemaitre connected it to the "creation ex nihilo." Although there are many writers who have been denied the big bang theory, such as Fred Hoyle, Geoffrey Burbidge and Halton Arp, here the author would

only give 3 refutations by elementary logic, namely:

- a. First: There is no sane person would build a house by blowing up a pile of bricks with a grenade. In essence, very, very small chance that all the order and structure that we observe in the universe is the result of purely random process. In other words, the big bang models have serious logical flaw.
- b. second: Careful calculations show that if the big bang happened because of fluctuations in the vacuum (Vacuum Fluctuation), then the implication is the cosmological constant would have a value of more than 10^{10} times greater than the observed value now. So it is clear that the assumption of many scientists that the big bang was triggered by fluctuations in vacuum would be simply an unfounded assumption. (Indeed, lately the hypothesis that the big bang came from vacuum fluctuations much to gain followers, especially those who argue that the universe started from nothing; but the essence of their argument is that the Universe did not require a Creator or God, see ref. (40)).
- c. Big Bang Theory has a primary assumption is that the universe began from a very small primordial egg. This hypothesis of cosmic egg was first proposed by Georges Lemaitre, based on the findings of Edwin Hubble, an American astronomer. If the law of Hubble is extrapolated backwards it will be found the starting point of the universe. The starting point is what is called a singularity or big bang (15). The question is: what if it can be shown that the singularity is not necessary to explain astronomical data?

Unfortunately, the big bang theory is already widely accepted as an indisputable fact, or in terms of Lakatos: research program (research program). As a result, almost all the paper that criticized the theory will necessarily be rejected in any scientific journal, because it does not comply with accepted research program as a consensus. It shows the repression of the authority of science worldwide; see ref. (15). Even Fred Hoyle once called the big bang as "religious fundamentalism"(6). For further discussion, for example the readers can see a website by Eric Lerner: www.bigbangneverhappened.org

However, thankfully lately there are also some cosmologists who propose cosmological

models without singularities. Of their courage to break down a well-worn theory should be appreciated. See example ref. (16).

In the context of Gen. 1, the universe could be considered to be eternal, but the earth and the solar system were created from a kind of primordial oceans. Theologically, God always be dynamically Trinity in eternity, and this topic has been appointed as the dissertation by Adrian Langdon (19).

Another approach taken rampant among experimental physicists is trying to look at what happened before the big bang, though of course the levels of speculation this approach is quite large (17).

Christology Approach to Cosmology

One of the most striking things in the Hymn of Jesus is the Logos who became flesh. Although there are similarities between these notions to the concept of Logos as a rule or immutable laws that govern the various changes in the universe (such as Heraclitus, the Stoics, and Philo), there are many significant differences between them (3, p. 186-287).

In the Hymn of Jesus, the Logos is personal, consubstantial with the Father, begotten by the Father, and incarnated into human and descended into the world and entered into human history. So instead of a human becomes divine, but instead of a divine being human. Regarding the question of whether the worship of Jesus as the Son of God, Kurios, and the Logos was emerging at a later stage, or indeed a unique original belief of the early Church, can be seen in the work of James Dunn (43).

Although the view of the cosmos in the light of Christology is most clearly evident in John 1: 1-14, but there's also Paul's writings that discuss the cosmic Christology, for example Col. 1: 15-17. Because it is alleged that the cosmic Christology of John's version has closeness in conceptual with cosmic version of Paul's Christology. In fact, according to John Gibbs, Cosmic Christology is at the core of Paul's conception of the divinity of Jesus, which is no less

important than the theology of the cross. It should be noted that Paul's concept of the divinity of Jesus is not from Hellenism, but rooted in the tradition of the early church itself. The combined evidence from various sources indicates that the work of the cosmic Christ is not less essential to the Christology of Paul than the redemptive work of Christ (4, p. 479).

The question then is: is it possible to develop Christological Cosmology from a theological- scientific discourse into an emancipatory science?

In my opinion, there are some things that can be drawn from the Hymn of Jesus (Jn. 1:14), of which:

- a. The Word and God the Father has an eternal existence and unity. The implication is the Word and the Father's identities are relational.
- b. The Word is the source of life for humans.
- c. The Word is the light of the world, and the darkness cannot beat it.
- d. The Word was already willing to go down into the world and into the meat (sarx), which is Jesus Christ.
- e. The Word of God is very involved in the process of creation of the universe (cosmos). And without Him nothing is finished in all of creation.

Of those phrases, then obviously there is a clash between the Word that is bright with a dark world. So the assumption of dialectical history is not true that says that advances in human civilization happened as a result of multiple-collisions between thesis and antithesis (Hegel). The truth is always conflict because the eternal dark world tends to reject the Light. Thus, the progress of civilization occurs because the Light itself which gives light unto the darkness of the world, so the world is gradually transformed into increasingly bright. This may conceivably be similar to the process of *diffusion* or *osmosis*.

The clear implication here is that those who were chosen to be the children of God are also called to take part in the world, with a variety of functions, among others:

- creation functions: creating order back,
- enlighten the darkness of the world who do not know God,
- restore order amid the chaos of the world (returning order),
- a witness for Christ, the Word
- sew dark world and full of suffering (rather close to the principle of "tikkun olam" which held the Jewish community).

Conclusions

Although there are differences, both Trinitarian and Christological approaches can be a starting point for developing a biblical approach to cosmology. Cosmological models which are built from Trinitarian or Christology have practical-ethical implications, while contrasting big bang cosmology or its derivatives which tend to put a man in a position of helplessness at the cosmic stage. Both approaches may be potentially developed further into a dialogue of religious pluralism.

The author is not advocating Social Gospel (Social Gospel). But at least the church can begin to actively build intense communication with the public, for example by means of open dialogue on theological issues in the public sphere. A dialogic interaction can emerge opportunity to exchange an understanding of the Trinity, Christology and others with other religious communities. Such a dialogue should be taken though certainly not make everyone converted in one go. In Jn. 7:14-8:59 narrated that Jesus also often communicated openly with the Jews even if the results are disappointing.

References

- (1) Robert C. Neville. Creation and the Trinity. *Theological Studies* Vol. 30 (March 1969), 3-26.
<http://www.robertcummingsneville.com/robert-neville-articles>
- (2) Christos S. Voulgaris. The Holy Trinity in Creation and Incarnation. *The Greek Orthodox theological review*, vol. 42/3-4, 1997. <http://www.apostoliki-diakonia.gr>
- (3) Russel Bradner Norris, Jr. Logos Christology as Cosmological Paradigm. *Pro Ecclesia* vol. v no. 2
- (4) John G. Gibbs. Pauline Cosmic Christology and ecological crisis. *Journal of Biblical Literature* Vol. 90, no. 4 (Dec. 1971), pp. 466-479. <http://www.jstor.org>
- (5) Kathleen P. Rushton. The Cosmology of John 1:1-14 and its implications for ethical action in this ecological age. *Colloquium* 45/2, 2013. url: <http://brisbaneansatz.org/2014/02/16/colloquium>
- (6) Stanford Encyclopedia of Philosophy. Cosmology and Theology.
<http://plato.stanford.edu/entries/cosmology-theology/>
- (7) Karlina Supelli dkk. *Dari kosmologi ke dialog*. Bandung: Penerbit Mizan, 2010.
- (8) Jurgen Habermas. *The Theory of Communicative Action*, 2 vols. Boston: Beacon Press, 1984.
- (9) Roger Bolton. Habermas's theory of communicative action and the theory of social capital.
- (10) Maureen Junker-Kenny. *Habermas and Theology*. New York: T&T Clark International, 2011. Lihat chapter 1, p. 1-40
- (11) Nicholas Adams. *Habermas and Theology*. Cambridge: Cambridge University Press, 2006.
- (12) V-M. Karkkainen. *Trinitas dan Pluralisme Agama*. Jakarta: BPK Gunung Mulia, 2013.
- (13) David A. Leeming. *Creation myths of the world*, second edition. Santa Barbara: ABC-CLIO, 2010.
- (14) Eugenie C. Scott. *Evolution vs. Creationism: An Introduction*. Westport: Greenwood Press, 2004.
- (15) Jerry Bergman. A brief history of intolerance in modern cosmology. *Answers Research Journal* 2 (2009): 1-9. <http://answersingenesis.org>
- (16) Ovidiu Christinel Stoica. The Friedmann-Lemaitre-Robertson-Walker big bang singularities are well behaved. Arxiv: 1112.4508 (2011). Lihat juga (16a) E.I. Guendelman, creating the universe without a singularity and the cosmological constant problem. Arxiv: 1306.4977 (2013)
- (17) "The cosmos - before the big bang," *New Scientist* magazine, issue 2601, april 2007
- (18) Wayne J. Hankey. *Theoria versus poesis: Neoplatonism and Trinitarian difference from Aquinas, John Milbank, Jean-Luc Marion, John Zizoulas*. *Modern Theology* 15:4, october 1999
- (19) Adrian E.V. Langdon. *God the eternal contemporary: Trinity, Eternity and time in Karl Barth's church dogmatics*. PhD dissertation to McGill University, 2008.

- (20) Mary Catherine Hilker. The Mystery of Persons in communion: The Trinitarian theology of Catherine Mowry LaCugna. *Word and World*, vol. xviii, no. 3, summer 1999.
- (21) Irene Ludji. God as sound-consciousness. *Indonesian Journal of Theology* Vol. 2 No. 1 (2014), <https://journalteologi.files.wordpress.com/2014/09/04-ijt-2-1-2014-god-as-sound-consciousness4.pdf>
- (22) David W. Hall. *Calvin di ranah publik: demokrasi liberal, hak asasi, dan kebebasan sipil*. Surabaya: Penerbit Momentum, 2009.
- (23) The Holberg Prize Seminar 2005. *Religion in the public Sphere*. Ludbig Holberg Semina Fund, Seminar report, 2005.
- (24) Jurgen Habermas and Christian Lenhardt. A postscript to knowledge and human interests? *Philosophy of the social sciences* 1973, 3:157. <http://pos.sagepub.com>
- (25) Jurgen Habermas. *The Structural Transformation of the Public Sphere*. Cambridge: MIT Press, 1991.
- (26) Jurgen Habermas, *Religion in the Public Sphere*. <http://www.sandiego.edu>
- (27) Ljubisa Mitrovic. New social paradigm: Habermas's theory of communicative action. *Facta Universitatis, Philosophy and Sociology*, vol. 2, no. 6/2, 1999, 217-223
- (28) S. Susen. Critical Notes on Habermas's theory of the Public sphere. *Sociological Analysis*, 5(1), pp. 37-62. <http://openaccess.city.ac.uk/1101>
- (29) Stig Hjarvard. *The Mediatization of Religion: a theory of the media as an agent of religious change*. Paper presented to the 5th Intl. Confr. On Media, Religion, and Culture: Mediating religion in the context of multicultural tension. The Sigtuna Foundation, Sweden, 6-9 July, 2006.
- (30) Mark Chaves and Philip S. Gorski. Religious Pluralism and Religious Participation. *Annual Review of Sociology*, Vol. 27 (2001), pp. 261-281. www.jstor.org
- (31) Veit Bader. Religious diversity and democratic institutional pluralism. *Political Theory* 2003, 31, 265. Url: <http://ptx.sagepub.com>
- (32) Chad Meister. *Introducing Philosophy of Religion*. New York: Routledge, 2009. Chapter IV: Cosmological arguments for God's existence.
- (33) Robert Letham. *Allah Trinitas*. Surabaya: Penerbit Momentum, 2011. h. 96-97
- (34) M.C. Steenberg. *Irenaus on creation: The Cosmic Christ and the Saga of redemption*. Leiden: Brill, 2008. P. 63-64
- (35) Vincent Brummer. *Atonement, Christology and the Trinity: making sense of Christian doctrine*. Hampshire: Ashgate, 2005. P. 97-107.
- (36) Gregory A. Barker & Stephen E. Gregg. *Jesus beyond Christianity: the classic texts*. Oxford: Oxford University Press, 2010.
- (37) Russell L. Friedman. *Medieval Trinitarian Thought from Aquinas to Ockham*. Cambridge:

Cambridge University Press, 2010. P. 52-56

- (38) Leon Turner. *Theology, Psychology and the Plural self*. Surrey: Ashgate Publishing Limited, 2008;
(38a) Karl Rahner. *The Trinity*. London: Burns & Oates, reprinted 2001, p. 115-118.
- (39) Achmad Chusairi. *Diri-jamak (plural self): diri dalam tinjauan psikologi diskursif*. *Jurnal Insan* vol. 12 no. 01, april 2010 (ringkasan tesis di Fakultas Psikologi UGM, Yogyakarta)
- (40) Natalie Wolchover. What's the total energy in the universe? url: <http://www.livescience.com/33129-total-energy-universe-zero.html>
- (41) According to story, one student came to Einstein and asked him: "The questions in this year's exam is the same with last years." "True," replied Einstein, "but this year all answers are different."
see <http://www.julianrubin.com/einsteinjokes.html>
- (42) Ajat Sudrajat. *Jurgen Habermas: Teori Kritis dengan paradigma komunikasi*.
<http://staff.uny.ac.id/system/files/penelitian/Ajat%20Sudrajat,%20Prof.%20Dr.%20M.Ag./Jurgen%20Habermas%20-%20Teori%20Kritis%20dengan%20Paradigma%20Komunikasi.pdf>
- (43) James D.G. Dunn. *Did the first Christians worship Jesus? New Testament evidence*. London: SPCK, 2010.

An outline of Cosmology based on interpretation of the Johannine Prologue

Victor Christianto

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: En avrch/| h=n o` lo,goj). 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:

$$\Delta\hat{\Psi} - \frac{1}{c^2} \frac{\partial^2 \hat{\Psi}}{\partial t^2} = 0 \quad (1)$$

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.

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 Mendeleev.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)

¹ Bob Goette, Why talk about Creation?, Bible and Spade 03:2 (Spring 1990): 45-48

² Wilf Hildebrandt, An Old Testament Theology of the Spirit of God (Peabody, Massachusetts: Hendrickson Publishers, Inc., 1995), 29.

³ Victor Christianto, A review on Schrödinger equation & classical wave equation. Prespacetime Journal Vol.5 No. 5, April 2014. URL: <http://www.prespacetime.com> or http://www.vixra.org/author/Victor_Christianto

⁴ George Shpenkov, Schrödinger's error in principle. Galilean Electrodynamics, 2002. URL: <http://shpenkov.janmax.com>

⁵ Victor Christianto, A derivation of GravitoElectroMagnetic (GEM) Proca-type equations in fractional space. Prespacetime Journal Vol. 5 No. 5, April 2014. URL: <http://www.prespacetime.com> or

⁶ Andrew Zimmerman Jones & Daniel Robbins, String Theory for Dummies (Indianapolis, Indiana: Wiley Publishing Inc., 2010), 169

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 1. Comparison of some texts in Targum and Gospel of John

Targum	Gospel of John
Memra min qedem Alaha (Gen. 31:24)	Kai ho logos en pros ton theon (John 1:1b)
Memra de Alaha (Gen. 19:17)	John. 1:3c

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,⁷ 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:

$$\hat{\Psi} = \hat{R}_l(kr)\Theta_{l,m}(\theta)\hat{\Phi}_m(\varphi)\hat{T}(\omega t), \quad (2)$$

And

$$\hat{\Psi} = \hat{R}_m(k,r)\hat{Z}(k_z z)\hat{\Phi}_m(\varphi)\hat{T}(\omega t). \quad (3)$$

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

$$\rho^2 \frac{d^2 \hat{R}_l}{d\rho^2} + 2\rho \frac{d\hat{R}_l}{d\rho} + (\rho^2 - l(l+1))\hat{R}_l = 0, \quad (4)$$

And

$$\frac{d^2 \hat{R}}{d(k,r)^2} + \frac{1}{k,r} \frac{d\hat{R}}{d(k,r)} + \left(1 - \frac{m^2}{(k,r)}\right)\hat{R} = 0, \quad (5)$$

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:

$$A_{sph} = \frac{A\hat{e}_l(kr)}{kr}, \quad (6)$$

⁷ George P. Shpenkov, Dialectical View of the World: Vol. 3 Dynamic Model of Elementary Particles – Part 2: Fundamentals. 2014. URL: <http://shpenkov.janmax.com/Vol.3.DynamicModel-2.pdf>

Where

$$\hat{e}_l(kr) = \sqrt{\frac{\pi kr}{2}} (J_{l+1/2}(kr) \pm Y_{l+1/2}(kr)), \quad (7)$$

$$k = \frac{\omega}{c}. \quad (8)$$

Here $J(kr)$ and $Y(kr)$ are Bessel functions; ω 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:

$$E_{cyl} = h\nu, \quad (9)$$

Where

$$h = \frac{2\pi m_e c a^2}{r} = 2\pi m_e \nu A_{cyl}, \quad (10)$$

And

$$A_{cyl} = \frac{a}{\sqrt{kr}}. \quad (11)$$

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

$$E_{cyl} = E_{sph} \quad (12)$$

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:

$$\frac{1}{\lambda} = R \left(\frac{1}{m^2} - \frac{1}{n^2} \right), \quad (13)$$

Where m and n are integers, and

$$R = \frac{m_0 c A^2}{2hr_0^2} \quad (14)$$

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.⁸ 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 Ψ -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:

⁸ George P. Shpenkov, “An Elucidation of the Nature of the Periodic Law,” Chapter 7 in “The Mathematics of the Periodic Table”, Rouvray, D. H. and King, R. B., ed. (New York: Nova Science Publishers, 2006), 119-160.

$$\hat{\Psi}(r, t) = \hat{\psi}(r)e^{\pm i\omega t} \tag{15}$$

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

$$\Delta \hat{\psi} + k^2 \hat{\psi} = 0 \tag{16}$$

The longitudinal component of the spherical-cylindrical field is described over a spherical realization of the wave equation (1). The separation of variables⁹ leads to one time equation :

$$\frac{d^2 \hat{T}}{d\tau^2} = -\hat{T}, \tag{17}$$

And three equations in spherical space :

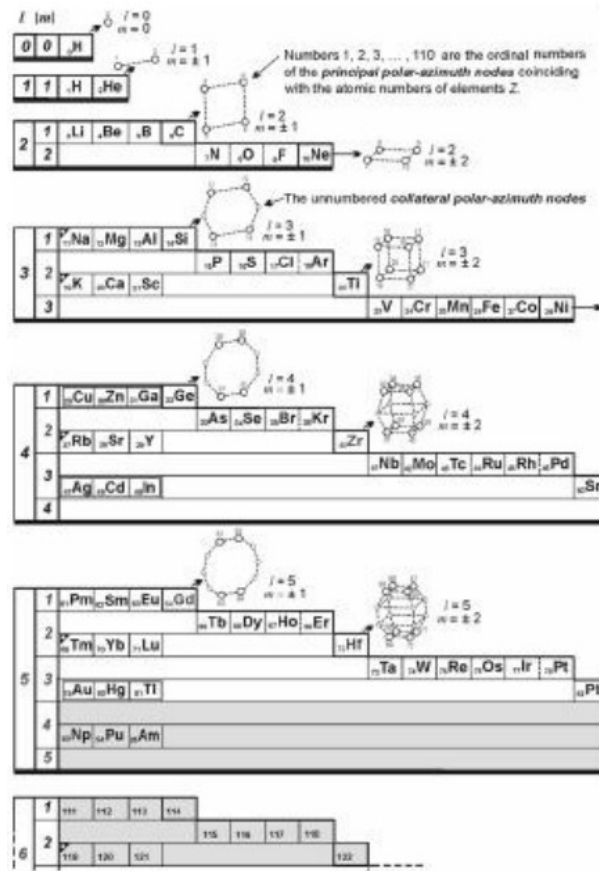
$$\rho^2 \frac{d^2 \hat{R}_\ell}{d\rho^2} + 2\rho \frac{d\hat{R}_\ell}{d\rho} + (\rho^2 - \ell(\ell+1))\hat{R}_\ell = 0, \tag{18}$$

$$\frac{d^2 \Theta_{\ell,m}}{d\theta^2} + ctg\theta \frac{d\Theta_{\ell,m}}{d\theta} + \left(\ell(\ell+1) - \frac{m^2}{\sin^2 \theta} \right) \Theta_{\ell,m} = 0, \tag{19}$$

$$\frac{d^2 \hat{\Phi}_m}{d\varphi^2} + m^2 \hat{\Phi}_m = 0, \tag{20}$$

Where $\rho = kr$ and $\tau = \alpha t$.

By solving the above equations which involving the use of Bessel functions, Shpenkov arrives at a periodic table of elements which are close to Mendeleev's periodic law. The result is shown in Figure 1 below.



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

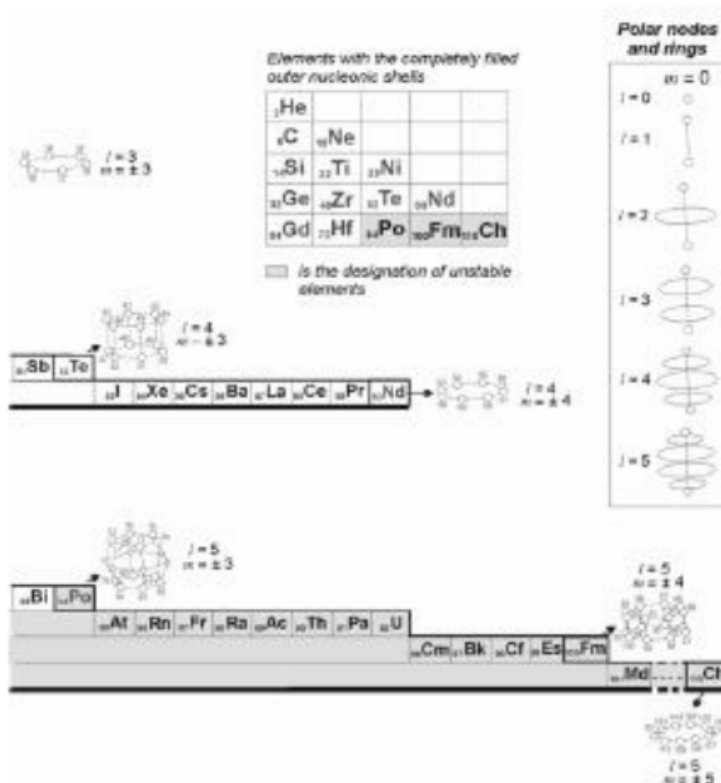


Figure 1. Generalized table of the elements from the particular solutions of the wave probabilistic equation (1), or the quasi-periodicity as a result of quasi-similarity of the nodal structure of external atomic shells.¹⁰

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

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).¹¹ In his interpretation, the gravitational frequency determines the gravitational radius of elementary particles, which is also the elementary radial gravitational wave:

$$\tilde{\lambda}_g = \frac{c}{\omega_g} = 3.274 \times 10^{11} m = 327.4 Mkm. \tag{21}$$

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:

$$r = \tilde{\lambda}_g \cdot z_{m,n} = 327.4 \times 10^6 \times z_{m,n} km, \tag{22}$$

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.

¹⁰ Shpenkov, “An Elucidation of the Nature of the Periodic Law,” 144-145.

¹¹ George Shpenkov, “Planetary Orbits,” Chapter 6 in Some words about Fundamental Problems of Physics, 2011. URL: <http://shpenkov.janmax.com>

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 particles¹²

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

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.

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:

$$\frac{\partial^{2\alpha} u(x,t)}{\partial t^{2\alpha}} + a^{2\alpha} \frac{\partial^{2\alpha} u(x,t)}{\partial x^{2\alpha}} = 0, \quad (23)$$

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

Now we look at the particular solutions of the form:

$$u(x,t) = \phi(x)T(t), \quad (24)$$

And arrive at the equations:

$$\phi^{(2\alpha)} + \lambda^{2\alpha} \phi = 0, \quad (25)$$

$$T^{(2\alpha)} + a^{2\alpha} \lambda^{2\alpha} T = 0. \quad (26)$$

¹² Ibid, p.40

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:

$$\frac{\partial^{2\alpha} u(x, y, z, t)}{\partial t^{2\alpha}} + a^{2\alpha} \nabla^{2\alpha} u(x, y, z, t) = 0, \quad (23)$$

Where local fractional Laplace operator is noted by:

$$\nabla^{2\alpha} = \frac{\partial^{2\alpha}}{\partial x^{2\alpha}} + \frac{\partial^{2\alpha}}{\partial y^{2\alpha}} + \frac{\partial^{2\alpha}}{\partial z^{2\alpha}}. \quad (24)$$

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:

$$\frac{\partial^{2\alpha} u(x, t)}{\partial t^{2\alpha}} + c \frac{\partial^{2\alpha} u(x, t)}{\partial x^{2\alpha}} = 0, \quad (25)$$

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]:

$$u(x, t) = E_{\alpha}(x^{\alpha}) [\cosh_{\alpha}(ct^{\alpha}) + \sinh_{\alpha}(ct^{\alpha})].$$

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:

- [1] Shpenkov, George P. 2013. Dialectical View of the World: The Wave Model (Selected Lectures). Volume I: Philosophical and Mathematical Background. URL: <http://shpenkov.janmax.com/Vol.1.Dialectics.pdf>
- [2] Rienstra, S.W., & Hirschberg, A. 2014. An Introduction to Acoustics. Eindhoven University of Technology. URL: www.win.tue.nl/~sjoerdr/papers/boek.pdf
- [3] Pain, H.J. 2005. The Physics of Vibrations and Waves. 6th ed. John Wiley & Sons, Ltd. ISBN: 0-470-01295-1(hardback); 0-470-01296-X(paperback). 563 pp.
- [4] Goette, Bob. 1990. Why talk about Creation?, Bible and Spade 03:2 (Spring 1990): 45-48
- [5] Hildebrandt, Wilf. 1995. An Old Testament Theology of the Spirit of God. Peabody, Massachusetts: Hendrickson Publishers, Inc., 29; see also [5a] Waltke, Bruce K. 1975. The Creation Account in the Genesis 1:1-3, Part IV: The theology of Genesis 1, Bibliotheca Sacra 132:528 (Oct. 1975): 327-341. URL: <http://www.galaxie.com/journals>

-
- [6] Shpenkov, George. 2002. Schrodinger's error in principle. Galilean Electrodynamics. URL: <http://shpenkov.janmax.com>
- [7] Christianto, Victor. 2014. A review on Schrödinger equation & classical wave equation. Prespacetime Journal Vol.5 No. 5, April 2014. URL: <http://www.prespacetime.com> or http://www.vixra.org/author/Victor_Christianto
- [8] Christianto, Victor. 2014. A derivation of GravitoElectroMagnetic (GEM) Proca-type equations in fractional space. Prespacetime Journal Vol. 5 No. 5, April 2014. URL: <http://www.prespacetime.com> or http://vixra.org/author/Victor_Christianto
- [9] Zimmerman Jones, Andrew, & Robbins, Daniel. 2010. String Theory for Dummies. Indianapolis, Indiana: Wiley Publishing Inc., p. 169.
- [10] Parker, James. 1988. The Incarnational Theology of John. Criswell Theological Review 3.1, 31-48.
- [11] Boyarin, Daniel. 2001. The Gospel of the Memra: Jewish Binitarianism and the Prologue to John. The Harvard Theological Review, Vol. 94 no. 3, pp. 243-284.
- [12] Byrne, Brendan. 1997. Christ's pre-existence in Pauline Soteriology. Theological Studies 58, pp. 308-330.
- [13] Helyer, Larry L. 1994. Cosmic Christology and Col. 1:15-20. JETS 37:2, pp. 236-246.
- [14] Henebury, Paul Martin. 2004. Jesus Christ, The Logos of God: An inquiry into the Johannine Prologue and Its Significance. CTJ 08:23, pp. 88-105.
- [15] Shepherd, Michael B. 2008. Targums, The New Testament, and Biblical Theology of the Messiah. JETS 51:1, pp. 46-58.
- [16] Kim, Stephen S. 2009. The Literary and Theological Significance of the Johannine Prologue. BSAC 166:664, pp. 422-435.
- [17] Shpenkov, George P. 2014. Dialectical View of the World: Vol. 3 Dynamic Model of Elementary Particles – Part 2: Fundamentals. <http://shpenkov.janmax.com/Vol.3.DynamicModel-2.pdf>
- [18] _____. 2006. An Elucidation of the Nature of the Periodic Law, Chapter 7 in "The Mathematics of the Periodic Table", Rouvray, D. H. and King, R. B., ed., Nova Science Publishers, NY, pp. 119-160.
- [19] Svozil, Karl. 2014. Mathematical Methods of Theoretical Physics. arXiv:1203.4558v4 [math-ph]
- [20] Shpenkov, George P. 2011. "Planetary Orbits," Chapter 6 in Some words about Fundamental Problems of Physics. URL: <http://shpenkov.janmax.com>
- [21] Hu, Ming-Sheng, Agarwal, Ravi P., & Yang, Xiao-Jung. 2012. Local Fractional Fourier Series with Application to Wave equation in Fractal Vibrating String. Abstract and Applied Analysis Vol. 2013, Article ID. 567401, doi:10.1155/2012/567401
- [22] Su, Wei-Hua, Yang, Xiao-Jun, Jafari, H., & Baleanu, Dumitru. 2013. Fractional complex transform method for wave equations on Cantor sets within local fractional differential operator. Advances in Difference Equations 2013:97, <http://www.advancesindifferenceequations.com/content/2013/1/97>
- [23] Yang, Ai-Min, Yang, Xiao-Jun, & Li, Zheng-Biao. 2013. Local Fractional Series Solution Method for solving Wave and Diffusion Equations on Cantor Sets. Abstract and Applied Analysis Vol. 2013, Article ID. 351057, <http://dx.doi.org/10.1155/2013/351057>

Volume 11

10.18052/www.scipress.com/BSMaSS.11

An Outline of Cosmology Based on Interpretation of the Johannine Prologue

10.18052/www.scipress.com/BSMaSS.11.4

DOI References

[12] Byrne, Brendan. 1997. Christ's pre-existence in Pauline Soteriology. *Theological Studies* 58, pp.308-330.

10.1177/004056399705800205

[21] Hu, Ming-Sheng, Agarwal, Ravi P., & Yang, Xiao-Jung. 2012. Local Fractional Fourier Series with Application to Wave equation in Fractal Vibrating String. *Abstract and Applied Analysis* Vol. 2013, Article ID. 567401, doi: 10. 1155/2012/567401.

10.1155/2012/567401

[22] Su, Wei-Hua, Yang, Xiao-Jun, Jafari, H., & Baleanu, Dumitru. 2013. Fractional complex transform method for wave equations on Cantor sets within local fractional differential operator. *Advances in Difference Equations* 2013: 97, [http: /www. advancesindifferenceequations. com/content/2013/1/97](http://www.advancesindifferenceequations.com/content/2013/1/97).

10.1186/1687-1847-2013-97

[23] Yang, Ai-Min, Yang, Xiao-Jun, & Li, Zheng-Biao. 2013. Local Fractional Series Solution Method for solving Wave and Diffusion Equations on Cantor Sets. *Abstract and Applied Analysis* Vol. 2013, Article ID. 351057, [http: /dx. doi. org/10. 1155/2013/351057](http://dx.doi.org/10.1155/2013/351057).

10.1155/2013/351057

Letter to the Editor

On Hermeneutics & Its Relation to Science

Victor Christianto*

Abstract

In this letter, I will suggest a new scheme for approaching hermeneutics & its relation to science. I call this scheme “spectrum of hermeneutics”. It should be noted that this is only a preliminary proposal.

Keywords: Hermeneutics, relation, spectrum, science.

In a paper written by Yong on relation between science and theology [1], he argues that evangelicals tend to blame science for making progress, leaving Bible alone with its prophets, and 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. In other words, Yong suggests that it is wrong to ask the Bible something about Creation story etc., as asked by many evangelicals.

Hermeneutics of suspicion is a phrase coined by Ricoeur in order to categorize the “breakthroughs” in science brought by Marx, Freud and Darwin *etc.* [6]. 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 or biology.

Regardless of the question 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, a hermeneutics is to be used, like it or not.

Perhaps the first thing we should be suspicious about is hermeneutics of suspicion itself. In other

*Correspondence: Victor Christianto, Independent Researcher. Email: victorchristianto@gmail.com.

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].

Let us accept the notion of Pentecostals’ hermeneutics as promoted by Yong and other Pentecostals scholars such as Gordon Fee [3-4]. But this is just one choice of hermeneutics among many of possible approaches. In addition, Pentecostal’s reading of the Bible often put more respect on their experiences rather than correct exegesis [2]. If my interpretation of Yong’s paper is correct, most of the time Pentecostals 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., claiming that the Bible means something when it actually does not. In other words, perhaps we should distinguish between a healthy Pentecostals hermeneutics and delusional hermeneutics.

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

Description	Critical	Believing	Involvement	Responsibility
Hypercritical (Radical Hermeneutics)	v	x	x	x
Hermeneutics of Suspicion	v	x	x	v
Hermeneutics of Neutrality	v	v	x	v
Hermeneutics of Respect	v	v	v	v
Hermeneutics of Faith	x	v	v	v
Pentecostals Hermeneutics	x	v	v	v

Delusional Hermeneutics	x	v	v	x
----------------------------	---	---	---	---

I will now suggest a new scheme which I will call “spectrum of hermeneutics”. From the above Table, we see 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 one is a Pentecostal, then perhaps he can take Yong’s approach to Pentecostals 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.

It should be noted that this is not an extensive review of many hermeneutics approaches in the literature. I believe that the above proposed scheme has practical value, especially for real scientists doing real science. However, one should be cautious before using radical hermeneutics and hermeneutics of suspicion to approach the Bible.

References

- [1] Amos Yong. Reading Scripture and Nature: Pentecostal Hermeneutics and Their implications for the Contemporary Evangelical Theology and Science Conversations. *Perspectives on Science and Christian Faith*, Vol. 63, No. 1, March 2011
- [2] William Atkinson. Pentecostal Hermeneutics – worth a second look?
- [3] Gordon D. Fee & Douglas Stuart. *How to read the Bible for all its worth*. Grand Rapids: Zondervan, 1993.
- [4] Gordon D. Fee. *Gospel and Spirit: Issues in New Testament Hermeneutics*. Peabody: Hendrickson Publishers, 1991.
- [5] Benjamin Uffenheimer and Henning Graf Reventlow (eds.). *Creative Biblical Exegesis*. JSOT 59. Sheffield: JSOT Press.
- [6] Alison Scott-Baumann. *Ricoeur and the Hermeneutics of Suspicion*. Great Britain: Continuum Books, 2009.
- [7] John B. Thompson. *Critical Hermeneutics: A study in the thought of Paul Ricoeur and Jurgen*

Habermas. Cambridge: Cambridge University Press, 1981.

[8] John D. Caputo. *Radical Hermeneutics: Repetitive, Deconstruction, and the Hermeneutic Project*. Bloomington: Indiana University Press, 1987.

An adventure from Wave Mechanics to Christocentric Cosmology Model

Victor Christianto¹

Abstract

This is a short reflection of my adventure over the last 20 years as an independent researcher, including the discovery process of a new Cosmology model based on interpretation of Cosmic Christology. While these ideas are in early phase, I wish that this article may stimulate further thinking and discussion in the dialogue between science and theology.

Introduction

Science has become a religion of its own. Universities and colleges all around the world are its temples where people come to worship the "gods" of science. For example, the "gods" in physics include Planck, Einstein, Bohr, Schrodinger, Dirac, Heisenberg etc. There were many people who refused to worship these gods, and they were expelled or dismissed as "rebels" or "dissidents". The worst kind of those rebels are called "heretics." Here allow me to tell you a story of a dissident.

Early days

I should admit here: that for some time in the past I have fallen to become such an idol worshipper, especially in the period between 1997-2014. In 1996 I bought a book edited by Wojciech Zurek with title "Complexity, Entropy and the Physics of Information", published by Santa Fe Institute (Addison-Wesley, 1991). Since then, practically I was very enthusiastic on

¹ Independent Researcher, phone: (62) 87859937095, url: <http://www.sci4God.com>, http://researchgate.net/profile/Victor_Christianto, email: victorchristianto@gmail.com

various interpretations of Quantum Mechanics. I then read several books on QM, including Alistair Rae's book.²

After around six years of independent study in wave mechanics, I decided that time has come to put my ideas in writing. In 2002 I submitted my first paper to Apeiron editor, but it was rejected soon. I forgot about the title. Then I put more effort to write a quite speculative paper, based on hypothesis that the solar system can be modelled as quantized vortices of superfluid helium.

Using this new model which is essentially a Bohr model of atom applied to solar system, I made a desperate effort in the form of two things: (a) predicting a brown dwarf companion of the Sun with negative mass about equal with the Sun, (b) predicting three undiscovered planets in the outer orbits of the Solar system, beyond Pluto orbit (at the time of writing, no such planet was discovered by astronomers).

The reviewer of this paper was Prof. Robert Kiehn, and he was so kind to read my often confusing English expressions. I am indebted to him, because he was the first person who gave encouragement to my endeavor. After editing and rewriting this 43-pages paper for about one year and a half, finally the editor of Apeiron received my paper for publication. It was published in January 2004.³

To my surprise, around four months later I read an online news telling that a new planetoid beyond pluto was found, dubbed as Sedna. It was discovered by Michael Brown and his team of astronomers from Caltech. I then rushed to my old desktop pc to calculate its orbit and to compare it with my prediction back in 2002, and I found that Sedna's orbit is very close to my prediction. Then I quickly wrote a paper discussing Sedna finding. This paper was received and

² Alistair I.M. Rae. Quantum Mechanics. 3rd ed. See for example: http://avxhome.se/ebooks/Quantum_Mechanics_4th.html

³ Victor Christianto. A Cantorian Superfluid Vortex and the Quantization of Planetary motion. Apeiron Vol. 11, No. 1, January 2004. Url: <http://redshift.vif.com/JournalFiles/V11NO1PDF/V11N1CHR.pdf>

published in Apeiron's July 2004 edition.⁴ See also an updated paper.⁵

After what may be called a beginner's luck, I felt so motivated to continue my investigation on quantum mechanics, especially in deterministic QM with quantum vortice interpretation of wavefunction. These early period investigations have been documented in several books and papers***, including in Annales de la Fondation Louis de Broglie, 2006.⁶

Over those early years, I have learned from many interesting persons, including but not limited to Prof. Brian Josephson, Prof. Carlos Castro, Prof. Mat Pitkanen, Dr. Jack Sarfatti, Prof. Florentin Smarandache, Dmitri Rabounski etc. Almost all those people whom I knew via email conversations have one similarity, i.e. they were dissidents and were completely or partially blacklisted by www.arxiv.org, **** the online "temple" of mainstream physics, especially it is a place to worship high energy physics.**

In 2005, through email discussion, Prof. Brian Josephson (Noble laureate) suggested a name for our new alternative preprint server, that is www.sciprint.org. Since may 2005, then I became administrator of www.sciprint.org. I administered sciprint.org beside my daily profession until 2009 when for some reasons, my admin password was compromised, so I cannot continue administering that preprint server.*****

Fortunately, a colleague told me that a new preprint service has just come to appear, i.e.

www.vixra.org, administered by Dr. Phil Gibbs ("vixra" is "arxiv" read backward). Then I asked him whether he would like to host our files in sciprint.org. After he accepted, then I tried my best

⁴ Victor Christianto. Comparison of Predictions of Planetary Quantization and Implications of the Sedna Finding. Apeiron Vol. 11 No. 3, July 2004.

⁵ Victor Christianto & Florentin Smarandache. 2005. On recent discovery of new planetoids in the solar system and quantization of celestial system.

Url: <http://www.gallup.unm.edu/~smarandache/ScArt6/RecentDiscoveryPlanetoids.pdf>

⁶ Victor Christianto. On the origin of macroquantization in astrophysics and celestial motion. Annales de la Fondation Louis de Broglie Vol. 31 No. 1, 2006.

url: https://www.researchgate.net/publication/240305621_On_the_origin_of_macroquantization_in_astrophysics_and_celestial_motion

to recover and send these files of almost 300MB to a friend in Germany, who then downloaded the files and burned those files into a disc. Thereafter he mailed the disc to Phil Gibbs in England. That is why until now you will find some papers in vixra.org with small notes that they were recovered from www.sciprint.org.

Moment of enlightenment

Around October 2009, in a prayer Jesus Christ called me to become His servant, and one of His instruction was I must return to my hometown. Then I went to my hometown in East Java, and began to serve in a local church where I grew up with. In 2011, I decided to equip myself with a formal education in theology. In those years I was quite busy with other things, so practically I left behind science stuff. I guess I should leave science behind me, that at a point I did not answer back when Prof. Florentin Smarandache called me in phone.

But gradually I found a balance in my life, so I tried to write some papers again since. I also compiled a few books on astrophysics with Prof. Florentin Smarandache.

Then I came to a point that my theology education was almost completed, so I can return to former fields of interest: cosmology and astrophysics.

Around May 2014, when I was travelling in a bus, then a thought came to me: what is the power behind a worship song? It came to me that it was frequency which has power to turn even the walls of Jericho to ruining. This was my first moment of enlightenment.

The second moment came around that time (may-june), when I found some papers by Dr. George Shpenkov (<http://shpenkov.janmax.com>), who was able to show convincingly that there are many errors with Schrodinger equation. So I concluded that it was not only the mistake of Max Born who introduced probability interpretation of quantum mechanics, but Schrodinger

himself made serious errors too in deriving his then famous equation.

Then I wrote a paper reviewing Schrodinger equation and classical wave equation, that paper was published in Prespacetime Journal, July 2014.⁷ Although I agree with Dr. Shpenkov that classical wave equation is better than the Schrodinger equation, it does not mean that I agree with his dialectic philosophy.

Gradually, I came to think that frequency and wave were also important at the time of creation, therefore I began my study into an interpretation of Cosmic Christology through the Johannine prologue (John 1:1-18).

Cosmic Christology

Cosmic Christology is a basic Christian doctrine that was often debated during the past 40 years. Cosmic Christology is deeply related with the Cosmic Christ who is the universal but inclusive Savior.⁸

The biblical teaching on Cosmic Christology was a legacy of the faith of the Early Church, and this teaching was told in Jesus hymn in the Johannine prologue and the prologue of St. Paul's letter to Colossians (John 1:1-18; Col. 1:15-20), see also Christ hymn in letter to Philippians 2:6-11.

Besides, there are also some texts which were often referred in the Old Testament; these texts indicate the personified Wisdom of God, who acts as the agent of creation. And this character was then used for Jesus Christ. (Proverbs 8:22-31; Wisdom of Solomon 8:4-6; Sirakh 1:4-9).

There are also extra-biblical sources which can be referred, such as the Son of God text of

⁷ Victor Christianto. A review of Schrodinger equation and classical wave equation. Prespacetime Journal, July 2014. Url: <http://prespacetime.com/index.php/pst/article/view/625>

⁸ Robbyanto Notomihardjo. Kristologi Kosmik: tinjauan ulang dari sudut biblikal, teologikal dan historikal. Veritas 1/1, April 2000, 29-38

Qumran (*Bereh di El*, 4Q246). Such a text indicates messianic hope of Essene people, and that hope was very close to the faith of Early Church toward Jesus Christ.

Several implications

That is why, one of my focus of research in the past 3 years until now was to find implications of Cosmic Christology in the context of physics and cosmology. That idea was motivated by the fact that there has been a serious tension between science and theology, after they were separated especially since Galileo Galilei was put into isolation by the Church. One of the books which has inspired me was by Tollefsen which discusses Christocentric Cosmology.⁹ My investigation has led to several hypotheses, five of them will be discussed shortly below:

(a) Jesus Christ is the Word of God, and He is the agent of God during the creation of the Universe. Because word means voice, and voice means sound, and sound means wave and frequency, then this thought led us to a hypothesis of the existence of primordial sound in the early time of creation.¹⁰ Perhaps such a primordial sound will be verified later by Cosmic microwave background radiation observation (CMBR).¹¹

(b) another thought is that (electromagnetic) wave and frequency are very influential to begin each life of creatures. It appears that such a hypothesis was supported by experiments carried out by Prof. Luc Montagnier et al on the wave nature of DNA;^{12, 13}

⁹ Thorstein Theodor Tollefsen. *The Christocentric Cosmology of St. Maximus the Confessor*. New York: Oxford University Press, 2008.

¹⁰ Victor Christianto. *An outline of cosmology based on interpretation of The Johannine Prologue*. BSMaSS Vol. 11, 2014. Url: <https://www.scipress.com/BSMaSS.11.4.pdf>

¹¹ Amedeo Balbi. *The music of the Big Bang*. Berlin: Springer-Verlag, 2008.

¹² Luc Montagnier et al. *DNA waves and water*. *Journal of Physics: Conf. Series* 306, 2011. Url: http://montagnier.org/IMG/pdf/DNA_waves_and_water.pdf

(c) that thought on the wave nature of the Universe also led to a wave model of superconductor electrostatics. In physics, conductor is matter which can transmit electric current, while superconductor is matter which can transmit electric current at zero resistance. My hypothesis on superconductor electrostatics has been presented in a paper published last year in IJET;¹⁴

(d) frequency may also be used to develop a novel approach of cancer therapy;¹⁵

(e) the light particle which was dubbed as photon has also the wave character. The photon wave can be loaded with information (bits), and according to some experiments on lab, such a method is potentially capable to improve the wireless internet capacity significantly, possibly at the order of 100-160 Gigabits per second. But this method needs to develop further before it can be used as practical technology.¹⁶

Concluding remarks

I hope that I have told my story with clarity. It should be clear that I began as a dissident in the same temple of Quantum Mechanics, but gradually I turned out to refuse to worship those "gods" of mainstream physics. Instead, I decided to develop a new path where science and theology can meet.

Hopefully the above story will inspire many more young students and graduate students alike to return to God, instead of wandering around from one temple to another, only to find many kinds of deception over and over again.

I also wish that I already presented my interpretation on Cosmic Christology based on the

¹³ Victor Christianto & Yunita Umniyati. On the Plausible Implications of Gariaev & Montagnier's Work: Omne vivum ex vivo via crebritudo? DNA Decipher Journal, vol. 6, Issue 2, 2016. URL: <http://dnadecipher.com/index.php/ddj/article/view/102/112>

¹⁴ Victor Christianto. Evolving Trends in Engineering and Technology vol. 4, 2015. Url: <https://www.scipress.com/ETET.4.1>

¹⁵ Victor Christianto. <https://www.scipress.com/IFSL.4.7>

¹⁶ Victor Christianto. Url: <http://rxiv.org/abs/1603.0229>

Johannine prologue, albeit not a complete one.

As a last remark, allow me to cite Psalm 19:1-3

- 1 "The heavens declare the glory of God; and the firmament sheweth his handywork.
- 2 Day unto day uttereth speech, and night unto night sheweth knowledge.
- 3 There is no speech nor language, where their voice is not heard. "(KJV)

If the readers are interested to carry out further investigations on one or more of the above directions, you can contact me at email: victorchristianto@gmail.com. May God be with you.

Acknowledgment

This paper is dedicated for Jesus Christ, who has helped this author out of so many problems. He is the Lord of the Universe and the Good Shepherd.

versi 1.0: 26 maret 2016, pk. 8:53; version 1.1: April 14, 2016 (21:55).
VC

Publication history:

- a. blog version, www.sci4God.com, since april 2016
- b. Submitted to Asian Journal of Theology, 29th June 2016, <http://ojs.atesea.net/>
- c. To be submitted to Australian eJournal of Theology

Postscript:

*url: http://researchgate.net/profile/Victor_Christianto

**I sincerely do hope that someday arxiv.org administrators will change their draconian policy

and cumbersome submitting procedures. Fortunately there is news that they are now conducting an online survey (dated 6th april 2016), so I hope that many dissidents like me can submit papers without being rejected by arxiv.org.

***Check our books in pdf version at the homepage of Prof. Florentin Smarandache,
<http://fs.gallup.unm.edu/FlorentinSmarandache.htm>

****Check <http://www.archivefreedom.org>, see also Against the Tide book
at <http://vixra.org/abs/0909.0002>

*****If you want to verify this story of sciprint.org, you can contact Prof. Carlos Castro Perelman at perelmanc@hotmail.com, or Prof. Florentin Smarandache at fsmarandache@gmail.com

Short biography

He was born in East Java, Indonesia, and then he studied engineering in a state university in East Java from 1987-1992. Then he worked until 2008. In December 2008 he was granted a scholarship to study gravitation and cosmology at Institute of Gravitation and Cosmology in Moscow until June 2009. Since Oct. 2009, he works for Jesus Christ. Then in 2011 he went to study theology. He graduated as Master in Theology in September 2014. He published more than 40 papers and 14 books. Since August 2015, he holds Doctor of Divinity and administers www.Sci4God.com.

APPLICATIONS

Report

A Graphic Plot for a Soliton Solution of Sine-Gordon model of DNA

Victor Christianto^{*1} & Yunita Umniyati²

¹Malang Institute of Agriculture, Malang, Indonesia

²Swiss German University, Tangerang – Indonesia

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.

Key Words: soliton solution, sine-Gordon, DNA, graphic.

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 such a 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

Assuming the wavefunction Ψ to be a function of x and t , then the sine-Gordon model of DNA can be written as follows: [3, p.7]

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

or in Mathematica expression:

$$\Psi = U[x - c t];$$
$$\text{pde} = D[\Psi, x, x] - D[\Psi, t, t] - \sin[\Psi] == 0$$

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

* Correspondence: Victor Christianto, Malang Institute of Agriculture, Malang – Indonesia.
URL: http://researchgate.net/profile/Victor_Christianto. Email: victorchristianto@gmail.com

$$-\sin[U[z]] + U''[z] - c^2 U''[z] = 0 \tag{2}$$

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

$$\Phi = 4\text{ArcTan}[c\text{Sinh}[x/\text{Sqrt}[1 - c^2]]/\text{Cosh}[ct/\text{Sqrt}[1 - c^2]]] \tag{3}$$

or in Mathematica:

$$4\text{ArcTan}\left[c\text{Sech}\left[\frac{ct}{\sqrt{1-c^2}}\right]\text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]\right]$$

Differentiating for t, it yields:

$$\begin{aligned} &\partial_t \left(4\text{ArcTan}\left[c\text{Sech}\left[\frac{ct}{\sqrt{1-c^2}}\right]\text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]\right] \right) \\ &= \frac{4c^2\text{Sech}\left[\frac{ct}{\sqrt{1-c^2}}\right]\text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]\text{Tanh}\left[\frac{ct}{\sqrt{1-c^2}}\right]}{\sqrt{1-c^2}(1+c^2\text{Sech}\left[\frac{ct}{\sqrt{1-c^2}}\right]^2\text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]^2)} \end{aligned}$$

Simplifying the above result, it yields:

$$\begin{aligned} &\text{Simplify}\left[\frac{4c^2\text{Sech}\left[\frac{ct}{\sqrt{1-c^2}}\right]\text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]\text{Tanh}\left[\frac{ct}{\sqrt{1-c^2}}\right]}{\sqrt{1-c^2}\left(1+c^2\text{Sech}\left[\frac{ct}{\sqrt{1-c^2}}\right]^2\text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]^2\right)}\right] \\ &= \frac{8c^2\text{Sinh}\left[\frac{ct}{\sqrt{1-c^2}}\right]\text{Sinh}\left[\frac{x}{\sqrt{1-c^2}}\right]}{\sqrt{1-c^2}\left(1-c^2+\text{Cosh}\left[\frac{2ct}{\sqrt{1-c^2}}\right]+c^2\text{Cosh}\left[\frac{2x}{\sqrt{1-c^2}}\right]\right)} \end{aligned}$$

The 3D plot is given below for c= 0.72

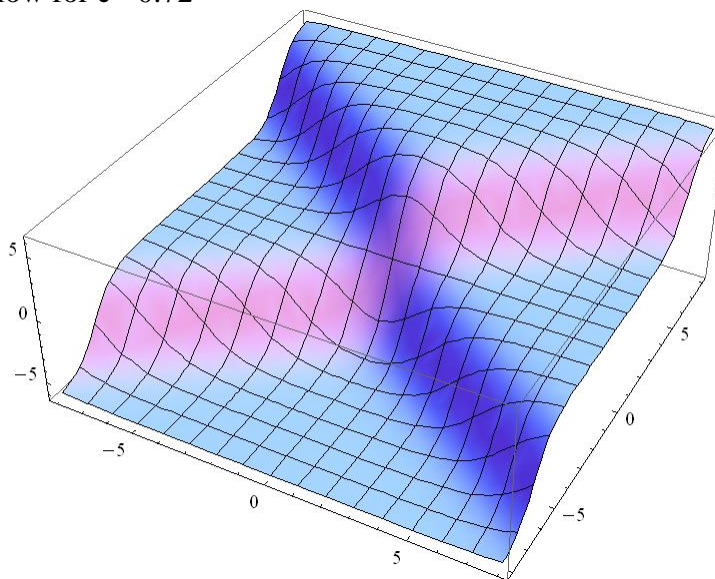


Figure 1. Mathematica plot of soliton solution on sine-Gordon equation for $c=0.72$

Perturbed Sine-Gordon Equation (SGE)

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

$$\Psi_{tt} + \Phi\Psi_t - \Psi_{zz} + \sin(\Psi) = F \quad (4)$$

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

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

$$\Psi_{tt} - \Psi_{zz} + \sin(\Psi) = Mf(\omega t) \quad (5)$$

b. Damped and driven SGE:

$$\Psi_{tt} - \Psi_{zz} + \sin(\Psi) = Mf(\omega t) - \alpha\Psi_t + \eta \quad (6)$$

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

$$\Psi_{tt} = \Psi_{xx} + \Psi_{yy} - \sin(\Psi) \quad (7)$$

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.

Conclusion

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 have discussed 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, 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.

References

- [1] Ludmila V. Yakushevich. *Nonlinear Physics of DNA*. Second, rev. ed. Berlin: Wiley-VCH Verlag GmbH & Co., 2004.
- [2] M. Salerno, *Phys. Rev. A* 44 (1991) 5292
- [3] M. Daniel & V. Vasumathi. *Soliton-like base pair opening in a helicoidal DNA: An analogy with helimagnet and cholesterics*. arXiv:0812.4536 [nlin.PS], 2008.
- [4] Richard H. Enns & George C. McGuire. *Nonlinear Physics with Mathematica for Scientists and Engineers*. Berlin: Birkhäuser, 2001, p. 443-445.
- [5] Sadri Hassani. *Mathematical Methods using Mathematica: For Students of Physics and Related Fields*. New York: Springer-Verlag New York, Inc., 2003.
- [6] Sara Cuenda, Angel Sanchez, & Niurka R. Quintero. Does the dynamics of sine-Gordon solitons predict active regions of DNA? *Physica D* 223 (2006) 214-221.
- [7] Vladimir G. Ivancevic and Tijana T. Ivancevic. *Sine-Gordon solitons, Kinks and Breathers as Physical Models of Nonlinear Excitations in Living Cellular Structures*. arXiv:1305.0613 [q-bio.OT]

Exploration**On the Plausible Implications of Gariaev & Montagnier's Work:
*Omne Vivum ex Vivo via Crebritudo?***Victor Christianto^{*1} & Yunita Umniyati²¹Malang Institute of Agriculture, Malang, Indonesia²Swiss German University, Tangerang – Indonesia**ABSTRACT**

Recently Luc Montagnier and his group reported that genetic information might be transmitted to water through applications of electromagnetic field. These experiments seem to confirm what have been done by Peter Gariaev and his group in the past three decades, *i.e.*, that DNA has wave character. However, non-particle view of DNA seems to challenge the standard paradigm of DNA and biology. In this paper, we briefly explore the non-particle view of DNA and consider an extension of the known adage “*Omne vivum ex vivo*” to “*Omne Vivum ex Vivo via Crebritudo (frequency)*”.

Keywords: DNA, genetic information, transmission, Gariaev, Montagnier, wave character.

Introduction

Recently Luc Montagnier and his group reported that genetical information might be transmitted to water through applications of electromagnetic field [2-3]. These experiments seem to confirm what have been done by Peter Gariaev and his group in the past three decades, *i.e.*, DNA has wave character. However, non-particle view of DNA seems to challenge standard paradigm of DNA and biology. In this paper, we briefly explore the non-particle view of DNA.

Concluding her review on Montagnier's experiments, Laurence Hecht wrote [1]:

With the results of Montagnier, we recognize that the principle, *omne vivum ex vivo*, still holds, but only on the condition that we adopt a non-particle conception of life.

Since there are extensive reports since 1980s concerning the possibility of long distance communication between cells, especially using E.M. field, it seems appropriate to consider an extension of the known adage: “*Omne vivum ex vivo*” to “*Omne Vivum ex Vivo via Crebritudo (frequency)*”.

* Correspondence: Victor Christianto, Malang Institute of Agriculture, Malang – Indonesia.

URL: http://researchgate.net/profile/Victor_Christianto. Email: victorchristianto@gmail.com

DNA & De Broglie's Matter-wave Hypothesis

Experiments carried out by Montagnier group seem to suggest that genetic information can be transmitted to water via electromagnetic waves. This is very interesting since it challenges standard paradigm in biology [2-3]. This is also related to Gariaev's proposal of DNA wave genetics [4-6].

That cell has capability to communicate at a distance may be not surprising, since there are reports indicating that effect [7-8]. But that electromagnetic field can transmit genetic information to water is interesting result which seems to bring us back to an old battle between corpuscular view and wave view of matter, *i.e.*, Newtonian corpuscular model *vis a vis* Huygens-Fresnel's wave model of matter. Louis De Broglie seemed to give a hint on that issue by proposing matter-wave hypothesis but it appears that this issue is not solved completely.

For clarity, let us put aside objections on Einstein's special relativity and follow De Broglie's argument in his thesis:

$$E = hf, \quad (1)$$

and

$$E = mc^2 \quad (2)$$

Equating (1) and (2) we get:

$$\hbar f = mc^2, \quad (3)$$

or

$$m = f \frac{\hbar}{c^2}. \quad (4)$$

In other words, matter comes from frequency. Therefore, it seems possible at least in theory that not only E.M. field can transmit genetic information to water, but also that E.M. frequency can alter genetic code.

As a note, although our starting point of using (1) and (2) comes from De Broglie's original proposal, the conclusion is rather different because we do not have to accept his pilot wave model.

It seems that equation (4) can give some hints to explain many phenomena related to Montagnier and Gariaev's experiments and may plausibly open new ways to treat DNA as quantum biocomputer [4].

If this proposition holds true, then it is possible to extend the old adage "all life come from life" (*Omne vivum ex vivo*) to "all life come from life through frequency" (*Omne vivum ex vivo via crebritudo*). This is because genetic information can be altered or transmitted through E.M. field and frequency. In other words, one may use 'frequentia', so it becomes: "*Omne vivum ex vivo via frequentia*."

Plausible Application of the Proposed Concept

To test the new concept of “all life comes from life through frequency” (*Omne vivum ex vivo via crebritudo*) which challenges the standard paradigm in biology, we suggest the following:

Let us define f = yield frequency, *i.e.*, frequency where matter becomes wave and a new parameter:

$$k = \frac{\hbar}{c^2}, \quad (5)$$

Then we can write equation (4) as a ratio:

$$\frac{m}{f} = k. \quad (6)$$

In other words, from the above equation we may predict that the ratio between a small mass (m) like photon with its yield frequency (f) is always a constant. The small mass here can be extended to neutrino, electron, muon etc. We hope that the above equation may serve as a means to test the proposed concept.

One plausible application of this proposition is alternative method of cancer treatment using various frequencies. It is known that some frequencies like 444Hz may kill cancer cell without destroying the normal cells. Such a method seems worthy to be investigated and developed further [9].

Montagnier *et al.* also use very low frequency such as 7.83 Hz, which seems to be closely related to the Schumann resonance of 7 Hz. Whether or not such a 7.83 Hz corresponds to ambient frequency of electromagnetic noise in water should be tested with experiments.

DNA as Perturbed SGE Soliton

There are various models of DNA, one of them is using solitary wave [10]. Its use as a model of phyllotaxis systems including DNA has been proposed elsewhere [11-14]. Now, we will only consider Perturbed sine-Gordon equation (PSGE) as a model of interaction between soliton and external E.M. field.

Perturbed SGE comes in a variety of forms. One common form is a damped and driven SGE: [11, p.17]

$$\Psi_{tt} + \Phi\Psi_t - \Psi_{zz} + \sin(\Psi) = F \quad (7)$$

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

a. Directly forced SGE: [11, p.19]

$$\Psi_{tt} - \Psi_{zz} + \sin(\Psi) = Mf(\omega t) \quad (8)$$

b. Damped and driven SGE:

$$\Psi_{tt} - \Psi_{zz} + \sin(\Psi) = Mf(\omega t) - \alpha\Psi_t + \eta \quad (9)$$

In the meantime, (2+1)D SGE with additional spatial coordinate (y) is defined as: [11,p.21]

$$\Psi_{tt} = \Psi_{xx} + \Psi_{yy} - \sin(\Psi) \quad (10)$$

In their in-depth review of SGE, Ivancevic and Ivancevic [11] 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

Recently Luc Montagnier and his group reported that genetic information might be transmitted to water through applications of electromagnetic field. These experiments seem to confirm what have been done by Peter Gariaev and his group in the past 3 decades, *i.e.*, that DNA has wave character.

Concluding her review on Montagnier's experiments, Laurence Hecht wrote [1]:

With the results of Montagnier, we recognize that the principle, *omne vivum ex vivo*, still holds, but only on the condition that we adopt a non-particle conception of life.

In this paper, we have briefly explored the non-particle view of DNA and consider an extension of the known adage: "*Omne vivum ex vivo*" to "*Omne Vivum ex Vivo via Crebritudo (frequency)*".

Acknowledgement: The first authors wishes to express his gratitude to Renata Wong and Prof. Akira Kanda for discussion and insight.

References

- [1] Laurence Hecht. "Luc Montagnier's Revolution in Biology: New Evidence for a Non-Particle view of Life." *21st Century Science and Technology*, Winter 2010/2011. URL: http://www.21stcenturysciencetech.com/articles_2011/Winter-2010/Montagnier.pdf
- [2] Luc Montagnier, et al. (2011). "DNA Waves and Water." *5th Intr. Workshop DICE 2010; Journal of Physics: Conf. Series 306 (2011) 012007*; [2a] <http://arXiv.org/pdf/1012.5166>
- [3] Luc Montagnier et al. (2015) "Transduction of DNA information through water and electromagnetic waves," arXiv:1501.0162 [q-bio.OT]; see also [3a] Luc Montagnier, et al. (2009) "Electromagnetic Signals are produced by aqueous nanostructures derived from bacterial DNA Sequences." *Interdiscip. Sci. Comput. Life. Sci.*
- [4] Peter Gariaev, et al. (2011) "DNA as basis for Quantum Biocomputer," *DNA Decipher Journal, January 2011, Vol. 1 Issue 1*, pp. 025-046. <http://www.dnadecipher.com>
- [5] Matt Pitkanen (2011) "DNA & Water memory: comments on Montagnier group's recent findings," *DNA Decipher Journal, January 2011, Vol. 1 Issue 1*, pp. 181-190. <http://www.dnadecipher.com>
- [6] Peter Gariaev & Matt Pitkanen (2010) "Model for the findings about Hologram Generating Properties of DNA," url: http://tgd.wippiespace.com/public_html/
- [7] Ashkan Farhadi (2014) "Non-chemical distant cellular interactions as a potential confounder of cell biology experiments," *Frontiers in Physiology*, Oct. 2014, Vol. 5 Article 405
- [8] A.V. Khalyavkin & A.E. Gurvich (1978) "Role of distant interactions of lymphocytes in the development of antibody formation in vitro," *Bull. Exp. Biol. & Medicine*, Plenum Publishing Corp. Available at www.researchgate.net
- [9] Victor Christianto (2015) "A review of Cancer electromagnetic frequency therapy: Towards Physics of Cancer," *Intr. Front. Sci. Lett.*, www.scipress.com
- [10] Victor Christianto & Yunita Umniyati (2015) "Graphical Plot of Soliton Solution of sine-Gordon model of DNA," *DNA Decipher Journal*, www.dnadecipher.com
- [11] Vladimir G. Ivancevic and Tijana T. Ivancevic. *Sine-Gordon solitons, Kinks and Breathers as Physical Models of Nonlinear Excitations in Living Cellular Structures*. arXiv:1305.0613 [q-bio.OT]
- [12] Cristiano Nisoli (2009) "Spiraling soliton: A continuum model for dynamical phyllotaxis of physical systems," *Phys. Rev. E* 80, 026110
- [13] Ludmila V. Yakushevich. *Nonlinear Physics of DNA*. Second, rev. ed. Berlin: Wiley-VCH Verlag GmbH & Co., 2004
- [14] Sara Cuenda, Angel Sanchez, Niurka R. Quintero. Does the dynamics of sine-Gordon solitons predict active regions of DNA? *Physica D* 223 (2006) 214-221.

A Review of Cancer Electromagnetic Frequency Therapy: Towards Physics of Cancer

Victor Christiano¹

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

¹ Contact: victorchristiano@gmail.com, URL: <http://www.sciprint.org> or http://www.researchgate.net/profile/Victor_Christiano

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 Ψ to be a function of x and t , then the sine-Gordon (SGE) model of DNA can be written as follows: [8, p.7]

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

Meanwhile, perturbed SGE come in a variety of forms. One common form is a damped and driven SGE: [10, p.17]

$$\Psi_{tt} + \phi\Psi_t - \Psi_{zz} + \sin(\Psi) = F \quad (2)$$

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

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

$$\Psi_{tt} - \Psi_{zz} + \sin(\Psi) = Mf(\omega t) \quad (3)$$

b. Damped and driven SGE:

$$\Psi_{tt} - \Psi_{zz} + \sin(\Psi) = Mf(\omega t) - \alpha\Psi_t + \eta \quad (4)$$

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.

Appendix: Table of Clinics offering Electromagnetic Frequency Therapy (not limited to cancer treatment)

Name	Institute/Method	URL	City	Country
Panos T. Pappas	BioElectroDynamics	www.papimi.gr	Athens	Greece
Hans Kempe	GKA System	www.mcm-fp.ch		Switzerland
Margit Michel-Donate		www.ams-magneticfieldtherapie.de		Germany
Zoetron Therapy		www.csct.com		Europe, North America
Electromagnetic Biofeedback Institute		www.bicomresonance.com		Germany
Demetrio Sodi Pollares				Mexico
Darko Mardjetko	Sanoviv Health Retreat			Mexico
Beam Ray Corporation			Alabama	USA
Rife Technology				Canada
David Spall	Quantronic Resonance Therapy			Australia

References:

- [1] Mark J. Neveu & Richard Blanco, Emerging Opportunity: Cancer Electromagnetic Frequency Therapy. *The National Foundation for Alternative Medicine*, <http://www.nfam.org>. Contact email: mneveu@nfam.org
- [2] Yoed Rabin, Cancer Treatment by Electromagnetic Activated Nanoheaters, *Nanotechnology Essays*, EurekAlert! Nanotechnology InContext, August 2002. Contact email: rabin@cmu.edu
- [3] Alexandre Barbault *et al.*, Amplitude-modulated electromagnetic fields for the treatment of cancer: discovery of tumour-specific frequencies and assessment of a novel therapeutic approach. *J. Exp. Clin. Cancer Res.* Vol. 28, no. 1 (April 2009), pp. 51, ISSN 1756-9966. URL: <http://www.jecr.com/content/28/1/51>
- [4] Jacquelyn W. Zimmerman *et al.*, Targeted treatment of cancer with radiofrequency electromagnetic fields amplitude-modulated at tumor-specific frequencies, *Chin. J. Cancer* Vol. 32 Issue 11 (2013), <http://www.cjcsysu.com>

-
- [5] I. Verginadis *et al.*, Beneficial effects of Electromagnetic Radiation in Cancer (2012), <http://www.intechopen.com>
- [6] Ludmila V. Yakushevich. *Nonlinear Physics of DNA*. Second, rev. ed. Berlin: Wiley-VCH Verlag GmbH & Co., 2004.
- [7] M. Salerno, *Phys. Rev. A* 44 (1991) 5292
- [8] M. Daniel & V. Vasumathi. *Soliton-like base pair opening in a helicoidal DNA: An analogy with helimagnet and cholesterics*. arXiv:0812.4536 [nlin.PS], 2008.
- [9] Sara Cuenda, Angel Sanchez & Niurka R. Quintero. Does the dynamics of sine-Gordon solitons predict active regions of DNA? *Physica D* 223 (2006) 214-221.
- [10] Vladimir G. Ivancevic & Tijana T. Ivancevic. *Sine-Gordon solitons, Kinks and Breathers as Physical Models of Nonlinear Excitations in Living Cellular Structures*. arXiv:1305.0613 [q-bio.OT]

Volume 4

10.18052/www.scipress.com/IFSL.4

A Review of Cancer Electromagnetic Frequency Therapy: Towards Physics of Cancer

10.18052/www.scipress.com/IFSL.4.7

DOI References

[3] Alexandre Barbault et al., Amplitude-modulated electromagnetic fields for the treatment of cancer: discovery of tumour-specific frequencies and assessment of a novel therapeutic approach. *J. Exp. Clin. Cancer Res.* Vol. 28, no. 1 (April 2009), p.51.

10.1186/1756-9966-28-51

[4] Jacquelyn W. Zimmerman et al., Targeted treatment of cancer with radiofrequency electromagnetic fields amplitude-modulated at tumor-specific frequencies, *Chin. J. Cancer* Vol. 32 Issue 11 (2013), <http://www.cjcsysu.com>.

10.5732/cjc.013.10177

[7] M. Salerno, *Phys. Rev. A* 44 (1991) 5292.

10.1103/physreva.44.5292

[9] Sara Cuenda, Angel Sanchez & Niurka R. Quintero. Does the dynamics of sine-Gordon solitons predict active regions of DNA? *Physica D* 223 (2006) 214-221.

10.1016/j.physd.2006.09.005

[10] Vladimir G. Ivancevic & Tijana T. Ivancevic. Sine-Gordon solitons, Kinks and Breathers as Physical Models of Nonlinear Excitations in Living Cellular Structures. arXiv: 1305.0613 [qbio. OT].

10.7546/jgsp-31-2013-1-56

Letter to the Editor

Some Implications of Human Genome Research and Its Related Ethical Discourse

Victor Christiano *

ABSTRACT

We discuss a number of ethical considerations related to genome research and results of human genome project's efforts. It shall become apparent that there are ethical risks and also numerous questions which are open and yet to be defined by those reputable teams, especially concerning the use of genetic enhancement and genetic enrichment of particular human being in comparison with other human being given differences in economics position in society.

Key Words: human genome, genetic enhancement, genetic enrichment, risk, ethical issues.

Despite a number of widespreading articles [2][3] considering the completion and possible advantages of human genome project (HGP), there are only few articles which focus on ethical concerns related to HGP, see article [1] for instance. These ethical concerns include germline intervention and also enhancement engineering, for example.

“Germline interventions involve more significant ethical concerns, because risks will extend across generations, magnifying the impact of unforeseen consequences. While these greater risks call for added caution, most ethicists would not object to the use of germline interventions for the treatment of serious disease if we reach the point where such interventions could be performed safely and effectively.”[1]

“Enhancement engineering is widely regarded as both scientifically and ethically problematic. From a scientific standpoint, it is unlikely that we will soon be able to enhance normally functioning genes without risking grave side effects.”[1]

Furthermore, one should keep in mind that Genome Project was actually a sequence of eugenics research in the past (eugenics office was part of the United Nations shortly after the Second World War, and eugenics are kept into practice in the form of depopulation policy(ii), depopulation policy are being put into practice until now in the form of NSSM 200), and therefore it should be considered more cautiously with respect to ethical and moral conducts in practice. In practice, however, there is risk that enhancement engineering is translated to become genetic enrichment, but then there is question concerning who is responsible for both the effect of enrichment and whether the treatment will not leave under-developed countries in unwelcome condition. For instance, if numerous kids in developed countries receive genetic enrichment treatment while people in underdeveloped countries do not receive that treatment because of economics consideration, then can it be considered as malthusian selection?

In general, malthusian selection(i) is a way created by human to introduce certain effects in order to create preferences of certain race with respect to its probability of survival. By

* Correspondence: Victor Christiano, <http://www.sciprint.org> E-mail: victorchristiano@gmail.com

introducing malthusian selection effect to a particular race then such a practice can be considered as violation of human right, since it would mean that certain genetic engineering treatment and enhancement engineering are available only for certain race for particular malthusian reasons.

Whether such a malthusian selection is true or not is yet to be confirmed by either NIH or genome project consortium, and it is apparent that genetic enhancement (engineering) will not be considered available to many human being in the foreseeable future. It is much more making sense that genetic engineers who are doctors that are responsible for genetic enhancement only offer their special service for a particular number of patients who are economically possible to give them better position to get genetic enhancement and enrichment treatment.

Apart from malthusian aspects of such enhancement engineering,[1] there are other aspects of both genetic and genome related research which can be considered unethical, that is: who will be the subject of genome extensive research in the forthcoming years.[4] It is known that for certain basic research, researchers often use mice or other animals, but for disease treatment and other drug related research, it is often required to conduct treatment test to human being. But as the effect of genetic treatment or enhancement will be spreading and extended towards other genetic related persons of the subject being treated medically, then whom will offer themselves to be the lab mice? History tells us that the victims of such drug testing abuse were often soldiers, prisoners, or people in under-developed countries. See for example the movie "Constant Gardener" (based on true story) in order you to know how such an abuse can be very large scale and country-wide, and sometimes it is backed by soldiers from developed countries. Such unethical practices and abuse in drug testing and also in distributing and delivery of obsolete drug to under-developed countries should be stopped and be avoided completely.

Concluding Remarks

We have discussed a number of ethical considerations related to genome research and results of human genome project's efforts. It becomes clearly apparent that there are ethical risks and also numerous questions which are open and yet to be defined by those reputable teams, especially concerning the use of genetic enhancement and genetic enrichment of particular human being in comparison with other human being given differences in economics position in society.

If such questions are deemed to be valid then one should begin to explore further ethical and critical questions concerning suitability of particular enhancement engineering treatment as a means of both malthusian selection or social darwinism agenda, which resemble in sort of eugenics in the past. These questions demand further thinking and ethical considerations beyond what are common to most genetic engineers.

References:

- [1] M. Carroll & J. Ciarra (2003), "The Human Genome Project: a scientific and ethical overview," http://www.actionbioscience.org/genomic/carroll_ciaffa.html
- [2] NIH (2010) <http://ghr.nlm.nih.gov/handbook/hgp.pdf> dated November 7, 2010
- [3] <http://www.nytimes.com/2001/02/13/science/an-online-tour-of-the-human-genome-is-just-a-few-clicks-away.html>
- [4] TIME magazine (2001), "The future of drugs," january 22, page 31-41.

Endnote:

- (i) malthusian selection, on the other hand, is proposed as a force for selection at the level of populations in addition to natural selection. "...the malthusian paradigm pictures competition between organisms of the same species as an important force. Attention was shifted from the struggle between the lion and the lamb to that between the lamb and the lamb." source: http://members.optusnet.com.au/exponentialist/malthus_evolution.htm
- (ii) depopulation policy. See NSSM 200, that is depopulation policy as part of social darwinism. Source: http://policestateplanning.com/chapter_14_.htm

Letter to the Editor

On Direct Detection of Cosmic Neutrino Background & Cosmic Singularity

Victor Christianto*

Abstract

According to standard cosmology, neutrinos should be the most abundant particles in the Universe after CMB photons. The CMB neutrino is the oldest relic, present since BBN era. However, in the past 5 decades or so, attempts to directly detect Cosmic Neutrino Background have never been succeeded. Taking into considerations of two recent developments, I argue that the direct detection of Cosmic Neutrino Background is impossible because there is no such thing as Cosmic Singularity.

Keywords: Cosmic neutrino background, relic neutrino density, cosmic singularity, Big Bang, direct detection.

Conventional standard cosmology (Hot Big Bang model) predicts the existence of relic photons in the Universe, remnants of the primordial plasma which became transparent about 380,000 years after the inferred big bang singularity. The hot big bang model also predicts that neutrinos and antineutrinos of all flavors become free-streaming particles at approximately one second after the big bang [7].

However, one fact plagues all big bang cosmologists is the fact that Cosmic Neutrino Background has never been detected. Of course, many proposals have been suggested to detect CNB experimentally, for instance using beta decay nuclei, but it remains untested. For this author, such a fact opens up the plausibility that the entire hot big bang industry may fail, especially if one is willing to consider the Robitaille's work [3] which suggests that the standard interpretation of Cosmic Microwave Background Radiation may be wrong [4-6].

My reasoning goes as follows: According to Hot Big Bang scenario, few seconds after Big Bang event (cosmic singularity) there were only relic neutrinos. Then, 380,000 years later emerge relic photons which were detected by COBE and WMAP. Therefore, such a Cosmic Neutrino Background should be able to observe in present days, but unfortunately there is no such thing like direct detection of CNB so far. This fact leaves us with only two possibilities:

* Correspondence: Victor Christianto, Independent Researcher http://researchgate.net/profile/Victor_Christianto.

Email: victorchristianto@gmail.com

- a. We should develop new theories where such CNB are vanishing; and
- b. The entire argument of Hot Big Bang should fail.

Of course, one may wait forever until new theories predicting vanishing CNB appear, and also one may come up novel techniques for direct detection of such CNB [8-11]. However, if one is willing to consider the following work:

- a. Earth Microwave Background by Robitaille [3], and
- b. New theories which are capable to exclude cosmic singularity [1],

It seems that the only remaining possibility is that *there is no such thing as Cosmic Singularity*.

Received June 3, 2016; Accepted June 10, 2016

References

- [1] Victor Christianto. An outline of new cosmology model inspired by Cosmic Christology of the Johannine Prologue. *Scientific God Journal*, Vol. 7, No. 4, April 2016. url: <http://www.scigod.com/index.php/sgj/article/view/468/518>
- [2] Victor Christianto. An exact solution of Riccati form of Boltzmann equation with Mathematica. *Prespacetime Journal*, Vol. 6 No. 12 (2015). url: <http://www.prespacetime.com>
- [3] Pierre-Marie L. Robitaille. The Earth Microwave Background (EMB), atmospheric scattering and the generation of isotropy. *Prog. In Phys.* 2008, vol. 2, 164-165. URL: http://ptep-online.com/index_files/2007/PP-10-01.PDF
- [4] Pierre-Marie L. Robitaille. COBE: A radiological analysis. *Prog. In Phys.* 2009, vol. 4, 17-42. URL: http://ptep-online.com/index_files/2009/PP-19-03.PDF
- [5] Stephen J. Crothers. COBE and WMAP: Signal analysis by fact or fiction? url: <http://sjcrothers.plasmareources.com/COBEWmap-3.pdf>
- [6] John Hartnett. WMAP 'proof' of big bang fails normal radiological standards. *Journal of Creation*. 21 (2) 2007. URL: http://creationontheweb.com/images/pdfs/tj/j21_2/j21_2_5-7.pdf
- [7] J.S. Diaz & F.R. Klinkhamer. Neutrino refraction by the cosmic neutrino background. *Phys. Rev. D* 93, 053004 (2016). Also in arxiv: 1512.00817
- [8] Graciela B. Gelmini. Prospect for Relic Neutrino Searches. *Physica Scripta* Vol. T121, 131-136, 2005.
- [9] Bob McElrath. Laboratory tests for the cosmic neutrino background using beta-decaying nuclei. arXiv: 0901.3491 [hep-ph]
- [10] Alfredo G. Cocco, Gianpiero Mangano, Marcello Messina. Capturing Relic Neutrinos with β -decaying nuclei. arXiv: 0711.1762 [astro-ph]
- [11] Julien Lesgourgues & Sergio Pastor. Neutrino cosmology and PLANCK. arXiv: 1404.1740 [hep-ph]

Grand Design, Intelligent Designer, or Simply GOD: Stephen Hawking and His "Hoax"

Victor Christiano *

ABSTRACT

Stephen Hawking only wish to have his words heard, regardless whether there are sufficient proof. According to Black Hole proponents, there should be Black Hole inside the galaxy center of our Milky Way. But despite there is very large mass inside the Milky Way center, its center remains bright that is enough disproof for all hypotheses of Black Hole by Stephen Hawking.

Key Words: GOD, grand design, intellegent designer, Stephen Hawking, hoax.

There are a number of good reasons to say that Big Bang support evolution theory's idea of creation by pure statistical chance alone. And that is why: some people do think that Big Bang can happen out of nothing. That standpoint of view, albeit not new, are reiterated by Stephen Hawking from Cambridge, in his latest book: the grand design [1][2].

Another middle-point of view, if you are believer of middle-viewpoint, is that there is a substantial amount of complexity which is irreducible in nature, that is sufficient enough to say that there must be the Grand Intelligent Designer, according to Behe and a host of other proponents of intelligent design (ID) [3][4]. But still they do not want to admit that there should be God who is behind those flawless creations.

Now if you are really an astronomy person, you can free your mind of this emotional baggage from philosophical school or other pseudo-teacher who do not prove anything in their life, and start to think afresh from data:

A. If Big Bang is true, then the universe stabilize and evolve to become more and more structured, but that is in contradiction to the basic proposition of second law of thermodynamics, that entropy is created continuously along the time. Using this argument alone, which Stephen Hawking should be more adept because he is famous for his black hole entropy which has never been observed, then one can argue that Big Bang create entropy along the course of time, and by doing so the universe is eventually getting more and more inherently chaotic (because entropy creation mean more chaos). This is in direct contradiction with Big Bang proponents' own proposition.

B. Furthermore, typical of some philosophers like Stephen Hawking (even if he said that philosophy is dead), he only wish to have his words heard, regardless whether there are sufficient proof. For readers' information, according to black hole proponents, there should be Black Hole inside the galaxy center of our Milky Way. But despite there is very large mass inside the Milky Way center, its center remains bright [5] that is enough disproof for all hypotheses of Black Hole by Stephen Hawking.

* Correspondence: Victor Christiano, <http://www.sciprint.org> E-mail: victorchristiano@gmail.com

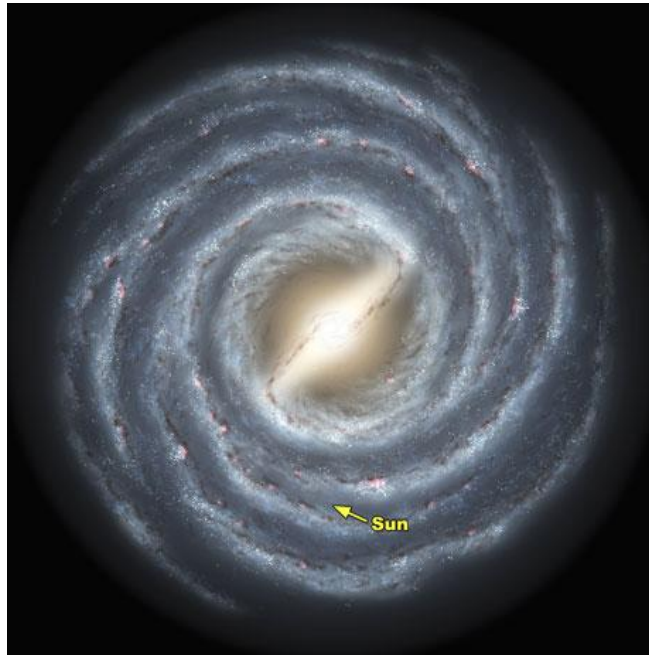


Figure1. Milky Way center show a bar and bright center, and not a black hole.
http://news.nationalgeographic.com/news/2005/08/0817_050817_milkywaybar.html

C. If one is an honest astronomer, then he can admit that there is growing consensus of the universal law which suggests not only irreducible complexity, but also scale-organization (note that this time we do not use self-organized criticality terminology or s.o.c.). By scale organization we mean that there is apparent organization across different scales, which can be characterized for instance by Hausdorff dimension ~ 2 , for instance across different astrophysics observations [6]. There is also hint pointing toward ordering in nature, for instance one can point to quantization of planets both in solar system and beyond (exoplanets) which seem to suggest that the Grand Designer, means here clearly God, do create and recreate the universe [7].

D. Some other clever physicist like Erwin Schrodinger has suggested that there should be negative-entropy in order to resolve the contradiction of entropy in the Big Bang and time progress, but nobody seem to observe the negative entropy until now.

E. Similar Hausdorff measure can be found in quantum mechanics. Feynman already mentioned that quantum mechanics are characterized by dimension ~ 2 . See the work of Ord, Nottale, and others for they are already completing their program concerning scale relativity theory [7]. The question whether there is deep link between this Hausdorff dimension in quantum mechanics and the observed dimension ~ 2 in astrophysics observation has been discussed by a number of astronomers, including Nottale.

F. Even if one's calculation points to something, which this time we should verify if Stephen Hawking calculate his own proposition, saying that one can create something out of nothing is not only ridiculous but awkward, just the same way as some people always think of Black Hole which do not exist.

G. Hawking apparently argue in his latest book 'Grand design,' that based on quantum theory then the Universe has multiverse history, but that is only if we accept the notion of sum-over-history and path-integral quantum mechanics. The meaning is that what he says is full of 'ifs', furthermore Hawking's model is full of fine-tuning of parameters (quote: "We discuss how the laws of our particular universe are extraordinarily finely tuned so as to allow for our existence..."), just like what M-theory proponents are busy trying in order they can explain elementary particles (especially particle masses) . Do not be misled by Hawking just because he often pokes you with philosophical questions. Hawking is not Einstein. He only cites and recites Einstein's questions and reinterprets those questions to what he likes to think. The result of quantization model in astrophysics, suggest that the distance between the Sun and Earth, for instance is not result of anthropic principle, but can be derived from a wave-equation model [7]. Actually, anthropic principle is another circular logic type of thinking, kind of thinking which certain teachers tend to use to fool some young students.

H. Another remarkable coincidence is that the Cosmic Microwave Background (COBE) temperature that is 2.73 degree Kelvin, it surprisingly resembles menger sponge dimension. In other words, the Cosmos may look like a big sponge just like what Zel'dovich outlined a few years ago [8].

I. Of course, microbiologist, paleontologist or philanthropist perhaps has his/her own way to say whether they prefer to be a believer of God or not. And even if one is a philosophy student, one may have risk to get one's grade downgraded just because one admits that one does not believe in evolution theory.

Finally, I would like to quote Paul Sheldon in [1]: "I choose to believe in a God that is so kind as to permit me to understand without dismissing me with "Just because I said so". Such a God does do something in the universe: he is what Jaim Ginnott called a good teacher/student. My faith says I and the entire research community are manifestations of God."

What can we conclude from enormous number of astronomic observation? Apparently, if one is humble enough, then one can say along with the Psalm 19:1: "The heavens declare the glory of God; and the firmament sheweth His handy work." And that: "God looked down from heaven upon the children of men, to see if there were any that did understand, that did seek God." (Psalm 53:2).

References

[1] http://blogs.discovermagazine.com/cosmicvariance/2010/09/02/Stephen-Hawking-settles-the-god-question-once-and-for-all/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+CosmicVarianceBlog+%28Cosmic+Variance%29&utm_content=Twitter

[2] the grand design and some criticism, <http://www.amazon.com/Grand-Design-Stephen-Hawking/dp/0553805371/>

[3] comment to Behe's Darwin's Black Box: The Biochemical Challenge to Evolution, http://www.creationismstrojanhorse.com/Gross_Behe_Review_10.2007.pdf

[4] other comment on Behe, <http://pondside.uchicago.edu/cluster/pdf/coyne/Behe, www.kean.edu/~bregal/docs/Behe.pdf>

[5] see this smitsonian picture of center of Milky Way. In other words, milky way center show a bar and bright center, and not a black hole.

http://news.nationalgeographic.com/news/2005/08/0817_050817_milkywaybar.html

[6] there is K measure suggest a Hausdorff dimension ~ 2 to large scale structures, Martinis and Sobic, arXiv:astro-ph/0708.0173 (2007). Quote: "From this point of view and together with the emersion of modern redshift surveys, the galaxy structures appear highly irregular and self-similar with fractal dimension $D \sim 2$ up to the deepest scales probed so far..."

[7] a few years ago we wrote a book consist of documentary of quantization of astrophysics, title: Quantization in astrophysics, brownian motion, and supersymmetry. Tamil Nadu, 2007, available in amazon.com. (this book has been downloaded more than 1000 times in the first 3 days). <http://vixra.org/abs/1003.0025>

[8] for further discussion of Menger sponge and the CMBR/COBE data, see M. El Naschie, Chaos, Soliton, and Fractals 41 (2009) 2635-2646.

Four Possible Methods to Extend Lehnert's Screw-shaped Photon

Victor Christianto^{*1} & Yunita Umniyati²

¹Malang Institute of Agriculture (IPM), Malang, Indonesia

²Swiss German University (SGU), Tangerang, Indonesia

ABSTRACT

In a series of papers, Bo Lehnert has suggested screw-shaped model of photon, inspired by his revised quantum electrodynamics (RQED). In this paper, we will review 4 possible methods to extend the screw-shaped photon model. In the meantime, there is recent debate concerning theoretical basis and utilization of photon orbital angular momentum (OAM), in particular, as a means to increase wireless internet capacity. Promising results have been reported from laboratory experiments carried out by Bo Thide group and others too. But considering Vigier's proposal to consider photon as soliton, we will discuss in this paper not the usual photon OAM as suggested by Thide group, instead, we will consider soliton orbital angular momentum. If the proposed concept holds true, then it is possible to develop soliton radio wave based on OAM.

Keywords: Screw-shaped, photon, revised quantum electrodynamics, soliton, orbital angular momentum.

1. Introduction

Light in helical modes has received much attention since its discovery because of the orbital angular momentum (OAM) that it carries. A single photon carries $\ell\hbar$ of OAM, with ℓ being its topological charge or the winding of the phase about the beam center in multiples of 2π [13].

This paper was at-least-partially inspired by the problem of relatively slow internet connection in our country. We believe that the same common problem has plagued other developing countries like ours, so it seems that we need a new technology to increase the internet capacity, especially the wireless network capacity. One way to do that is to look at the photon electrodynamics theory.

In a series of papers, Bo Lehnert has suggested screw-shaped model of photon [1][2], inspired by his Revised Quantum Electrodynamics (RQED). Therefore in this paper we will review 4 possible methods to extend his screw-shaped photon model.

In the meantime, there is recent debate concerning theoretical basis[4] and utilization of photon orbital angular momentum (OAM), in particular as a means to increase wireless internet

* Correspondence: Victor Christianto, Independent Researcher http://researchgate.net/profile/Victor_Christianto.

Email: victorchristianto@gmail.com

capacity.[10] Promising results have been reported from laboratory experiments carried out by Bo Thide group and others too [5][6][7][8][9]. But considering Vigier's proposal to consider photon as soliton, in this paper we will discuss not the usual photon OAM as suggested by Thide group, instead we will consider soliton orbital angular momentum. If the proposed concept holds true, then it is possible to develop soliton radio wave based on OAM, which we call here as SOAmR (Soliton Orbital Angular Momentum Radio).

2. Four Possible Methods to Extend Lehnert's Screw-shaped Model of Photon

In a series of papers, Bo Lehnert has suggested screw-shaped model of photon [1][2], inspired by his Revised Quantum Electrodynamics (RQED). Therefore in this paper we will review 4 possible methods to extend his screw-shaped photon model.

a. Esposito's superluminal photon [29]

Salvatore Esposito has proposed a very simple but general method to construct solutions of Maxwell equations propagating with a group velocity not equal to speed of light ($v_{gr} \neq c$). This result is obviously unlike the standard STR that electromagnetic travels with speed of light. Although neutrino is considered massless, nonetheless it is quite surprising that experiment carried out some years ago indicate that some neutrino is also superluminal.

b. Tomilin's Potential-Vortex theory [30][31]

A.K. Tomilin has derived an extended version of Maxwell's electromagnetic equations with a bottom-up strategy, as follows [30, p.349]:

$$\nabla \times H + \nabla H^* = j + \frac{\partial D}{\partial t}, \quad (1)$$

$$\nabla \cdot D = \rho + \varepsilon' \varepsilon_0 \frac{\partial B^*}{\partial t}, \quad (2)$$

$$B^* = \mu' \mu_0 H^*, \quad (3)$$

And the last two equations are the same with Maxwell equations:

$$\nabla \times E = -\frac{\partial B}{\partial t}, \quad (4)$$

$$\nabla \cdot B = 0. \quad (5)$$

c. Hirsch's superconductor electromagnetic theory [32][33]

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. Then Hirsch discusses a revised version of London equations in order to explain electrodynamics of superconductors.[32]

Hirsch proposes a new fundamental equation for electrodynamics for superconductors as follows: [32]

$$\square^2(A - A_0) = \frac{1}{\lambda_L^2}(A - A_0), \quad (6)$$

where

- London penetration depth λ_L is defined as follows:[33]

$$\frac{1}{\lambda_L^2} = \frac{4\pi n_s e^2}{m_e c^2}, \quad (7)$$

- And d'Alembertian operator is defined as: [32]

$$\square^2 = \nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}. \quad (8)$$

Then he proposes the following equations: [32]

$$\square^2(F - F_0) = \frac{1}{\lambda_L^2}(F - F_0), \quad (9)$$

And

$$\square^2(J - J_0) = \frac{1}{\lambda_L^2}(J - J_0), \quad (10)$$

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

Then in a recent paper I discuss a possible extension of Hirsch's equations by modifying Proca equations, as follows [3]:

$$(\square^2 - m_\gamma^2)(F - F_0) = \frac{1}{\lambda_L^2}(F - F_0), \quad (11)$$

And

$$(\square^2 - m_\gamma^2)(J - J_0) = \frac{1}{\lambda_L^2}(J - J_0). \quad (12)$$

Assuming that photon can be considered as boson, then it seems possible to consider photon as superconductor too. If yes, then the above modified Proca equations may be worthy to discuss in the context of massive photon electrodynamics.

d. Photon-soliton model

Kamenov & Slavov and also Hunter et al. [18][19] have discussed possible soliton model of photon. They may be inspired by earlier photon-soliton model of Vigier. Eckholdt also discusses possible soliton model of electron [27].

In this context, it is interesting to note that Firth and Skryabin have discussed optical soliton which carries orbital angular momentum [21]. This concept is considered very important, so we discuss that concept of SOAM in the next section.

3. Soliton Orbital Angular Momentum (SOAM)

In the preceding section, we already reviewed 4 possible methods to extend Lehnert's screw-shaped photon model. However, we shall note that the screw-shaped model of photon is deeply related with its orbital angular momentum (OAM), and as Leader remarks in [4], photon orbital angular momentum has been plagued by controversy until now. There is also restriction of utilizing photon OAM for long-distance radio communication [11].

Moreover, it is known since Jefimenko that Maxwell's electromagnetic theory violates momentum conservation law.¹ Therefore, it seems that this is a second problem with Bo Thide's photon OAM radio proposal. So, we need an alternative route which obeys momentum conservation law. And photon-soliton model seems to work in this context.

In this regards, it seems worth to consider a paper by A.S. Desyatnikov & A.I. Maimistov (2000) which suggests that multidimensional optical soliton obeys momentum conservation law [22]. Therefore in this section we will focus on their treatment on soliton, by keeping in mind that it is possible to consider photon as solitary wave.

The propagation of a light wave in a medium with the focusing Kerr nonlinearity and defocusing fifth-order nonlinearity is described by a parabolic equation, which is a generalization of the NLSE [22]:

$$i \frac{\partial u}{\partial z} + \Delta u + |u|^2 u - |u|^4 u = 0, \quad (13)$$

Where u is the slowly varying normalized envelope of the light wave.

¹ I have been told about Maxwell theory's violation of momentum conservation law through communication with Prof. Akira Kanda. See also: Kholmetskii *et al.* [12], Enders [14] and Lindberg [34].

The conservation of the angular momentum is a consequence of the invariance of the parabolic equation (13) to the rotation transformation in the plane perpendicular to the propagation direction. The Lagrangian corresponding to this equation is also invariant to the rotation transformation. [22]

Using the Galilean invariance of the equations, it can be shown that the angular momentum of the soliton is the sum of its spin and angular momentum [22]:

$$M = \frac{E}{2} \left| r \times \frac{dr_0}{dz} \right| + sE. \quad (14)$$

This expression may be compared with expression of photon OAM, see for instance [9][15][16][34][35].

4. Possibility of Soliton Orbital Angular Momentum Radio (SOAmR)

To our best knowledge, Amiri group in Malaysia seems to work in novel radio wave communication based on soliton physics [23][24][25], but it appears that they do not consider yet soliton Orbital Angular Momentum as discussed in this paper. Therefore, this paper discusses the possible concept of SOAmR for the first time.

Various applications for Photon OAM seem to be working for soliton OAM too, at least in theory.[10][15][21][26]

Zhao Guan has discussed secure communication protocol for single photon, and it seems this concept may be applicable for photon-soliton too. [17].

5. Conclusion

Light in helical modes has received much attention since its discovery because of the orbital angular momentum (OAM) that it carries. A single photon carries $\ell\hbar$ of OAM, with ℓ being its topological charge or the winding of the phase about the beam center in multiples of 2π . [13]

This paper was at-least-partially inspired by the problem of relatively slow internet connection in our country. We believe that the same common problem has plagued other developing countries like ours, so it seems that we need a new technology to increase the internet capacity, especially the wireless network capacity. One way to do that is to look at the photon electrodynamics theory. In a series of papers, Bo Lehnert has suggested screw-shaped model of photon, inspired by his Revised Quantum Electrodynamics (RQED). Therefore in this paper we will review 4 possible methods to extend his screw-shaped photon model.

In the mean time, there is recent debate concerning theoretical basis and utilization of photon orbital angular momentum (OAM), in particular as a means to increase wireless internet capacity. Promising results have been reported from laboratory experiments carried out by Bo Thide group and others too. But considering Vigier's proposal to consider photon as soliton, in this paper we will discuss not the usual photon OAM as suggested by Thide group, instead we will consider soliton orbital angular momentum. If the proposed concept holds true, then it is possible to develop soliton radio wave based on OAM, which we call here as SOAmR (Soliton Orbital Angular Momentum Radio).

Acknowledgement: One of these authors (VC) wishes to express his gratitude to Prof. Bo Lehnert, Prof. Akira Kanda and Dr. Volodymyr Krasnoholovets for discussion and insights.

Received March 17, 2016; Accepted March 26, 2016

References

- [1] Bo Lehnert (2006) "Photon Physics of Revised Electromagnetic," *Progress in Physics*, April 2006, Vol. 2. url: <http://ptep-online.com>
- [2] Bo Lehnert (2008) *A Revised Electromagnetic Theory with Fundamental Applications*. Stockholm: Svenska fysikarkivet, 2008. 159 pp.
- [3] Victor Christianto (2015). "London-Proca-Hirsch equations for electrodynamics of superconductors on Cantor Sets," ETET vol. 4, url: www.scipress.com
- [4] Elliot Leader (2016) "The photon angular momentum controversy: Resolution of a conflict between laser optics and particle physics," *Physics Lett. B*, accepted 8 march 2016
- [5] Bo Thide et al. (2010) "Linear and angular momentum of electromagnetic fields generated by an arbitrary distribution of charge and current densities at rest," arXiv:1001.0954 [physics.class-ph]
- [6] Bo Thide et al.(2009) "Utilization of photon orbital angular momentum in the low-frequency radio domain," arXiv:0705.1208 [astro-ph]
- [7] Bo Thide et al. (2015) "The physics of angular momentum radio," arXiv:1410.4268 [physics.optics]
- [8] F. Tamburini et al. (2013) "Experimental demonstration of free-space information transfer using phase modulated orbital angular momentum radio," arXiv:1302.2990 [physics.class-ph]
- [9] Masud Mansuripur (2011) "Spin and Orbital Angular Momenta of Electromagnetic Waves in Free Space," *Phys. Rev. A*84, 033838 (2011)
- [10] Yan Yan, et al. (2014) "High-capacity millimetre-wave communications with orbital angular momentum multiplexing," *Nature Communications*, 16 Sep. 2014
- [11] Yingjie Zhang et al. (2013) "On the restriction of utilizing orbital angular momentum in radio communications," 2013 8th Intr. Conf. on Communications and Networking in China (CHINACOM)
- [12] Alexander L. Kholmetskii, Oleg Mishevitch & T. Yarman (2014) "Law of Conservation of Momentum and Angular Momentum in Classical Electrodynamics of Material Media," arXiv:1411.6446

- [13] E.J. Galvez, et al. (2011) Interferometric measurement of the helical mode of a single photon,” *New Journal of Physics* 13, 053017 (2011)
- [14] Peter Enders (1999) “Electromagnetic Momentum Balance in Maxwell’s and Hertz’s work,” *Galilean Electrodynamics*. Available at www.researchgate.net
- [15] Les Allen and Miles Padgett. (2011) “The Orbital Angular Momentum of Light: An Introduction,” chapter 1 in Juan P. Torress & Louis Turner (eds.) *Twisted Photons: Applications of Light with Orbital Angular Momentum*. Weinsheim: Wiley-VCH Verlag GmbH & Co., 2011.
- [16] Jonathan Leach, et al. (2002) “Measuring the Orbital Angular Momentum of a Single Photon,” *Phys. Rev. Lett.* Vol. 88 No. 25
- [17] Zhao Guoan (2014) “One-way quantum secure communication protocol based on single photon,” *Advanced Science and Technology Letters* Vol. 74, pp. 96-100
- [18] P. Kamenov & B. Slavov (1996) “A soliton-like model for the photon,” *Bulg. J. of Physics* 23 No. ¾, pp. 116-128.
- [19] Geoffrey Hunter, Marian Kowalski and Camil Alexandrescu (2005) “Einstein’s photon concept quantified by the Bohr model of the photon,” arXiv:quant-ph/0506231
- [20] G.F. Calvo, A. Picon & E. Bagan (2006) “Quantum field theory of photons with orbital angular momentum,” *Phys. Rev. A* 73, 013805
- [21] William J. Firth & Dmitry V. Skryabin (1997) “Optical Solitons carrying Orbital Angular Momentum,” *Phys. Rev. Lett.* Vol. 79 No. 13
- [22] A.S. Desyatnikov & A.I. Maimistov (2000) “Conservation of the angular momentum for multidimensional optical soliton,” *Quantum Electronics* 30 (11) 1009-1013
- [23] I.S. Amiri, D. Gifany, J. Ali (2013) “Long distance communication using localized optical soliton via entangled photon,” *IOSR Journal of Applied Physics* Vol. 3 Issue 1 (Jan.-Feb. 2013), pp. 32-39
- [24] M.A. Jalil et al. (2011) “Radio wave generation using dark and bright soliton,” *Procedia Engineering* 8 (2011) 401-406.
- [25] Iraj Sadegh Amiri, Ali Nikoukar, & Sayed Ehsan Alavi (2014) *Soliton and Radio over Fiber (ROF) applications*. Saarbrücken: LAP Lambert Academic Publisher, 2014.
- [26] Xinlu Gao et al. (2013) “Generating, multiplexing/demultiplexing and receiving the orbital angular momentum of radio frequency signals using an optical true time delay unit,” *J. Opt.* 15 (2013) 105401
- [27] Roald Ekholdt () “A soliton model of the electron with an internal nonlinearity cancelling the De Broglie-Bohm quantum potential,” arXiv.org
- [28] Stoil Donev & D.A. Trifonov (1999) “How to describe Photons as (3+1) Solitons?” arXiv:physics/9812009
- [29] Salvatore Esposito (1996) “Classical $v_{gr} \neq c$ solutions of Maxwell equations and the tunneling photon effect.” arXiv:physics/9611018
- [30] A.K. Tomilin (2013) “The Potential-Vortex theory of electromagnetic waves,” *J. Electromagnetic Analysis and Applications* 2013, 5, 347-353
- [31] A.K. Tomilin (2013) “The Fundamentals of Generalized Electrodynamics,” <http://arXiv.org/ftp/arxiv/papers/0807/0807.2172.pdf>
- [32] J.E. Hirsch (2003). *Electrodynamics of superconductors*. arXiv:cond-mat/0312619 [cond-mat.str-el.]

- [33] _____. (2012). Correcting 100 years of misunderstanding: electric fields in superconductors, hole superconductivity, and the Meissner effect. arXiv: 1202.1851 [cond-mat.supr-con]
- [34] Johan Lindberg (2009) Angular Momentum and Conservation Laws in Classical Electrodynamics. Uppsala Universitet Master thesis.
- [35] Johan Sjöholm & Kristoffer Palmer (2007) Angular Momentum of Electromagnetic Radiation: Fundamental physics applied to the radio domain for innovative studies of space and development of new concepts in wireless communications. Uppsala Universitet Diploma.

Exploration

Exploration of a SU(2) Electrodynamics Based on Lehnert's Revised Quantum Electrodynamics

Victor Christianto^{*1} & Yunita Umniyati²

¹Malang Institute of Agriculture (IPM), Malang, Indonesia

²Swiss German University (SGU), Tangerang, Indonesia

ABSTRACT

Historically, electromagnetic theory was developed for situations described by the U(1) group. The dynamics equations describing the transformations and interrelationships of the force field are the well-known Maxwell equations, and the group algebra underlying these equations are U(1). There was a need to extend these equations to describe SU(2) situations and to derive equations whose underlying algebra is SU(2). In this paper, we will start with Terence W. Barrett's SU(2) symmetric form of electrodynamics based on topological considerations. Meanwhile, in a series of papers Bo Lehnert proposed a novel and revised version of Quantum Electrodynamics (RQED) based on Proca equations. Therefore, we will write down a combination between Barrett's SU(2) electrodynamics with Lehnert's RQED. It is hoped that this paper may stimulate further investigations and experiments in particular for finding physics beyond Standard Model. This is a preliminary report, so it is far from being a complete description of SU(2) electrodynamics.

Keywords: SU(2) electrodynamics, topology, Maxwell equations, Proca equations, revised quantum electrodynamics.

1. Introduction

Conventional electromagnetic theory based on Maxwell's equations and quantum mechanics has been successful in its applications in numerous problems in physics, and has sometimes manifested itself in a good agreement with experiments. Nevertheless, as already stated by Feynman, there are unsolved problems leading to difficulties with Maxwell's equations that are not removed by and not directly associated with quantum mechanics [2]. Therefore QED, which is an extension of Maxwell's equations, also becomes subject to the typical shortcomings of electromagnetic in its conventional form. This reasoning makes a way for Revised Quantum Electrodynamics as proposed by Bo Lehnert.[1-5]

Historically, electromagnetic theory was developed for situations described by the U(1) group. The dynamics equations describing the transformations and interrelationships of the force field are the well-known Maxwell equations, and the group algebra underlying these equations are

* Correspondence: Victor Christianto, Independent Researcher http://researchgate.net/profile/Victor_Christianto.
Email: victorchristianto@gmail.com

U(1). There was a need to extend these equations to describe SU(2) situations and to derive equations whose underlying algebra is SU(2).[13] In this paper, we will start with Terrence W. Barrett's SU(2) symmetric form of electrodynamics based on topological considerations [14]. Meanwhile, in a series of papers Bo Lehnert proposed a novel and revised version of Quantum Electrodynamics (RQED) based on Proca equations. Therefore, we will write down a combination between Barrett's SU(2) electrodynamics and Lehnert's RQED-Proca equations. Such a combination has never been discussed before in the literature. It is hoped that this paper may stimulate further investigations and experiments in particular for finding physics beyond Standard Model. This is a preliminary report, so it is far from being a complete description of SU(2) electrodynamics.

2. Barrett's SU(2) Symmetry Form of Electrodynamics

It is known that there are several different attempts in the past few decades to write down SU(2) electrodynamics, for example by Asim Barut et al. [15], Lawrence Crowell [16], and Sanchez-Monroy & Quimbay [17]. But in the present paper, we will start with Barrett's SU(2) Symmetry Form because of their simplicity.[13][14]

Barrett showed that the spacetime topology defines electromagnetic field equations – whether the fields be of force or of phase. That is to say, the premise of this enterprise is that a set of field equations are only valid with respect to a set of defined topological description of the physical situation. In particular, he has addressed demonstrating that the A_μ potentials are not just mathematical convenience, but - *in certain well-defined situations* - are measurable, i.e. physical. Those situations in which the A_μ potentials are measurable possess a topology, the transformation rules of which are describable by the SU(2) group; and those situations in which the A_μ potentials are not measurable possess a topology, the transformation rules of which are describable by the U(1) group. [13]

According to Barrett, using Yang-Mills theory, the non-Abelian Maxwell equations which describe SU(2)-symmetry conditioned radiation can be written as follows: [14, p.70]

a. Gauss' Law: $\nabla \bullet E - J_0 + iq(A \bullet E - E \bullet A) = 0$ (1)

b. Ampere's Law: $\frac{\partial E}{\partial t} - \nabla \times B + J + iq[A_0, E] - iq(A \times B - B \times A) = 0$ (2)

c. $\nabla \bullet B + iq(A \bullet B - B \bullet A) = 0$ (3)

d. Faraday's Law: $\nabla \times E + \frac{\partial B}{\partial t} + iq[A_0, B] + iq(A \times E - E \times A) = 0$ (4)

After writing down the above equations, now we will discuss Lehnert's RQED.

3. Lehnert's Revised Quantum Electrodynamics

In a series of papers, Bo Lehnert proposed a novel and revised version of Quantum Electrodynamics, which he calls as RQED. His theory is based on the hypothesis of a nonzero electric charge density in the vacuum, and it is based on Proca-type field equations [2, p. 23]:

$$\left(\frac{1}{c^2} \frac{\partial^2}{\partial t^2} - \nabla^2 \right) A_\mu = \mu_0 J_\mu, \mu = 1, 2, 3, 4 \quad (5)$$

Where

$$A_\mu = \left(A, \frac{i\phi}{c} \right), \quad (6)$$

With A and ϕ standing for the magnetic vector potential and the electrostatic potential in three-space. In three dimensions equation (5) in the vacuum results in [2, p.23]:

$$\frac{\text{curl} B}{\mu_0} = \varepsilon_0 (\text{div} E) C + \frac{\varepsilon_0 \partial E}{\partial t}, \quad (7)$$

$$\text{curl} E = -\frac{\partial B}{\partial t}, \quad (8)$$

$$B = \text{curl} A, \text{div} B = 0, \quad (9)$$

$$E = -\nabla \phi - \frac{\partial A}{\partial t}, \quad (10)$$

$$\text{div} E = \frac{\bar{\rho}}{\varepsilon_0}. \quad (11)$$

These equations differ from the conventional form, by a nonzero electric field divergence equation (11) and by the additional space-charge current density in addition to displacement current at equation (7). The extended field equations (7)-(11) are easily found also to become invariant to a gauge transformation.[2, p.23]

The main characteristic new features of the present theory can be summarized as follows [2, p.24]:

- a. The hypothesis of a nonzero electric field divergence in the vacuum introduces an additional degree of freedom, leading to new physical phenomena. The associated nonzero electric charge density thereby acts somewhat like a hidden variable.

- b. This also abolishes the symmetry between the electric and magnetic fields, and then the field equations obtain the character of intrinsic linear symmetry breaking.
- c. The theory is both Lorentz and gauge invariant.
- d. The velocity of light is no longer a scalar quantity, but is represented by a velocity vector of the modulus c .
- e. Additional results: Lehnert is also able to derive the mass of Z boson and Higgs-like boson.[3-5] These would pave an alternative way to new physics beyond Standard Model.

4. An extended SU(2) Electrodynamics based on RQED

Now let us extend Lehnert's RQED to SU(2) case. First, we shall recall that Lehnert's additional current density is quite similar to Harmuth's ansatz [14, p. 71]. And according to Barrett, they can be added to SU(2) symmetry form. Therefore now we will combine equations (1)-(4) and (7)-(11) using simple addition rule. The results are as follows:

e. Gauss' Law: $\nabla \cdot E - \frac{\bar{\rho}}{\epsilon_0} - J_0 + iq(A \cdot E - E \cdot A) = 0$ (12)

f. Ampere's Law:
 $\frac{\epsilon_0 \mu_0 \partial E}{\partial t} + \epsilon_0 \mu_0 (\nabla \cdot E)C - \nabla \times B + \mu_0 J + \mu_0 iq[A_0, E] - \mu_0 iq(A \times B - B \times A) = 0$ (13)

g. $\nabla \cdot B + iq(A \cdot B - B \cdot A) = 0$ (14)

h. Faraday's Law: $\nabla \times E + \frac{\partial B}{\partial t} + iq[A_0, B] + iq(A \times E - E \times A) = 0$ (15)

These last four equations (12)-(15) can be called: Extended SU(2) electrodynamics based on Lehnert's RQED. Their full implications should be investigated further.

Concluding remarks

The dynamics equations describing the transformations and interrelationships of the force field are the well-known Maxwell equations, and the group algebra underlying these equations are U(1). There was a need to extend these equations to describe SU(2) situations and to derive equations whose underlying algebra is SU(2).[13] In this paper, we will start with Terrence W. Barrett's SU(2) symmetric form of electrodynamics based on topological considerations [14]. Meanwhile, in a series of papers Bo Lehnert proposed a novel and revised version of Quantum Electrodynamics (RQED) based on Proca equations. Therefore, we will write down a combination between Barrett's SU(2) electrodynamics and Lehnert's RQED-Proca equations. Such a combination has never been discussed before in the literature.

It shall be noted that the present paper is not intended to be a complete description of SU(2) non-abelian electrodynamics or new physics beyond Standard Model. Instead, this paper is intended to stimulate further investigations and experiments, and their implications to hadron model.

Acknowledgment: Special thanks to Prof. Bo Lehnert for sending some reprints of his work, and also for his suggestions.

Received June 16, 2016; Accepted July 2, 2016

References

- [1] Lehnert, Bo, Sisir Roy, Arkaprabha Deb. 2000. An Extended Electromagnetic Theory. *Apeiron* Vol. 7, No. 1-2, January-April 2000. p. 53-58. URL: <http://redshift.vif.com/JournalFiles/Pre2001/V07NO1PDF/V07N1LEH.pdf>
- [2] Lehnert, Bo. 2012. A way to Revised Quantum Electrodynamics. *Progress in Physics*, April 2012, Vol. 2, <http://www.ptep-online.com>
- [3] _____. 2013. Higgs-Like Particle due to Revised Quantum Electrodynamics. *Progress in Physics*, July 2013, Vol. 3. <http://www.ptep-online.com>
- [4] _____. 2013. Potentialities of Revised Quantum Electrodynamics. *Progress in Physics*, October 2013, Vol. 4. <http://www.ptep-online.com>
- [5] _____. 2014. Mass-Radius Relations of Z and Higgs-like Bosons. *Progress in Physics*, Vol. 10 Issue 1, January 2014, <http://www.ptep-online.com>
- [6] Gondran, Michel. 2009. Proca equations derived from first principles. arXiv:0901.3300 [quant-ph], URL: <http://arxiv.org/pdf/0901.3300.pdf>
- [7] Blackledge, Jonathan M. 2007. An Approach to Unification using a Linear Systems Model for the Propagation of Broad-band Signals. *ISAST Transaction on Electronics and Signal Processing*, Vol. 1, No. 1, 2007. URL: <http://eleceng.dit.ie/papers/100.pdf>
- [8] Demir, Suleyman. 2013. Space-time algebra for the generalization of gravitational field equations. *Pramana* Vol. 80 No. 5 (Indian Academy of Sciences), May 2013, 811-823. URL: <http://www.ias.ac.in/pramana/v80/p811/fulltext.pdf>
- [9] Schwinger, Julian, DeRaad, Jr., Lester L., Milton, Kimball A., & Tsai, Wu-yang. 1998. *Classical Electrodynamics*. Reading, Massachusetts: Perseus Books. 591 p.
- [10] Penrose, Roger. 2004. *The Road to Reality: A Complete Guide to the Laws of the Universe*. London: Jonathan Cape. 1123 p. URL: <http://staff.washington.edu/freitz/penrose.pdf>
- [11] Christianto, Victor. 2014. A derivation of GravitoElectroMagnetic Proca equations in fractional space. *Prespacetime Journal*, May 2014. URL: www.prespacetime.com.
- [12] Christianto, Victor. 2015. London-Proca-Hirsch equations for electrodynamics of superconductors on Cantor Sets. *Prespacetime Journal*, November 2015. <http://www.prespacetime.com>
- [13] Barrett, Terence W. 2000. Topology and the Physical Properties of Electromagnetic Fields. *Apeiron* Vol. 7 No. 1-2, January-April, 2000. URL: <http://redshift.vif.com/JournalFiles/Pre2001/V07NO1PDF/V07N1BAR.pdf>
- [14] _____. 2008. *Topological Foundations of Electromagnetism*. World Scientific Series in Contemporary Chemical Physics – Vol. 26. Singapore: World Scientific Publishing Co. Pte. Ltd., 2008.
- [15] Barut, A.O., S. Malin, & M. Semon. 1982. Electrodynamics in terms of functions over the group SU(2): II. Quantization. *Foundations of Physics*, Vol. 12 No. 5.

- [16] Crowell, Lawrence B. 2000. Nonabelian Electrodynamics SU(2)xSU(2) Electroweak Theory in LEP1 Data on Z Particle Production. *Apeiron* Vol. 7 No. 1-2, January-April, 2000. URL: <http://redshift.vif.com/JournalFiles/Pre2001/V07NO1PDF/V07N1CRO.pdf>
- [17] Sanchez-Monroy, J.A., & C.J. Quimbay. 2010. Some classical properties of the non-abelian Yang-Mills theories. *Revista Mexicana De Fisica* E56 (2), 172-176.
- [18] Lehnert, Bo. 2015. Some elucidations of the theory on Revised Quantum Electrodynamics. *Journal of Modern Physics*, Vol. 6 No. 6, p. 1695-1700.

Exploration

London-Proca-Hirsch Equations for Electrodynamics of Superconductors on Cantor Sets

Victor Christianto*

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].

* Correspondence: Victor Christianto, Independent Researcher. Phone: (62) 878-59937095, Email: victorchristianto@gmail.com
http://researchgate.net/profile/Victor_Christianto.

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.[2] 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.[1] However he still uses four- vectors J and A according to Maxwell's equations:

$$\square^2 A = -\frac{4\pi}{c} J, \tag{1}$$

and

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

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

$$\square^2 (A - A_0) = \frac{1}{\lambda_L^2} (A - A_0), \tag{3a}$$

where

- London penetration depth λ_L is defined as follows:[2]

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

- And d'Alembertian operator is defined as: [1]

$$\square^2 = \nabla^2 - \frac{1}{c^2} \frac{\partial^2}{\partial t^2}. \quad (3c)$$

Then he proposes the following equations: [1]

$$\square^2 (F - F_0) = \frac{1}{\lambda_L^2} (F - F_0), \quad (4)$$

and

$$\square^2 (J - J_0) = \frac{1}{\lambda_L^2} (J - J_0), \quad (5)$$

where F is the usual electromagnetic field tensor and F_0 is the field tensor with entries \vec{E}_0 and 0 from \vec{E} and \vec{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 describe 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]

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

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]:

$$(\square + m_\gamma^2) A_\mu = \frac{4\pi}{c} J_\mu. \quad (6b)$$

Similarly, according to Kruglov [15] the Proca equation for a free particle processing the mass m can be written as follows:

$$\partial_\nu \varphi_{\mu\nu}(x) + m^2 \varphi_\mu(x) = 0, \quad (6)$$

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:

$$(\square^2 - m_\gamma^2)(F - F_0) = \frac{1}{\lambda_L^2}(F - F_0), \tag{8a}$$

and

$$(\square^2 - m_\gamma^2)(J - J_0) = \frac{1}{\lambda_L^2}(J - J_0). \tag{8b}$$

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]:

$$\text{- Gauss's law for the fractal electric field: } \nabla^\alpha \cdot D = \rho, \tag{9}$$

$$\text{- Ampere's law in the fractal magnetic field: } \nabla^\alpha \times H = J_a + \frac{\partial^\alpha D}{\partial t^\alpha}, \tag{10}$$

$$\text{- Faraday's law in the fractal electric field: } \nabla^\alpha \times E = -\frac{\partial^\alpha B}{\partial t^\alpha}, \tag{11}$$

$$\text{- magnetic Gauss's law in the fractal magnetic field: } \nabla^\alpha \cdot B = 0, \tag{12}$$

and the continuity equation can be defined as:

$$\nabla^\alpha \cdot J = -\frac{\partial^\alpha \rho}{\partial t^\alpha}, \tag{13}$$

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

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

$$\nabla^\alpha \cdot u = \text{div}^\alpha u = \frac{\partial^\alpha u_1}{\partial x_1^\alpha} + \frac{\partial^\alpha u_2}{\partial x_2^\alpha} + \frac{\partial^\alpha u_3}{\partial x_3^\alpha}, \tag{14}$$

$$\nabla^\alpha \times u = \text{curl}^\alpha u = \left(\frac{\partial^\alpha u_3}{\partial x_2^\alpha} - \frac{\partial^\alpha u_2}{\partial x_3^\alpha} \right) e_1^\alpha + \left(\frac{\partial^\alpha u_1}{\partial x_3^\alpha} - \frac{\partial^\alpha u_3}{\partial x_1^\alpha} \right) e_2^\alpha + \left(\frac{\partial^\alpha u_2}{\partial x_1^\alpha} - \frac{\partial^\alpha u_1}{\partial x_2^\alpha} \right) e_3^\alpha. \tag{15}$$

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

$$\nabla^\alpha \cdot r = \frac{\partial^\alpha r_R}{\partial R^\alpha} + \frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} + \frac{r_R}{R^\alpha} + \frac{\partial^\alpha r_z}{\partial z^\alpha}, \quad (16)$$

$$\nabla^\alpha \times r = \left(\frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} - \frac{\partial^\alpha r_\theta}{\partial z^\alpha} \right) e_R^\alpha + \left(\frac{\partial^\alpha r_R}{\partial z^\alpha} - \frac{\partial^\alpha r_z}{\partial R^\alpha} \right) e_\theta^\alpha + \left(\frac{\partial^\alpha r_\theta}{\partial R^\alpha} + \frac{r_R}{R^\alpha} - \frac{1}{R^\alpha} \frac{\partial^\alpha r_R}{\partial \theta^\alpha} \right) e_z^\alpha. \quad (17)$$

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]:

$$\nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0} - \kappa^2 \phi, \quad (18)$$

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

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

$$\nabla \times \vec{B} = \mu_0 j + \epsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} + \kappa^2 \vec{A}, \quad (21)$$

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:

$$\nabla^\alpha \cdot \vec{E} = \frac{\rho}{\epsilon_0} - \kappa^2 \phi, \quad (25)$$

$$\nabla^\alpha \cdot \vec{B} = 0, \quad (26)$$

$$\nabla^\alpha \times \vec{E} = -\frac{\partial^\alpha \vec{B}}{\partial t^\alpha}, \quad (27)$$

$$\nabla^\alpha \times \vec{B} = \mu_0 j_a + \epsilon_0 \mu_0 \frac{\partial^\alpha \vec{E}}{\partial t^\alpha} + \kappa^2 \vec{A}, \quad (28)$$

where:

$$\nabla^\alpha \phi = -\frac{\partial^\alpha \vec{A}}{\partial t^\alpha} - \vec{E}, \quad (29)$$

$$\vec{B} = \nabla^\alpha \times \vec{A}, \quad (30)$$

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

$$\nabla^\alpha \phi = \frac{\partial^\alpha \phi}{\partial x_1^\alpha} e_1^\alpha + \frac{\partial^\alpha \phi}{\partial x_2^\alpha} e_2^\alpha + \frac{\partial^\alpha \phi}{\partial x_3^\alpha} e_3^\alpha. \quad (31)$$

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:

$$(\square_\alpha^2 - \kappa^2)(F - F_0) = \frac{1}{\lambda_L^2}(F - F_0), \quad (32)$$

And

$$(\square_\alpha^2 - \kappa^2)(J - J_0) = \frac{1}{\lambda_L^2}(J - J_0), \quad (33)$$

where

$$\square_\alpha^2 = \nabla^{\alpha 2} - \frac{1}{c^2} \frac{\partial^{\alpha 2}}{\partial t^\alpha}. \quad (34)$$

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.

Conclusions

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 would like to express my sincere gratitude to Dr. George Shpenkov for sending his books and papers. Special thanks to Dr. K. R. R. Gandhi for publishing my two earlier papers at IJMSEA and BMSA.

References

- [1] Hirsch, J.E. 2003. Electrodynamics of superconductors. arXiv:cond-mat/0312619 [cond-mat.str-el.]
- [2] Hirsch, J.E. 2012. Correcting 100 years of misunderstanding: electric fields in superconductors, hole superconductivity, and the Meissner effect. arXiv: 1202.1851 [cond-mat.supr-con]
- [3] Zhao, Y., Baleanu, D., Cattani, C., Cheng, D-F., & Yang, X-J. 2013. Maxwell's equations on Cantor Sets: A Local Fractional Approach. *Advances in High Energy Physics* Vol. 2013 Article ID 686371, <http://dx.doi.org/10.1155/2013/686371>, <http://downloads.hindawi.com/journals/ahep/2013/686371.pdf>

- [4] Tajmar, M. 2008. Electrodynamics in Superconductor explained by Proca equations. arXiv:cond-mat/0803.3080
- [5] de Matos, C.J., & Tajmar, M. 2006. Gravitomagnetic London Moment and the Graviton Mass inside a Superconductor. arXiv:gr-qc/0602591
- [6] Gondran, Michel. 2009. Proca equations derived from first principles. arXiv:0901.3300 [quant-ph], URL: <http://arxiv.org/pdf/0901.3300.pdf>
- [7] Blackledge, Jonathan M. 2007. An Approach to Unification using a Linear Systems Model for the Propagation of Broad-band Signals. *ISAST Transaction on Electronics and Signal Processing*, Vol. 1, No. 1, 2007. URL: <http://eleceng.dit.ie/papers/100.pdf>
- [8] Demir, Suleyman. 2013. Space-time algebra for the generalization of gravitational field equations. *Pramana* Vol. 80 No. 5 (Indian Academy of Sciences), May 2013, 811-823. URL: <http://www.ias.ac.in/pramana/v80/p811/fulltext.pdf>
- [9] Schwinger, Julian, DeRaad, Jr., Lester L., Milton, Kimball A., & Tsai, Wu-yang. 1998. *Classical Electrodynamics*. Reading, Massachusetts: Perseus Books. p. 591.
- [10] Yang, X-J., Baleanu, D., & Tenreiro Machado, J.A. 2013. Systems of Navier-Stokes on Cantor Sets. *Mathematical Problems in Engineering* Vol. 2013, Article ID 769724, <http://dx.doi.org/10.1155/2013/769724>, URL: <http://www.hindawi.com/journals/mpe/2013/769724/>, or URL: http://recipp.ipp.pt/bitstream/10400.22/3455/1/ART_TenreiroMachado_2013_DEE.pdf
- [11] Christianto, Victor. 2014. 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>
- [12] Christianto, Victor. 2014. A derivation of GravitoElectroMagnetic Proca equations in fractional space. *Prespacetime Journal*, May 2014. URL: www.prespacetime.com.
- [13] Christianto, Victor. 2014. An Outline of Cosmology based on Interpretation of The Johannine Prologue. *Bull. Soc. Math. Services and Standards (BSOMASS)*, Sept. 2014. URL: www.ijmsea.com
- [14] Christianto, Victor & Rahul, Biruduganti. 2014. A derivation of Proca equations on Cantor Sets: A Local Fractional Approach. *Bull. Mathematical Sciences and Applications (BMSA)*, Nov. 2014. URL: www.bmsa.us
- [15] Kruglov, S.I. 2004. "Square root" of the Proca equation: Spin-3/2 field equation. arXiv:hep-th/0405088
- [16] Dressel, M. 2013. Electrodynamics of Metallic Superconductors. *Adv. Cond. Matt. Phys.* Article ID 104379. <http://dx.doi.org/10.1155/2013/104379>
- [17] Candemir, Nuray; Tanish, Murat; Ozdas, Kudret and Demir, Suleyman. 2008. Hyperbolic Octonionic Proca-Maxwell equations. *Z. Naturforsch.* 63a, 15-18 (2008). URL: <http://www.znaturforsch.com/s63a/s63a0015.pdf>

A Derivation of Proca Equations on Cantor Sets: A Local Fractional Approach

Victor Christianto, Biruduganti Rahul

Institute of Gravitation and Cosmology of the Peoples' Friendship University of Russia, Moscow.
victorchristianto@gmail.com

Electronics and Communications, KJ Somaiya College of Engineering, Mumbai.
rahulsid91@gmail.com

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

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 we 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, We 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.

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 correct interpretation of classical wave equation yields a periodic table of elements which is close to Mendeleev'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:

$$\Delta\hat{\Psi} - \frac{1}{c^2} \frac{\partial^2 \hat{\Psi}}{\partial t^2} = 0 \quad (1)$$

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 hat conjecture based on the same classical wave equation. [20][21] He hypothesizes that the frequency of the Universe is: [22]

$$f_{Univ} = 4,047 \cdot 10^{-21} \text{ Hz} \tag{2}$$

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 his 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 $f = F \sin \phi$, where F is the maximal value of force, ϕ is the phase angle.

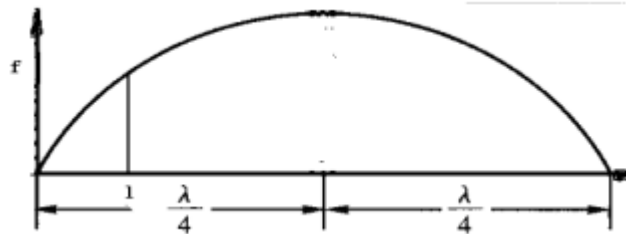


Figure 1. The force deferring to sine function acting on the particle [23]

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

$$W = \int_0^S F \sin(2\pi \frac{l}{\lambda}) ds, \tag{3}$$

where the sine function can be expanded

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} \tag{4}$$

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 , λ , ν 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

$$E = h\nu \quad (7)$$

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:

$$\nabla^2 \phi = \left(\frac{1}{c^2} \right) \frac{\partial^2 \phi}{\partial t^2}, \text{ see Thornhill [25].}$$

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]

$$\frac{\partial^{2\alpha} u(x,t)}{\partial t^{2\alpha}} - a^{2\alpha} \frac{\partial^{2\alpha} u(x,t)}{\partial x^{2\alpha}} = 0 \quad (8)$$

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 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 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

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]. Penrose also discusses Maxwell equations shortly in his book: The Road to Reality[10]. 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: $\nabla^\alpha \cdot D = \rho$, (9)

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

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

- magnetic Gauss's law in the fractal magnetic field: $\nabla^\alpha \cdot B = 0$, (12)

and the continuity equation can be defined as:

$$\nabla^\alpha \cdot J = -\frac{\partial^\alpha \rho}{\partial t^\alpha}, \tag{13}$$

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

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

$$\nabla^\alpha \cdot u = \text{div}^\alpha u = \frac{\partial^\alpha u_1}{\partial x_1^\alpha} + \frac{\partial^\alpha u_2}{\partial x_2^\alpha} + \frac{\partial^\alpha u_3}{\partial x_3^\alpha}, \tag{14}$$

$$\nabla^\alpha \times u = \text{curl}^\alpha u = \left(\frac{\partial^\alpha u_3}{\partial x_2^\alpha} - \frac{\partial^\alpha u_2}{\partial x_3^\alpha} \right) e_1^\alpha + \left(\frac{\partial^\alpha u_1}{\partial x_3^\alpha} - \frac{\partial^\alpha u_3}{\partial x_1^\alpha} \right) e_2^\alpha + \left(\frac{\partial^\alpha u_2}{\partial x_1^\alpha} - \frac{\partial^\alpha u_1}{\partial x_2^\alpha} \right) e_3^\alpha. \tag{15}$$

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

$$\nabla^\alpha \cdot r = \frac{\partial^\alpha r_R}{\partial R^\alpha} + \frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} + \frac{r_R}{R^\alpha} + \frac{\partial^\alpha r_z}{\partial z^\alpha}, \tag{16}$$

$$\nabla^\alpha \times r = \left(\frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} - \frac{\partial^\alpha r_\theta}{\partial z^\alpha} \right) e_R^\alpha + \left(\frac{\partial^\alpha r_R}{\partial z^\alpha} - \frac{\partial^\alpha r_z}{\partial R^\alpha} \right) e_\theta^\alpha + \left(\frac{\partial^\alpha r_\theta}{\partial R^\alpha} + \frac{r_R}{R^\alpha} - \frac{1}{R^\alpha} \frac{\partial^\alpha r_R}{\partial \theta^\alpha} \right) e_z^\alpha. \tag{17}$$

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]

$$\nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0} - \kappa^2 \phi, \tag{18}$$

$$\nabla \cdot \vec{B} = 0, \tag{19}$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}, \tag{20}$$

$$\nabla \times \vec{B} = \mu_0 j + \epsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} + \kappa^2 \vec{A}, \tag{21}$$

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:

$$\nabla^\alpha \cdot \vec{E} = \frac{\rho}{\epsilon_0} - \kappa^2 \phi, \quad (25)$$

$$\nabla^\alpha \cdot \vec{B} = 0, \quad (26)$$

$$\nabla^\alpha \times \vec{E} = -\frac{\partial^\alpha \vec{B}}{\partial t^\alpha}, \quad (27)$$

$$\nabla^\alpha \times \vec{B} = \mu_0 j_\alpha + \epsilon_0 \mu_0 \frac{\partial^\alpha \vec{E}}{\partial t^\alpha} + \kappa^2 \vec{A}, \quad (28)$$

where:

$$\nabla^\alpha \phi = -\frac{\partial^\alpha \vec{A}}{\partial t^\alpha} - \vec{E}, \quad (29)$$

$$\vec{B} = \nabla^\alpha \times \vec{A}, \quad (30)$$

and Del operator $\nabla^\alpha \phi$ can be defined as follows [11, p.2]:

$$\nabla^\alpha \phi = \frac{\partial^\alpha \phi}{\partial x_1^\alpha} e_1^\alpha + \frac{\partial^\alpha \phi}{\partial x_2^\alpha} e_2^\alpha + \frac{\partial^\alpha \phi}{\partial x_3^\alpha} e_3^\alpha. \quad (31)$$

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 length 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]

Author (year)	Type of measurement	Limits on m_γ (g)
Ross et al. (1937)	Radio waves transmission overland	5.9×10^{-42}
Mandelstam & Papalexi (1944)	Radio waves transmission over sea	5.0×10^{-43}
Al'pert et al. (1941)	Radio waves transmission over sea	2.5×10^{-43}
Florman (1955)	Radio-wave interferometer	5.7×10^{-42}
Lovell et al. (1964)	Pulsar observations on flour flare stars	1.6×10^{-42}
Frome (1958)	Radio-wave interferometer	4.3×10^{-40}
Warner et al. (1969)	Observations on Crab Nebula pulsar	5.2×10^{-41}
Brown et al. (1973)	Short pulses radiation	1.4×10^{-33}
Bay et al. (1972)	Pulsar emission	3.0×10^{-46}
Schaefer (1999)	Gamma ray bursts	4.2×10^{-44}
	Gamma ray bursts	6.1×10^{-39}

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):

$$\nabla \cdot \vec{E}_g = -\rho_e - \kappa_g^2 \phi, \tag{32}$$

$$\nabla \cdot \vec{H}_g = 0, \tag{33}$$

$$\nabla \times \vec{E}_g = -\frac{\partial \vec{H}_g}{\partial t}, \quad (34)$$

$$\nabla \times \vec{H}_g = -J_g^e + \frac{\partial \vec{E}_g}{\partial t} + \kappa_g^2 \vec{A}_g^e, \quad (35)$$

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 κ_g represents the inverse Compton wavelength of the graviton, [8]

$$\kappa_g = \frac{m_g c}{\hbar}. \quad (36)$$

$$\nabla^\alpha \cdot \vec{E}_g = -\rho_e - \kappa_g^2 \phi, \quad (37)$$

$$\nabla^\alpha \cdot \vec{H}_g = 0, \quad (38)$$

$$\nabla^\alpha \times \vec{E}_g = -\frac{\partial^\alpha \vec{H}_g}{\partial t^\alpha}, \quad (39)$$

$$\nabla^\alpha \times \vec{H}_g = -J_g^e + \frac{\partial^\alpha \vec{E}_g}{\partial t^\alpha} + \kappa_g^2 \vec{A}_g^e, \quad (40)$$

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:

We would 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.

References

- [1] Mandelbrot, B.B. 1989. Fractal geometry: what is it, and what does it do? Proc. R. Soc. Lond. A. 423, 3-16, URL: http://users.math.yale.edu/~bbm3/web_pdfs/fractalGeometryWhatIsIt.pdf; [1a] Mandelbrot, B.B. Fractals and the Geometry of Nature. Encyclopedia Britannica, URL: http://users.math.yale.edu/~bbm3/web_pdfs/encyclopediaBritannica.pdf
- [2] Zhao, Y., Baleanu, D., Cattani, C., Cheng, D-F., & Yang, X-J. 2013. Maxwell's equations on Cantor Sets: A Local Fractional Approach. Advances in High Energy Physics Vol. 2013 Article ID 686371, <http://dx.doi.org/10.1155/2013/686371>, <http://downloads.hindawi.com/journals/ahp/2013/686371.pdf>
- [3] Ostoja-Starzewski, Martin. 2012. Electromagnetism in anisotropic fractal media. Z. Angew. Math. Phys. (ZAMP) DOI 10.1007/s00033-012-0230-z . URL: http://mechanical.illinois.edu/media/uploads/web_sites/82/files/zamp_2012.20121002.06b39d642e987.85850489.pdf; [3a] Also in arXiv: 1106.1491 [math-ph], URL: <http://arxiv.org/pdf/1106.1491.pdf>.
- [4] Tajmar, M. 2008. Electrodynamics in Superconductor explained by Proca equations. arXiv:cond-mat/0803.3080
- [5] de Matos, C.J., & Tajmar, M. 2006. Gravitomagnetic London Moment and the Graviton Mass inside a Superconductor. arXiv:gr-qc/0602591
- [6] Gondran, Michel. 2009. Proca equations derived from first principles. arXiv:0901.3300 [quant-ph], URL: <http://arxiv.org/pdf/0901.3300.pdf>
- [7] Blackledge, Jonathan M. 2007. An Approach to Unification using a Linear Systems Model for the Propagation of Broad-band Signals. ISAST Transaction on Electronics and Signal Processing, Vol. 1, No. 1, 2007. URL: <http://eleceng.dit.ie/papers/100.pdf>
- [8] Demir, Suleyman. 2013. Space-time algebra for the generalization of gravitational field equations. Pramana Vol. 80 No. 5 (Indian Academy of Sciences), May 2013, 811-823. URL: <http://www.ias.ac.in/pramana/v80/p811/fulltext.pdf>
- [9] Schwinger, Julian, DeRaad, Jr., Lester L., Milton, Kimball A., & Tsai, Wu-yang. 1998. Classical Electrodynamics. Reading, Massachusetts: Perseus Books. 591 p.
- [10] Penrose, Roger. 2004. The Road to Reality: A Complete Guide to the Laws of the Universe. London: Jonathan Cape. 1123 p. URL: <http://staff.washington.edu/freitz/penrose.pdf>
- [11] Yang, X-J., Baleanu, D., & Tenreiro Machado, J.A. 2013. Systems of Navier-Stokes on Cantor Sets. Mathematical Problems in Engineering Vol. 2013, Article ID 769724, <http://dx.doi.org/10.1155/2013/769724>, URL: <http://www.hindawi.com/journals/mpe/2013/769724/>, or URL: http://recipp.ipp.pt/bitstream/10400.22/3455/1/ART_TenreiroMachado_2013_DEE.pdf
- [12] Shpenkov, George P. 2013. Dialectical View of the World: The Wave Model (Selected Lectures). Volume I: Philosophical and Mathematical Background. URL: <http://shpenkov.janmax.com/Vol.1.Dialectics.pdf>
- [13] 2006. An Elucidation of the Nature of the Periodic Law, Chapter 7 in The Mathematics of the Periodic Table, Rouvray, D. H. and King, R. B., ed., Nova Science Publishers, NY, pp. 119-160

- [14] Shpenkov, George P. & Kreidik, Leonid G. 2005. Schrödinger's error in principle. *Galilean Electrodynamics* Vol. 16, No. 3, 51-56, (2005); URL: <http://shpenkov.janmax.com/Blunders.pdf>
- [15] Kreidik, Leonid G., & Shpenkov, George P. 2002. Important Results of Analyzing Foundations of Quantum Mechanics. *Galilean Electrodynamics & QED-EAST*, Vol. 13, Special Issues No. 2, 23-30; URL: <http://shpenkov.janmax.com/QM-Analysis.pdf>
- [16] Christianto, Victor. 2014. A Review of Schrodinger Equation and Classical Wave Equation. *Prespacetime Journal*, May 2014. URL: www.prespacetime.com. Also available at: <http://vixra.org/abs/1404.0020>
- [17] Tarasov, Vasily E. 2005. Wave Equation for Fractal Solid String. *Mod. Phys. Lett. B*, Vol. 19, No. 15, 721-728. URL: <http://theory.sinp.msu.ru/~tarasov/PDF/MPLB2005-1.pdf>
- [18] Hu, Ming-Sheng, Agarwal, Ravi P., & Yang, Xiao-Jun. 2012. Local Fractional Fourier Series with Application to Wave Equation in Fractal Vibrating String. *Abstract and Applied Analysis* Vol. 2012, Article ID 567401, 15p. doi:10.1155/2012/567401. URL:<http://downloads.hindawi.com/journals/aaa/2012/567401.pdf>
- [19] Christianto, Victor. 2014. A derivation of GravitoElectroMagnetic Proca equations in fractional space. *Prespacetime Journal*, May 2014. URL: www.prespacetime.com.
- [21] Rubino, Leonardo. 2011. A Dissertation on the Origins of Quantization in the Universe. <http://vixra.org/abs/1112.0087>
- [20] Rubino, Leonardo. 2012. The Whole Universe in Three Numbers. <http://vixra.org/abs/1205.0058>
- [22] Rubino, Leonardo. 2014. The Sound of the Universe. <http://vixra.org/abs/1402.0129>
- [23] Zhang, Xin-an. 2013. A wave vibration model basing on classical theory interpret the photoelectric effect, Compton effect, atomic hydrogen spectrum formula, as well as the blackbody radiation, in Xin-an Zhang, *Researches in the Nature of Quantum Wave*. Xiaotong Publisher, 2014. Available upon request at: 876840956@qq.com
- [24] Baleanu, D., Tenreiro Machado, J.A., Cattani, C., Baleanu, M.C., & Yang, X-J. 2014. Local Fractional Variational Iteration and Decomposition Methods for Wave Equation on Cantor Sets within Local Fractional Operators. *Abstract and Applied Analysis* Vol. 2014, Article ID 535048, <http://dx.doi.org/10.1155/2014/535048>; <http://downloads.hindawi.com/journals/aaa/2014/535048.pdf>
- [25] Thornhill, C.K. 1996. Real or Imaginary Space-Time? Reality or Relativity? *Hadronic Journal* Suppl. 11, 3: 209-224. URL: <http://vixra.org/abs/0702.0044>
- [26] Leighton, Luke Kenneth Casson. 2014. Expanded Rishon Model Particles. <http://arXiv.org/abs/1403.0016>
- [27] Tu, L-C., Luo, J., & George T. Gillies. 2005. The mass of the photon. *Rep. Prog. Phys.* 68:77-130. (Institute of Physics Publishing), doi:10.1088/0034-4885/68/1/R02
- [28] Christianto, Victor. 2014. An outline of cosmology based on interpretation of The Johannine Prologue. *Bull. Soc. Math. Services and Standards (BSOMASS)*, Sept. 2014. URL:www.ijmse.com

Volume 10

10.18052/www.scipress.com/BMSA.10

A Derivation of Proca Equations on Cantor Sets: A Local Fractional Approach

10.18052/www.scipress.com/BMSA.10.48

DOI References

[2] Zhao, Y., Baleanu, D., Cattani, C., Cheng, D-F., & Yang, X-J. 2013. Maxwell's equations on Cantor Sets: A Local Fractional Approach. *Advances in High Energy Physics* Vol. 2013 Article ID 686371, <http://dx.doi.org/10.1155/2013/686371>, <http://downloads.hindawi.com/journals/ahep/2013/686371.pdf>.

10.1155/2013/686371

[5] de Matos, C.J., & Tajmar, M. 2006. Gravitomagnetic London Moment and the Graviton Mass inside a Superconductor. *arXiv: gr-qc/0602591*.

10.1016/j.physc.2005.08.004

[8] Demir, Suleyman. 2013. Space-time algebra for the generalization of gravitational field equations. *Pramana* Vol. 80 No. 5 (Indian Academy of Sciences), May 2013, 811-823. URL: <http://www.ias.ac.in/pramana/v80/p.811/fulltext.pdf>.

10.1007/s12043-013-0516-5

[9] Schwinger, Julian, DeRaad, Jr., Lester L., Milton, Kimball A., & Tsai, Wu-yang. 1998. *Classical Electrodynamics*. Reading, Massachusetts: Perseus Books. 591 p.

10.1119/1.19413

[11] Yang, X-J., Baleanu, D., & Tenreiro Machado, J.A. 2013. Systems of Navier-Stokes on Cantor Sets. *Mathematical Problems in Engineering* Vol. 2013, Article ID 769724, <http://dx.doi.org/10.1155/2013/769724>, URL: <http://www.hindawi.com/journals/mpe/2013/769724/>, or URL: http://recipp.ipp.pt/bitstream/10400.22/3455/1/ART_TenreiroMachado_2013_DEE.pdf.

1155/2013/769724, URL: <http://www.hindawi.com/journals/mpe/2013/769724/>, or URL: http://recipp.ipp.pt/bitstream/10400.22/3455/1/ART_TenreiroMachado_2013_DEE.pdf.

10.1155/2013/769724

[18] Hu, Ming-Sheng, Agarwal, Ravi P., & Yang, Xiao-Jun. 2012. Local Fractional Fourier Series with Application to Wave Equation in Fractal Vibrating String. *Abstract and Applied Analysis* Vol. 2012, Article ID 567401, 15p. doi: 10.1155/2012/567401. URL: <http://downloads.hindawi.com/journals/aaa/2012/567401.pdf>.

10.1155/2012/567401

10.1155/2012/567401

[24] Baleanu, D., Tenreiro Machado, J.A., Cattani, C., Baleanu, M.C., & Yang, X-J. 2014. Local Fractional Variational Iteration and Decomposition Methods for Wave Equation on Cantor Sets within Local Fractional Operators. *Abstract and Applied Analysis* Vol. 2014, Article ID 535048, <http://dx.doi.org/10.1155/2014/535048>; <http://downloads.hindawi.com/journals/aaa/2014/535048.pdf>.

1155/2014/535048; <http://downloads.hindawi.com/journals/aaa/2014/535048.pdf>.

10.1155/2014/535048

[27] Tu, L-C., Luo, J., & George T. Gillies. 2005. The mass of the photon. *Rep. Prog. Phys.* 68: 77- 130. (Institute of Physics Publishing), doi: 10.1088/0034-4885/68/1/R02.

10.1088/0034-4885/68/1/r02

[28] Christianto, Victor. 2014. An outline of cosmology based on interpretation of The Johannine Prologue. *Bull. Soc. Math. Services and Standards (BSOMASS)*, Sept. 2014. URL: www.ijmse.com.

10.18052/www.scipress.com/bsmass.11.4

MISCELLANEOUS

Essay

On Quantization of Galactic Redshift & the Source-Sink Model of Galaxies

Victor Christianto*

Abstract

This paper briefly discusses a Source-Sink model of galaxies and its implication on the observed quantization of galactic redshift. As shown elsewhere, the Newton law and Maxwell electromagnetic equations can be described by the Source-Sink model too. The Source-Sink model of galaxies can be interpreted further in the context of superfluid dynamics as described by Gross-Pitaevskii equation. Because radial Gross-Pitaevskii equation can yield ring soliton-like solutions, I submit a hypothesis that the universe may likely have a center in the ring soliton-like form.

Key Words: quantization, galactic redshift, Source-Sink model, ring, soliton-like.

Introduction

In recent years there are some reports suggesting explanations for quantization of galactic redshift as observed by Tifft et al. One of those proposals is suggested by Firmin J. Oliveira, who submits a wave equation model based on Carmeli's Cosmological General Relativity in order to describe such a quantization of galactic redshift [1-2]. Despite its useful approach to describe this phenomenon of quantized redshift, Oliveira's approach apparently lacks a physical model to describe why there exists quantization of galactic redshift. Therefore, we seek a better approach which provides physical model of the phenomenon.

A Source-Sink model of Galaxies

Physical model of quantization of galactic redshift does exist. Hodge's Source-Sink model of Galaxies is an example. Hodge argues that on the galactic scale the universe is inhomogeneous and redshift z is occasionally less than zero. He also argues that several differences among galaxy types suggest that spiral galaxies are Sources and that early type, lenticular, and irregular galaxies are Sinks of a scalar potential field [3].

Hodge postulates the existence of a scalar potential ρ (erg) field with the characteristics to cause the observed differences in spiral and elliptical galaxies. The gradient of ρ is proportional to a

* Correspondence: Victor Christianto, <http://www.sciprint.org>, <http://independent.academia.edu/VChristianto>
Email: victorchristianto@gmail.com . Phone: (62) 341-403205.

force F_s (dyne) that acts on matter [3]. F_s exerts a force to repel matter from spiral galaxies and to attract matter to early type galaxies.

The derivation of Planck's black body radiation equation includes the proposition that the energy of a photon is discrete and composed of a number N of basic energy/particle packets [3]. From this conjecture, some formulas for redshift of sink and source galaxies can be derived.

While of course the arguments of Hodge can be discussed further, it seems interesting that he can come up with a physical model in order to explain such a quantization of galactic redshift.

Furthermore, it may be interesting to note here that both Newton law and Schrodinger equations can be derived from similar assumption of source-sink model [4-5]. In this regard, Rahman has given a proof that classical electrodynamics can be derived from similar source-sink fluid model [6].

While surely the aforementioned papers by Wang, Hodge and Rahman use different methods, all of them have the same assumption of the existence of source-sink particles. Therefore this approach seems quite promising to explore further.

Gross-Pitaevskiiian interpretation

Now I would like to extend further Hodge's source-sink model of galaxies into the context of Gross-Pitaevskii model. We know that Gross-Pitaevskii equation is often used to describe superfluid dynamics. In one of his papers, Moffat has shown that quantum phion condensate model with Gross-Pitaevskii equation yields an approximate fit to data corresponding to CMB spectrum, and it also yields a modified Newtonian acceleration law which is in good agreement with galaxy rotation curve data [7].

Furthermore, this author also has argued that Gross-Pitaevskii equations yields quantized vortices which can be used to explain the galactic intrinsic redshift phenomenon [8]. Therefore here I also argue that Hodge's Source-Sink model of galaxies can be related to Gross-Pitaevskiiian description of superfluidity.

In this regard, I would like to mention a recent paper by Toikka, Hietarinta, and Suominen [9], which suggests that there can be ring soliton-like solutions of the cylindrically symmetric (i.e. radial) Gross-Pitaevskii equation with a potential. Extrapolating this result to the universe scale, I submit a hypothesis that the universe may likely have a centre in the form of ring soliton-like. This hypothesis requires further observation in order to verify or refute.

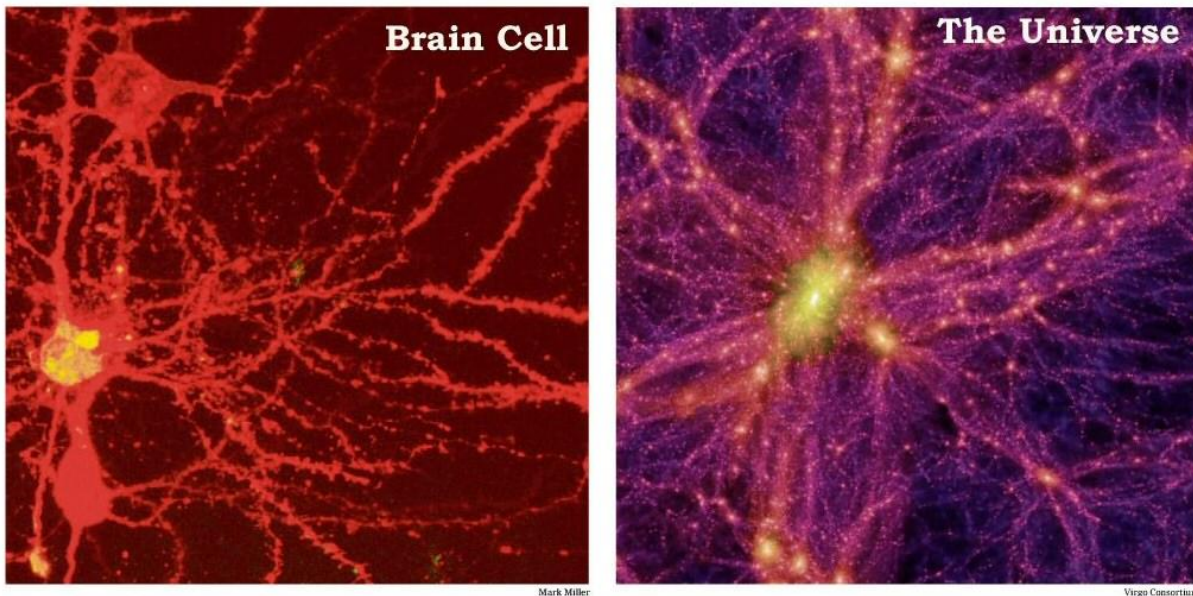
Interestingly, one can also note that Michael Peck has also suggested that the Universe may have a centre, using a revised model of General Relativity[10]. But of course it does not mean that I agree with all Peck's arguments.

Does the Universe have a centre?

In this section I would like to mention a picture suggesting similarity between brain's neuron and the structure of the universe. See Picture 1 [11-13].

(Note: One is only micrometers wide. The other is billions of light years across. One shows neurons in a mouse brain. The other is simulated image of the universe. Together they suggest the surprisingly similar patterns found in vastly different natural phenomena.- David Constantine)

One is only micrometers wide. The other is billions of light-years across. One shows neurons in a mouse brain. The other is a simulated image of the universe. Together they suggest the surprisingly similar patterns found in vastly different natural phenomena. DAVID CONSTANTINE



Mark Miller, a doctoral student at Brandeis University, is researching how particular types of neurons in the brain are connected to one another. By staining thin slices of a mouse's brain, he can identify the connections visually. The image above shows three neuron cells on the left (two red and one yellow) and their connections.

Source: Mark Miller, Brandeis University; Virgo Consortium for Cosmological Supercomputer Simulations; www.visualcomplexity.com

An international group of astrophysicists used a computer simulation last year to recreate how the universe grew and evolved. The simulation image above is a snapshot of the present universe that features a large cluster of galaxies (bright yellow) surrounded by thousands of stars, galaxies and dark matter (web).

The New York Times

If you enjoy mind-boggling science stories like this, visit Pickover.Com

Picture 1. Similarity between brain's neuron and the Universe

If the above picture holds true, then it seems to have a profound implication, suggesting that there can be a deep connection between brain's neuron and the structure of Universe.

While of course there is a question about the great differences between the structure of supercluster of galaxies and the structure of brain's neuron, one may recall that there are possible hints suggesting explanations about possible connection between brain's neuron and the structure of the Universe, for instance:

- Fractal theory suggests possible self-similarity between microscales and macroscales, see for instance the scale relativity theory of Nottale, 1997 [17]. See also Celerier & Nottale, 2005 [18].
- Spiral waves can be found in different scales from the microscales to the macroscales. These spiral waves may be a governing pattern in galaxy formation too, and these spiral waves are resulted from complex Ginzburg-Landau equations.
- A recent discovery of network cosmology by Dmitri Krioukov et al. suggests a deep similarity between brain, internet, and the Universe [14]. He finds theoretical link between hyperbolic metric and complex network. They write as follows: "Here we show that the causal network representing the large scale structure of spacetime in our accelerating universe is a power-law graph with strong clustering, similar to many complex networks such as the Internet, social, or biological networks. We prove that this structural similarity is a consequence of the asymptotic equivalence between the large-scale growth dynamics of complex networks and causal networks. This equivalence suggests that *unexpectedly similar laws govern the dynamics of complex networks and spacetime in the universe*, with implications to network science and cosmology"[14]. (emphasis is added)
- Krioukov et al.'s finding may be related to the work of Serrano et al [15], suggesting possible connection between self-similarity of complex networks and hidden metric space.

Regardless the differences of theoretical approaches as mentioned above, apparently we can agree about one thing from looking at Picture 1 above, that is both brain's neuron and the Universe have a centre. This can be generalized further as follows: Any complex network tends to have centre. Therefore apparently our hypothesis above that the universe can have a centre, which is based on Gross-Pitaevskiiian description, now seems to be supported by recent finding based on complex network studies.

There is other study based on network analysis which also supports the idea that complex networks tend to have centre, that is a recent study about global corporate control which results in a conclusion that there are "core" corporate which hold control on majority of other corporate in the world.[16] This finding about core corporate seems also to suggest that there is a centre in the network of global corporate control.

We summarize therefore that based on recent findings based on complex network studies we can find clues to support our hypothesis that the Universe may likely have a centre. However, this hypothesis requires further observation in order to verify or refute.

Moreover, it seems that there remains a long way to prove that there exists deep connection between brain's neuron and the structure of Universe.

Concluding Remarks

This paper briefly discusses a Source-Sink model of galaxies and its implication on the observed quantization of galactic redshift. As shown elsewhere, the Newton law and Maxwell electromagnetic equations can be described by the Source-Sink model too. The Source-Sink model of galaxies can be interpreted further in the context of superfluid dynamics as described by Gross-Pitaevskii equation. Because radial Gross-Pitaevskii equation can yield ring soliton-like solutions, I submit a hypothesis that the universe may likely have a center in the ring soliton-like form.

Acknowledgment: Special thanks to Dr. Arturo Geigel and Dr. Christopher Davia for discussing a question related to connection between brain and universe.

References

- [1] Oliveira, F.J. (2005) Quantized intrinsic redshift in Cosmological General Relativity. arXiv:gr-qc/0508094.
- [2] Oliveira, F.J. (2005) Exact solution of a linear wave equation in Cosmological General Relativity. arXiv:gr-qc/0509115.
- [3] Hodge, J.C., (2006) Scalar potential model of redshift and discrete redshift. arXiv: astro-ph/0602344.
- [4] Wang, X-S. (2005) Derivation of Newton's Law of Gravitation based on a Fluid Mechanical Singularity Model of particles. arXiv: physics/0506062.
- [5] Wang, X-S. (2006) Derivation of the Schrodinger equation from Newton's second law based on a fluidic continuum model of vacuum and a sink model of particles. arXiv: physics/0610224.
- [6] Rahman, S.A. (2004) Classical electrodynamics from the motion of a relativistic fluid. arXiv: physics/0408139.
- [7] Moffat, J. (2006) arXiv: astro-ph/0602067.
- [8] Smarandache, F., & Christianto, V. (2006) Plausible explanation of quantization of intrinsic redshift from Hall effect and Weyl quantization. *Progress in Physics* Vol. 2 No.2, 2006, <http://ptep-online.com>. Also reprinted in F. Smarandache & V. Christianto (eds.) *Quantization, Brownian Motion and Supersymmetry*, MathTiger, Tamil Nadu, Chennai, 2007, p.243, URL: <http://www.gallup.unm.edu/~smarandache/Quantization.pdf>.
- [9] Toikka, L.A., Hietarinta, J., Suominen, K.A. (2012) Exact soliton-like solutions of the radial Gross-Pitaevskii equation. arXiv: 1204.3009.

- [10] Peck, M., (2013) The Theory of Everything: Foundations, Applications and Corrections to General Relativity. <http://vixra.org/abs/1305.0138>
- [11] http://www.nytimes.com/imagepages/2006/08/14/science/20060815_SCILL_GRAPHIC.htm
- [12] <http://sprott.physics.wisc.edu/pickover/pc/brain-universe.html>
- [13] <http://disinfo.com/2011/07/our-brains-neurons-look-exactly-like-the-structure-of-the-univers>
- [14] Krioukov, D., et al. (2012) Network Cosmology. arXiv:1203.2109 [gr-qc]; [14a] see also their homepage: <http://www.caida.org>; [14b] <http://www.livescience.com/25027-universe-grows-like-brain.html>
- [15] Serrano, M.A., Krioukov, D., & Boguna, M., (2007) Self-similarity of complex networks and hidden metric space. arXiv:0710.2092 [cond-mat.dis-nn]; [15a] see also Song, C., Havlin, S., & Makse, H.A. (2005) Self-similarity of complex networks. *Nature* Vol. 433, 27 Jan. 2005, URL: <http://www.nature.com/nature>
- [16] Vitali, S., Glattfelder, J., & Battiston, S. (2011) The network of global corporate control. arXiv: 1107.5728 [q-fin.GN]
- [17] Nottale, L., *Astron. Astrophys.* **327**, 867-889 (1997).
- [18] Celerier, M.N., & Nottale, L. (2005) Generalized macroscopic Schrodinger equation in scale relativity, in F. Combes et al. (eds) *SF2A 2004*, arXiv: gr-qc/0505012 (2005).

Report

On Primordial Rotation of the Universe, Hydrodynamics, Vortices & Angular Momenta of Celestial Objects

Victor Christianto^{*}

Abstract

In the present paper, we make some comments on a recent paper by Sivaram & Arun in *The Open Astronomy Journal* 2012, 5, 7-11 with title: 'Primordial rotation of the Universe, Hydrodynamics, Vortices and angular momenta of celestial objects', where they put forth an interesting idea on the origin of rotation of stars and galaxies based on torsion gravity. We extend further their results by hypothesizing the presence of quantized vortices in relation with the torsion vector. If the hypothesis is proven and observed, then it can be used to explain numerous unexplainable phenomena in galaxies etc. The quantization of circulation can be generalized to be Bohr-Sommerfeld quantization rules, which are found useful to describe quantization in astrophysical phenomena, i.e. planetary orbit distances. Further recommendation for observation of the proposed quantized vortices of superfluid helium in astrophysical objects is also mentioned.

Key Words: primordial rotation, Universe, hydrodynamics, vortices, angular momenta, celestial objects.

Introduction

Two recent papers by Sivaram & Arun, one in *The Open Astronomy Journal* 2012, 5, 7-11 [1], and one in arXiv [2] are found very interesting. They are able to arrive at the observed value of effective cosmological constant by considering background torsion in the teleparallel gravity. According to them, "the background torsion due to a universal spin density not only gives rise to angular momenta of all structures but also provides a background centrifugal term acting as a repulsive gravity accelerating the universe, with spin density acting as effective cosmological constant." [1] The torsion is given by [1, p.10]:

$$Q = \frac{4\pi G\sigma}{c^3} \approx 10^{-28} \text{ cm}^{-1}, \quad (1)$$

And the background curvature [1, p.10] is given by:

$$Q^2 \approx 10^{-56} \text{ cm}^{-2}. \quad (2)$$

^{*}Correspondence: Victor Christianto, <http://www.sciprint.org>, E-Mail: victorchristianto@gmail.com, phone: (62) 341-403205

In the meantime, a recent review of dark energy theories in the literature (including teleparallel gravity) has been given in [4], and present problems in the standard model general relativistic cosmology are discussed by Starkman [5]. These seem to suggest that a torsion model of effective cosmological constant based on teleparallel gravity as suggested by Sivaram and Arun (2012) seems very promising as a description of phenomena related to accelerated expansion of the Universe usually attributed to 'dark energy' (as alternative to cosmological constant explanation).

However, Sivaram & Arun do not make further proposition concerning the connection between quantized vortices (Onsager-Feynman's rule) and the torsion vector. It will be shown here, that such a connection appears possible.

Here we present Bohr-Sommerfeld quantization rules for planetary orbit distances, which results in a good quantitative description of planetary orbit distance in the solar system [6][6b][7]. Then we find an expression which relates the torsion vector and quantized vortices from the viewpoint of Bohr-Sommerfeld quantization rules [3].

Further observation of the proposed quantized vortices of superfluid helium in astrophysical objects is recommended.

Bohr-Sommerfeld quantization rules and quantized vortices

The quantization of circulation for nonrelativistic superfluid is given by [1][3]:

$$\oint v dr = N \frac{\hbar}{m_s} \quad (3)$$

Where N, \hbar, m_s represents winding number, reduced Planck constant, and superfluid particle's mass, respectively [3]. And the total number of vortices is given by [1]:

$$N = \frac{\omega \cdot 2\pi r^2 m}{\hbar} \quad (4)$$

And based on the above equation (4), Sivaram & Arun [1] are able to give an estimate of the number of galaxies in the universe, along with an estimate of the number stars in a galaxy.

However, they do not give explanation between the quantization of circulation (3) and the quantization of angular momentum. According to Fischer [3], the quantization of angular momentum is a relativistic extension of quantization of circulation, and therefore it yields Bohr-Sommerfeld quantization rules.

Furthermore, it was suggested in [6] and [7] that Bohr-Sommerfeld quantization rules can yield an explanation of planetary orbit distances of the solar system and exoplanets. Here,

we begin with Bohr-Sommerfeld's conjecture of quantization of angular momentum. As we know, for the wavefunction to be well defined and unique, the momenta must satisfy Bohr-Sommerfeld's quantization condition:

$$\oint_{\Gamma} p \cdot dx = 2\pi \cdot n\hbar, \quad (5)$$

for any closed classical orbit Γ . For the free particle of unit mass on the unit sphere the left-hand side is:

$$\int_0^T v^2 \cdot d\tau = \omega^2 \cdot T = 2\pi \cdot \omega, \quad (6)$$

Where $T = \frac{2\pi}{\omega}$ is the period of the orbit. Hence the quantization rule amounts to quantization of the rotation frequency (the angular momentum): $\omega = n\hbar$. Then we can write the force balance relation of Newton's equation of motion:

$$\frac{GMm}{r^2} = \frac{mv^2}{r}. \quad (7)$$

Using Bohr-Sommerfeld's hypothesis of quantization of angular momentum (6), a new constant g was introduced:

$$mvr = \frac{ng}{2\pi}. \quad (8)$$

Just like in the elementary Bohr theory (just before Schrodinger), this pair of equations yields a known simple solution for the orbit radius for any quantum number of the form:

$$r = \frac{n^2 \cdot g^2}{4\pi^2 \cdot GMm^2}, \quad (9)$$

or

$$r = \frac{n^2 \cdot GM}{v_o^2}, \quad (10)$$

Where r , n , G , M , v_o represents orbit radii (semimajor axes), quantum number ($n=1,2,3,\dots$), Newton gravitation constant, and mass of the nucleus of orbit, and specific velocity, respectively. In equation (10), we denote:

$$v_o = \frac{2\pi}{g} GMm. \quad (11)$$

The value of m and g in equation (11) are adjustable parameters.

Interestingly, we can remark here that equation (10) is exactly the same with what is obtained by Nottale using his Schrodinger-Newton formula [8]. Therefore here we can verify that the result is the same, either one uses Bohr-Sommerfeld quantization rules or Schrodinger-Newton equation. The applicability of equation (10) includes that one can predict new exoplanets (extrasolar planets) with remarkable result.

Therefore, one can find a neat correspondence between Bohr-Sommerfeld quantization rules and motion of quantized vortice in condensed-matter systems, especially in superfluid helium [3]. Here we propose a conjecture that Bohr-Sommerfeld quantization rules also provide a good description for the motion of galaxies, therefore they should be included in the expression of torsion vector. We will discuss an expression of torsion vector of quantized vortices in the next section.

Torsion and quantized vortices

We cite here a rather old paper of Garcia de Andrade & Sivaram, 1998 [9], where they discuss propagation torsion model for quantized vortices. They consider the torsion to be propagating and it can be expressed as derivative of scalar field:

$$Q = \nabla \phi. \tag{12}$$

Therefore $\oint Q dS$ can be written as [9]:

$$\oint Q dS = \oint \nabla \phi dS = \int \nabla(\nabla \phi) dV \cong \int \nabla^2 \phi dV. \tag{13}$$

Also $\oint Q dS$ must have dimensions of length, and thus quantized as [9]:

$$\oint Q dS \cong \frac{n\hbar c}{M} \tag{14}$$

Now we invoke a result from the preceding section discussing Bohr-Sommerfeld quantization rules. Assuming that Bohr-Sommerfeld quantization rules also govern the galaxies motion as well as stars motion, then we can insert equation (11) into equation (14), to yield a new expression:

$$\oint Q dS \cong \frac{n\hbar c \cdot 2\pi Gm}{v_0 g} \tag{15}$$

Therefore, we submit a viewpoint that the torsion vector is also a quantized quantity, and it is a function of Planck constant, speed of light, Newton gravitation constant, vortex

particle's mass, a specific velocity and an adjustable parameter, g . It is interesting to find out whether this proposition agrees with observation data or not.

The above proposition (15) connects torsion vector with gravitation constant, which seems to give a torsion description of gravitation. There are numerous other models to describe alternative or modified gravitation theories, for instance Wang is able to derive Newton's second law and Schrodinger equation from fluid mechanical dynamics. [10][11]

In the mean time, for discussion of galaxy disk formation, see [12]. And [13] gives alternative vortices argument for dark matter.

The proposed quantization of circulation as suggested by Sivaram and Arun [1] is based on a conjecture that the universe is formed by superfluid or condensed matter. For models describing further this proposition, see discussion in Brook [14].

Concluding remarks

In the present paper, we make some comments on a recent paper by Sivaram & Arun in *The Open Astronomy Journal* 2012, 5, 7-11 where they put forth an interesting idea on the origin of rotation of stars and galaxies based on torsion gravity. We extend further their results by hypothesizing the presence of quantized vortices relation with the torsion vector. If the hypothesis is proven and observed, then it can be used to explain numerous unexplainable phenomena in galaxies etc. Further recommendation for observation of the proposed quantized vortices of superfluid helium in astrophysical objects is also mentioned.

References

- [1] Sivaram, C., & K. Arun (2012) Primordial rotation of the Universe, Hydrodynamics, Vortices and angular momenta of celestial objects, *The Open Astronomy Journal*, 5, 7-11. URL: <http://benthamsience.com/open/toaaj/articles/V005/7TOAAJ.pdf>
- [2] Sivaram, C., & K. Arun (2011) Primordial rotation of the Universe and angular momenta of a wide range of celestial objects, arXiv:1111.3873
- [3] Fischer, U., (1999) Motion of quantized vortices as elementary objects, *Ann. Phys. (N.Y.)* 278, 62-85, and also in arXiv:cond-mat/9907457
- [4] Bamba, K., Capozziello, C., Nojiri, S. & S.D. Odintsov (2012) Dark energy cosmology: the equivalent description via different theoretical models and cosmography tests, arXiv:1205.3421 [gr-qc] see p. 94.
- [5] Starkman, G.D. (2012) Modifying gravity: You can't always get what you want, arXiv: 1201.1697 [gr-qc].

- [6] Christianto, V. (2006) On the origin of macroquantization in astrophysics and celestial motion, *Annales de la Fondation Louis de Broglie*, Volume 31 no 1; [6b] F. Smarandache & Christianto, V. (2006) Schrodinger equation and the quantization of celestial systems. *Progress in Physics*, Vol. 2, April 2006.
- [7] Christianto, V., (2004) A Cantorian superfluid vortex and the quantization of planetary motion, *Apeiron*, Vol. 11, No. 1, January 2004, <http://redshift.vif.com>
- [8] Nottale, L., *Astron. Astrophys.* **327**, 867-889 (1997).
- [9] Garcia de Andrade, L.C., & C. Sivaram (1998) Torsion and quantized vortices, arXiv:hep-th/9811067.
- [10] Wang, X-S. (2005) Derivation of Newton's Law of Gravitation Based on a Fluid Mechanical Singularity Model of Particles, arXiv:physics/0506062.
- [11] Wang, X-S. (2006) Derivation of the Schrodinger equation from Newton's Second Law Based on a Fluidic Continuum Model of Vacuum and a Sink Model of Particles, arXiv:physics/0610224.
- [12] Silk, J. (2001) The formation of galaxy disks, arXiv:astro-ph/0010624
- [13] Kain, B., & H.Y. Ling (2010) Vortices in Bose-Einstein condensate dark matter, arXiv:1004.4692 [hep-ph]
- [14] Brook, M.N. (2010) Cosmology meets condensed matter. PhD Dissertation, The University of Nottingham. 171 p.

Article

On Astrometric Data & Time Varying Sun-Earth Distance in Light of Carmeli Metric

Victor Christianto^{*}

Abstract

In this note, we describe shortly time varying Sun-Earth distance in the light of Carmeli metric and compare the result with recent astrometric data. The graphical plot suggests that there should be linear-linear correspondence between Sun-planets distances and their time variation. Carmeli metric simply adds a momentum term to the normal 4-d spacetime formulation, to give us a 5-d working space, but actually the original Carmeli metric replaces time dimension in Minkowski metric to become momentum term divided by quadratic Hubble constant. One obvious advantage from Carmeli metric is that it can be used to derive Tully-Fisher law, which can explain galaxy motion without invoking dark matter.

Key Words: astrometric data, time varying, Sun-Earth distance, Carmeli metric.

Introduction

Recent astrometric data suggest that there is time variation of Sun-Earth distance at the order of 15 cm/year [1]. This observed effect can shed light on restriction in astronomy modeling.

In this regard we discuss how this time varying Sun-Earth distance can be explained by virtue of Carmeli metric [2]. In the first section we explain how Carmeli metric can be shown to be derivable from quaternion group, and in turn there are a number of new effects which can be observed as part of Carmeli metric. Carmeli metric simply adds a momentum term to the normal 4-d spacetime formulation, to give us a 5-d working space, but actually the original Carmeli metric replaces time dimension in Minkowski metric to become momentum term divided by quadratic Hubble constant. One obvious advantage from Carmeli metric is that it can be used to derive Tully-Fisher law, which can explain galaxy motion without invoking dark matter [2]. There are other advantages from the viewpoint of clarity of modeling,

* Victor Christianto, <http://www.sciprint.org> E-Mail: victorchristianto@gmail.com

including that one can expect to explain the presently un-described Earth geochronometry [4].

FLRW-metric from quaternion group and Carmeli metric

The quaternion algebra is one of the most important and most studied objects in mathematics and physics; and it has natural Hermitian form which induces Euclidean metric [3].

In this regards Trifonov has obtained that by using a natural extension of the structure tensors using nonzero quaternion bases then they will yield a metric as follows [3]:

$$g_{\alpha\beta} = \begin{pmatrix} \tau(\eta)\left(\frac{\dot{R}}{R}\right)^2 & 0 & 0 & 0 \\ 0 & -\tau(\eta) & 0 & 0 \\ 0 & 0 & -\tau(\eta)\sin^2(\chi) & 0 \\ 0 & 0 & 0 & -\tau(\eta)\sin^2(\chi)\sin^2(\vartheta) \end{pmatrix} \quad (1)$$

In order to obtain a closed-FLRW metric, one assume that [3]:

$$\tau(\eta)\left(\frac{\dot{R}}{R}\right)^2 = 1, \quad (2)$$

which can be rewritten in the form of a metric:[4]

$$\tau(\eta)(\dot{R})^2 = R^2 = dx^2 + dy^2 + dz^2, \quad (3)$$

or

$$ds^2 = dx^2 + dy^2 + dz^2 - \tau(\eta)(\dot{R})^2, \quad (4)$$

which in turn this metric can be compared with Carmeli metric:[2]

$$ds^2 = dR^2 - \frac{1}{H^2} dv^2 = dx^2 + dy^2 + dz^2 - \tau^2 dv^2, \quad (5)$$

where τ symbol denotes inverse of Hubble constant, H.

The standard procedure of Carmeli metric, however, is to begin with Hubble law [2]:

$$x = H_0^{-1}v, \tag{5a}$$

Where H and v are Hubble constant and velocity, respectively. Quote: “But one cannot use this law directly to obtain a relation between z and t. So we start by assuming that the Universe is empty of gravitation. One can then describe the property of expansion as a null-vector in the flat four dimensions of space and expanding velocity v.” [2a] From a viewpoint, one can say for clarity that Carmeli metric simply adds a momentum term to the normal 4-d spacetime formulation, to give us a 5-d working space, but actually the original Carmeli metric (see eq.(5)) replaces time dimension in Minkowski metric $ds^2 = dx^2 + dy^2 + dz^2 - c^2 dt^2$, to become momentum term divided by quadratic Hubble constant. One obvious advantage from Carmeli metric is that it can be used to derive Tully-Fisher law, which can explain galaxy motion without invoking dark matter.[2] There are other advantages from the viewpoint of clarity of modeling, including that one can expect to explain the presently un-described Earth geochronometry.[4] That is why we think that Carmeli metric can be one good candidate to explain galaxy motion without necessity to include dark matter.

One shall note here that this τ (tau) symbol is given different meaning compared with its meaning in equation (4), that is:

$$\tau^2 = \tau(\eta) = \frac{1}{\alpha H^n}. \tag{6}$$

One implication of this proposition has been found in [4], that there is such a proportionality which can be written as follows:

$$\left(\frac{R_1}{\dot{R}_1} \right) = \left(\frac{R_2}{\dot{R}_2} \right) = \sqrt{\tau(\eta)}. \tag{7}$$

The aforementioned proportionality corresponds to the observed Earth geochronometry phenomena which can be attributed to an expansion of Earth radius at the order of ~ 0.166 cm/yr [4].

Plausible explanation of time varying Sun-Earth distance

In order to explain time varying Sun-Earth distance, one can use similar analogies, but with introducing a coefficient in order to match with the observed data of Anderson et al. (that is around 15 cm /yr) [1]. The virtue of this calculation is that one can also expect to observe the time varying displacement of the other planets too, compared to their distances to the Sun.

Given we accept approximate radius of earth to be around 6367.5 km, or around 6.3675×10^6 meter, and that is why: elongation of metric scale can be estimated to be around: $\frac{0.166\text{meter} / \text{cy}}{6367500\text{meter}} \approx 0.2607 \times 10^{-7} \text{m.cy}^{-1} / \text{m} \approx 2.607 \times 10^{-10} \text{m.year}^{-1} / \text{m}$. And

that is approximately what one should find in a metrology device in order one can observe the effect of Hubble expansion to SI metric length scale. After conversion, this number amount to: $8.26674 \times 10^{-18} \text{m/sec/m'}$. Now times this amount with $1.4959 \times 10^{11} \text{m}$ of distance between the Sun and the earth, and we will obtain estimate of displacement per second. After conversion to displacement each year, one gets= 39.0 meter per year of displacement. In order to match this number with the observed, one multiply this number with $1/274$, and then one gets: 14.23 cm/year of displacement of the Earth from the Sun. While the value above appears to be a retrodiction compared to the observed value, the virtue here is one gets simplicity of framework to get estimate of displacement for other planets. The proportionality now for the planets could be written instead of (7):

$$\left(\frac{\dot{R}_1}{R_1} \right) = \left(\frac{\varepsilon \dot{R}_2}{R_2} \right), \text{ or} \quad (8)$$

$$\left(\frac{\dot{R}_1}{R_1} \right) \frac{R_2}{\varepsilon} = (\dot{R}_2), \quad (8a)$$

where the R_2 mean distance from planet to the Sun, and R_1 mean earth radius respectively. The symbol ε denotes factor 274 to match the observed data. This number in turn can be associated with the well-known fine structure constant, therefore equation (8a) can be rewritten for convenience as follows:

$$\left(\frac{\dot{R}_1}{R_1} \right) \frac{\alpha R_2}{2} = (\dot{R}_2), \quad (8b)$$

where α represents fine structure constant = $1/137, \dots$ That would be interesting to observe the actual time-varying distance between other planets to the Sun, in order to verify or refute the aforementioned proposition (8b).

The result of the above procedure is presented in the table 1 below.

Table 1. calculation of the time varying displacement of planets from the Sun

planet	distance	displcmt	observd(in cm)	log scale	log scale	log scale
	dist(10 ¹¹ m)	displac(in cm)		dist(10 ¹¹ m)	displac(in m)	observd(in m)
mercury	5,7894	5,51		0,7626	0,74	
venus	10,9506	10,42		1,0394	1,02	
earth	14,9598	14,23	15	1,1749	1,15	1,176
mars	22,7389	21,64		1,3568	1,34	
hungarias	31,4006	29,88		1,4969	1,48	
asteroid	40,3914	38,43		1,6063	1,58	
camilla	47,1233	44,84		1,6732	1,65	
jupiter	77,8358	74,06		1,8912	1,87	
saturn	142,7014	135,77		2,1544	2,13	
uranus	287,0783	273,14		2,4580	2,44	
neptune	450,2896	428,43		2,6535	2,63	
pluto	590,9116	562,23		2,7715	2,75	
2003ub313	777,9089	740,15		2,8909	2,87	

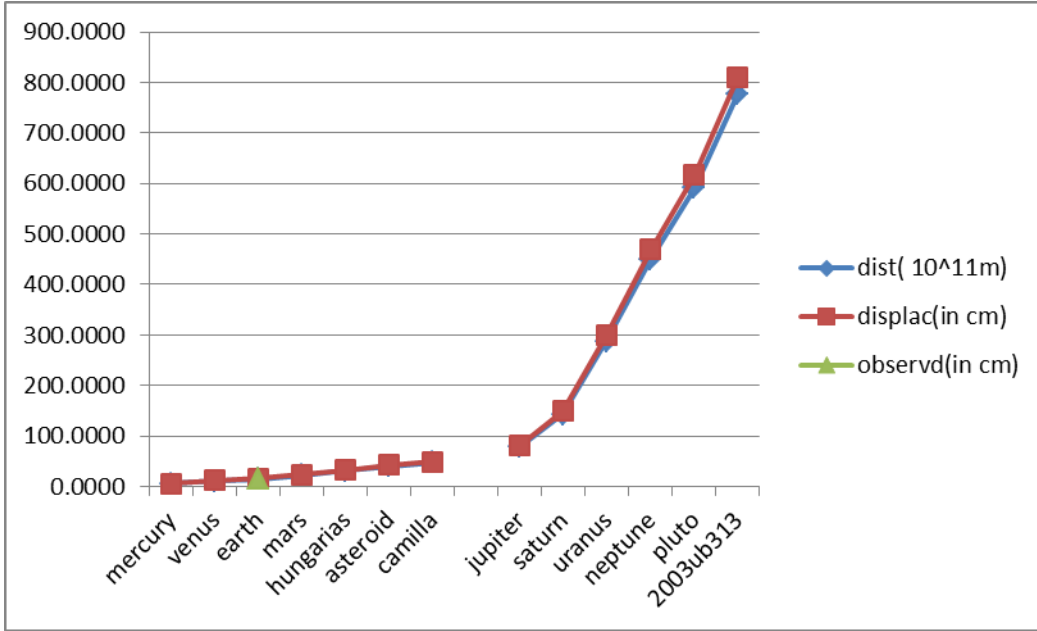


Figure 1. Graphical plot of time varying displacement of planets from the Sun

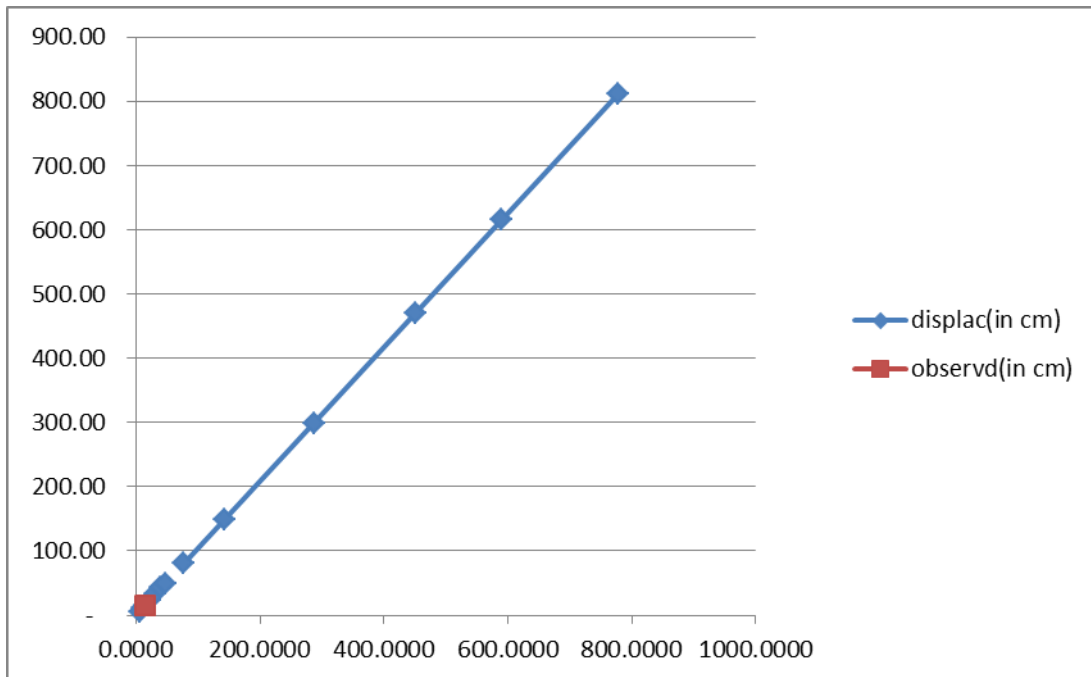


Figure 2. Graphical plot of distance vs. displacement of various planets from the Sun

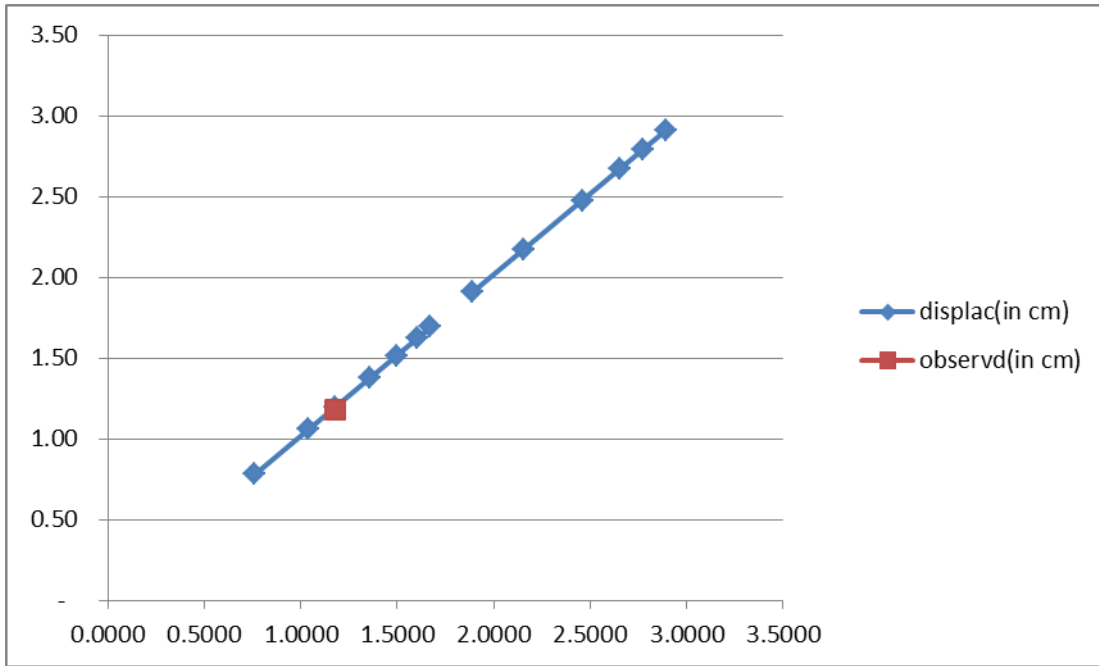


Figure 3. Graphical log-log plot of distance vs. displacement of various planets from the Sun.

Concluding remarks

In this note, we describe shortly time varying Sun-Earth distance in the light of Carmeli metric and compare the result with recent astrometric data. The graphical plot suggests that there should be linear-linear correspondence between Sun-planets distances and their time variation.

Not only that, the prediction made here suggests that Carmeli metric can be the sought after framework in order to describe the astrometric anomaly pertaining to the time varying distance of the Sun-Earth distance, and furthermore there are expected time varying distance effect between the Sun and other planets as well.

References:

- [1] J.D. Anderson & M.M. Nieto (2009), "Astrometric solar system anomalies," *Relativity in fundamental astronomy*. Proc. IAU Symposium no. 261, 2009, arXiv:gr-qc/0907.2469. (9p.)

[2] M. Carmeli (1996) "Is galaxy dark matter a property of spacetime?" arXiv: astro-ph/9607142. M. Carmeli, J. Hartnett, F.J. Oliveira (2005) "The cosmic time in terms of the redshift," arXiv: gr-qc/0506079 (2005).

[3] V. Trifonov (2003), "Geometry of the group of nonzero quaternions," arXiv: physics/0301052; [3a] arXiv: math-ph/0606007.

[4] V. Christianto & F. Smarandache (2008), "Kaluza-Klein-Carmeli metric from quaternion space, Lorentz's force, and some observable," *Progress in Physics* vol. 2, url: www.ptep-online.com. Vixra reference: <http://vixra.org/pdf/1003.0050v1.pdf>

[5] V. Christianto & F. Smarandache (2008), "What gravity is: some recent considerations," *Progress in Physics* vol. 3, url: www.ptep-online.com. Vixra reference: <http://vixra.org/pdf/1003.0015v1.pdf>

Essay

On Gödel's Incompleteness Theorem, Artificial Intelligence & Human Mind

Victor Christianto*

Abstract

In this essay, I discuss Gödel's incompleteness theorem and plausible implications to Artificial Intelligence/Life and human mind. Perhaps we should agree with Sullins III, that the value of this finding is not to discourage certain types of research in AI, but rather to help move us in a direction where we can more clearly define the results of that research. Gödel's incompleteness theorem has its own limitations, but so do Artificial Life systems. Based on our experiences, human mind has incredible abilities to interact with other part of human body including heart, which makes it difficult to simulate in AI/AL systems. However, it remains an open question to predict whether the future of AI including robotics science can bring this gap closer or not.

Key Words: Gödel, Incompleteness Theorem, artificial intelligence, artificial life, human mind.

Introduction

In 1931 a German mathematician named Gödel published a paper [9] which included a theorem which was to become known as his Incompleteness Theorem. This theorem stated that:

To every w -consistent recursive class k of formulae there correspond recursive class-signs r , such that neither $v \text{ Gen } r$ nor $\text{Neg } (v \text{ Gen } r)$ belongs to $\text{Flg}(k)$ (where v is the free variable of r)

In more common mathematical terms, this means that "all consistent axiomatic formulations of number theory include undecidable propositions" [9].

Another perspective on Gödel's incompleteness theorem can be found using polynomial equations [10]. It can be shown that Gödel's analysis does not reveal any essential incompleteness in formal reasoning systems nor any barrier to prove the consistency of such systems by ordinary mathematical means [10]. Further, Beklemishev discusses the limits of applicability of Gödel's incompleteness theorems in [11].

Does Gödel's incompleteness theorem limit Artificial Intelligence?

In the 1950s and 1960s, researchers predicted that when human knowledge could be expressed using logic with mathematical notation, it would be possible to create a machine that reasons

*Correspondence: Victor Christianto, <http://www.sciprint.org>, <http://independent.academia.edu/VChristianto>
Email: victorchristianto@gmail.com . Phone: (62) 341-403205.

known as artificial intelligence. This turned out to be more difficult than expected because of the complexity of human reasoning [12].

Nowadays, it is widely accepted that general purpose of artificial intelligence (AI) is to develop (1) conceptual models; (2) formal rewriting processes of these models; and (3) programming strategies and physical machines to reproduce as efficiently and thoroughly as possible the most authentic, cognitive, scientific and technical tasks of biological systems that we have labeled Intelligent [5, p.66].

According to Gelgi [1], Penrose claims that results of Gödel's theorem established that human understanding and insight cannot be reduced to any set of computational rules. Gelgi goes on to say that:

Gödel's theorem states that in any sufficiently complex formal system there exists at least one statement that cannot be proven to be true or false. Penrose believes that this would limit the ability of any AI system in its reasoning. He argues that there will always be a statement that can be constructed which is unprovable by the AI system.

The above question is very interesting to ponder, considering recent achievements in modern AI research. There are ongoing debates on this subject in many online forums, see for instance [5-9]. Here I give a summary of those articles and papers in simple words. Hopefully this effort will shed some light on this debatable subject. Those arguments basically stand either on the optimistic side (that Gödel's theorems do not limit AI) or on the pessimistic side (that Gödel's theorems limit AI).

Mechanism and reductionism in biology and implications to AI/AL

It is known that mechanistic or closely related reductionist's theories have been part of theoretical biology in one form or another at least since Descartes [8]. The various mechanistic and reductionist's theories are historically opposed to the much older and mostly debunked theories of vitalism. These theories (the former more than the latter), along with formism, contextualism, organicism and a number of other "isms" mark the major centers of thought in the modern theoretical biology debate [8].

The mechanistic and reductionist's view of the world were criticized by F. Capra in his book, *The Turning Point* [13].

According to Sullins III, Artificial Life (AL) falls curiously on many sides of these debates in the philosophy of biology [8]. For instance, AL uses the tools of complete mechanization, namely the computer, while at the same time it acknowledges the existence of emergent phenomena. Neither mechanism nor reductionism is usually thought to be persuaded by arguments appealing to emergence. Facts like this should make our discussion interesting. It may turn out that AL is hopelessly contradictory on this point, or it may provide an escape route for AL if we find that Gödel's incompleteness theorems do pose a theoretical road block to the mechanistic-reductionist's theories in biology.

Sullins III also writes that most theorists have outgrown the idea that life can be explained wholly in terms of classical mechanics [8]. Instead, what is usually meant is the following:

- 1) Living systems can and/or should be viewed as physico-chemical systems.
- 2) Living systems can and/or should be viewed as machines (This kind of mechanism is also known as the machine theory of life).
- 3) Living systems can be formally described. There are natural laws which fully describe living systems.

According to Sullins III, reductionism is related to mechanism in biology in that mechanists wish to reduce living systems to a mechanical description [8]. Reductionism is also the name of a more general world view or scientific strategy. In this world view, we explain phenomena around us by reducing them to their most basic and simple parts. Once we have an understanding of the components, it is then thought that we have an understanding of the whole. There are many types of reductionist strategies [8].

According to Sullins III, reductionism is a tool or strategy for solving complex problems [8]. There does not seem to be any reason that one has to be a mechanist to use these tools. For instance one could imagine a causal reductionistic vitalist who would believe that life is reducible to the *elan vital* or some other vital essence. And, conversely, one could imagine a mechanist who might believe that living systems can be described metaphorically as machines but that life was not reducible to being only a property of mechanics.

Sullins III also asserts that the strong variety of AL does not believe that living systems should only be viewed as physico-chemical systems [8]. AL is life-as-it-could-be, not life-as-we-know-it, and this statement suggests that AL is not overly concerned with modeling only physico-chemical systems. Postulates 2 and 3 seem to hold, though, as strong AL theories clearly state, that the machine or formal theory of life is valid and that simple laws underlie the complex and nonlinear behavior of living systems.

Sullins III goes on with his argument, saying that at least one of the basic qualities of our reality will always be missing from any conceivable artificial reality, namely, a complete formal system of mathematics [8]. This argument tends to make more sense when applied to strong AI claims about intelligent systems understanding concepts. He also concludes that it is impossible to completely formalize an artificial reality that is equal to the one we experience, so AL systems entirely resident in a computer must remain, for anyone persuaded by the mathematical realism posited by Gödel, a science which can only be capable of potentially creating extremely robust simulations of living systems but never one that can become a complete instantiation of a living system [8].

However, Sullins III also writes that the value of this finding is not to discourage certain types of research in AL, but rather to help move us in a direction where we can more clearly define the results of that research [8]. In fact, since one of the above arguments rests on the assumption that the universe is infinite and that some form of mathematical realism is true, if we are someday

able to complete the goal advanced in strong AL, it would seem to cast doubt on the validity of the assumptions made above.

For a debate on this issue in the context of fuzzy logic, see for instance Yalciner et al. [5]. The debates on the possibility of thinking machines or the limitations of AI research have never stopped. According to Yalciner et al., these debates on AI have been focused on three claims:

- (1) An AI system is in principle an axiomatic system.
- (2) The problem solving process of an AI system is equivalent to a Turing machine.
- (3) An AI system is formal, and only gets meaning according to model theoretic semantic [16].

More than other new sciences, AI and philosophy have things to say to one to another: any attempt to create and understand minds must be of philosophical interest [5]. May be we will never manage to build real artificial intelligence. The problem could be too difficult for human brain over to solve. Yalciner et al. also write that a fundamental problem in artificial intelligence is that nobody really knows what intelligence is [5]. The problem is especially acute when we need to consider artificial systems which are significantly different to humans.

Human mind is beyond machine capabilities

According to Gelgi, it follows that no machine can be a complete or adequate model of the mind, that minds are essentially different from machines [1]. This does not mean that a machine cannot simulate any piece of mind; it only says that there is no machine that can simulate every piece of mind. Lucas says that there may be deeper objections. Gödel's theorem applies to deductive systems, and human beings are not confined to making only deductive inferences. Gödel's theorem applies only to consistent systems, and one may have doubts about how far it is permissible to assume that human beings are consistent [1].

Therefore, it appears that there are some characteristics of human mind which go beyond machine capabilities. For example there are human capabilities as follows:

- a. To synchronize with heart, i.e., to love and to comprehend love;
- b. To fear God and to acknowledge God: "The fear of the LORD is the beginning of knowledge" (Proverbs 1:7);
- c. To admit own mistakes and sins;
- d. To repent and to do repentance; and
- e. To consider things from ethical perspectives.

All of the above capabilities are beyond the scope of present day AI machines, i.e., it seems that there is far distance between human mind capabilities and machine capabilities. However, we can predict that there will be much progress by AI research. For instance, by improving AI-based

chess programs (such as new generations of *Deep Blue*), one could see how far the machine can go.

Furthermore, there are other philosophical arguments concerning the distinction between human mind and machine intelligence. Dreyfus contends that it is impossible to create intelligent computer programs analogous to the human brain because the workings of human intelligence are entirely different from that of computing machines [5]. For Dreyfus, the human mind functions intuitively and not formally. Dreyfus's critique on AI proceeds from his critique on rationalist epistemological assumptions about human intelligence. Dreyfus's major attack targets the rationalist conception that human understanding or intelligence can be "formalized" [5, p.67].

The above argument can be seen as stronger than Penrose's. However, one should admit the fundamental differences between human intelligence and machine intelligence. Human intelligence is very good in identifying patterns and subjective matters. However, it is usually not very good in handling large amounts of data and doing massive computations. Nor can it process and solve complex problems with large number of constraints. This is especially true when real time processing of data and information is required. For these types of issues, machine intelligence is an excellent substitute [5].

Concluding remarks

In this essay, I discuss Gödel's incompleteness theorem and its plausible implications to artificial intelligence/life and human mind.

Perhaps, we should agree with Sullins III, that the value of this finding is not to discourage certain types of research in AL, but rather to help move us in a direction where we can more clearly define the results of that research [8]. Gödel's incompleteness theorems have their own limitations, but so do Artificial Life/Intelligence systems. Based on our experiences, human mind has incredible abilities to interact with other part of human body including heart, which makes it so difficult to simulate in AL/AI. However, it remains an open question to predict whether the future of AI including robotics science can bring this gap closer or not. In this regard, fuzzy logic may offer a way to improve significantly AL/AI research [15].

References

- [1] Gelgi, F. (2004) Implications of Gödel's Incompleteness Theorem on A.I. vs. Mind, *NeuroQuantology*, (3), 186-189. URL: <http://www.neuroquantology.com/index.php/journal/article/view/46>
- [2] Chalmers, DJ. (1995) Minds, Machines, and Mathematics. Psyche Symposium on Roger Penrose's book *Shadows of the Mind*. URL: <http://consc.net/papers/penrose.html>
- [3] Gödel, K. (1931) On Formally Undecidable Propositions of Principia Mathematica and related systems I. *Monatshefte für Mathematik und Physik*, vol. 38 (1931), pp. 173-198. <http://www.ddc.net/ygg/etext/godel/>
- [4] Pelletier, F.J. (2000) Metamathematics of fuzzy logic, *The Bulletin of Symbolic Logic*, Vol. 6, No.3, 342-346, URL: <http://www.sfu.ca/~jeffpell/papers/ReviewHajek.pdf>

- [5] Yalciner, A.Y., Denizhan, B., Taskin, H. (2010) c. TJFS: *Turkish Journal of Fuzzy Systems* Vol.1, No.1, pp. 55-79. URL: http://www.tjfs-journal.org/TJFS_v1n1_pp55_79.pdf
- [6] Karavasileiadis, C. & O'Bryan, S., (2008) *Philosophy of Logic and Artificial Intelligence*.
- [7] Collins, J.C. (2001) On the compatibility between physics and intelligent organisms, arXiv:physics/0102024. URL: <http://arxiv.org/abs/physics/0102024>
- [8] Sullins III, J.P. (1997) Gödel's Incompleteness Theorems and Artificial Life - Digital Library & archives, Society for Philosophy and Technology, <http://scholar.lib.vt.edu/ejournals/SPT/v2n3n4/sullins.html>
- [9] Makey, J. (1995) Gödel's Incompleteness Theorem is Not an Obstacle to Artificial Intelligence, URL: http://www.sdsc.edu/~jeff/Godel_vs_AI.html
- [10] Norman, J.W. (2011) Resolving Gödel's incompleteness myth: Polynomial Equations and Dynamical Systems for Algebraic Logic, arXiv:1112.2141 [math.GM]. URL: <http://arxiv.org/abs/1112.2141>
- [11] Beklemishev, L.D. (2010) Gödel incompleteness theorems and the limits of their applicability. I, *Russian Math. Surv.* 65 857, URL: <http://iopscience.iop.org/0036-0279/65/5/R03>; or <http://www.mi.ras.ru/~bekl/Papers/goedel-en.pdf>
- [12] <http://www.wikipedia.org/Logic>
- [13] Capra, F. (1982) *The Turning Point*. Bantam Books. See URL: <http://www.juwing.sp.ru/Capra/CONTENTS.htm>
- [14] Chaitin, G.J. (1999) A century of controversy over the foundations of mathematics, arXiv: chaos-dyn/9909001. URL: <http://arxiv.org/abs/chaos-dyn/9909001>
- [15] Schumann, A. & Smarandache, F. (2007) *Neutrality and many-valued logics*. American Research Press. 121 p. URL: <http://arxiv.org/abs/0707.3205>
- [16] Wang, P. (2006) Three Fundamental Misconceptions of Artificial Intelligence, http://www.cis.temple.edu/~pwang/Publication/AI_Misconceptions.pdf
- [17] http://www.wikipedia.org/Philosophy_of_artificial_intelligence
- [18] Straccia, U. (2000) On the relationship between fuzzy logic and four-valued relevance logic, arXiv:cs/0010037. URL: <http://arxiv.org/abs/cs/0010037>
- [19] Born, R.P. (2004) Epistemological Investigations into the Foundations of Artificial Intelligence, http://www.iwp.jku.at/born/mpwfst/04/0401Turing_engl_1p.pdf

An Exact Solution of modified KdV (mKdV) Equation as a reduction of Self-Dual Yang-Mills theory

Victor Christianto¹

¹ Contact Email: victorchristianto@gmail.com, URL: <http://www.sciprint.org> or
http://www.researchgate.net/profile/Victor_Christianto

Abstract. It is known for quite a long time that Self-Dual Yang Mills (SDYM) theory reduce to Korteweg- DeVries equation, but recently Shehata and Alzaidy have proved that SDYM reduces to modified KdV equation. Therefore, this paper discusses an exact solution of modified Korteweg-DeVries equation with Mathematica. An implication of the proposed solution is that it is possible to consider hadrons as (a set of) KdV soliton.

Introduction

It is known for quite a long time that Self-Dual Yang Mills (SDYM) theory reduce to Korteweg- DeVries equation [1][2], but recently Shehata and Alzaidy have proved that SDYM reduces to modified KdV equation [3]. Therefore, this paper discusses an exact solution of modified Korteweg- DeVries equation with Mathematica. I use Mathematica rel. 9.0. An implication of the proposed solution is that it is possible to consider hadrons as (a set of) KdV soliton.

Self-Dual Yang Mills theory and its canonical reduction to Korteweg-DeVries equation

It has been shown since 1990s that many, and possibly all, integrable systems can be obtained by dimensional reduction of self-dual Yang Mills.[1] Moreover, according to Schiff [1] a remarkable piece of evidence for this was produced a few years ago by Mason and Sparling, who showed how to obtain the Korteweg-de Vries (KdV) and Nonlinear Schrodinger (NLS) equations from SDYM. Schiff also showed how the reduction method of Mason and Sparling could be extended to obtain certain three dimensional versions of the KdV and NLS equations from SDYM.[1] But it seems no one tries to reduce SDYM to mKdV, see also [2].

In this regard, it seems very interesting that A.R. Shehata and J.F. Alzaidy were able to reduce SDYM to mKdV equation in their 2011 paper.[3] The following is a summary of their canonical reduction of SDYM:

The SDYM equations can be written in compact form as follows [3, p.148]:

$$P_t + [P, R] = 0, \tag{1}$$

$$R_x - Q_t - [Q, R] = 0. \tag{2}$$

Let P take the canonical form

$$P = \begin{pmatrix} 0 & k \\ -k & 0 \end{pmatrix} \tag{3}$$

$$R = \begin{pmatrix} 0 & -u_{xx} - 2u^3 \\ u_{xx} + 2u^3 & 0 \end{pmatrix}, \tag{4}$$

$$Q = \begin{pmatrix} 0 & u \\ -u & 0 \end{pmatrix}, \quad (5)$$

From eq. (5) then they obtain the mKdV equation:

$$u_t + 6u_x u^2 + u_{xxx} = 0 \quad (6)$$

Solution of KdV equation with Mathematica

The KdV equation can be written as follows [6]:

$$u_t + 6u_x u + u_{xxx} = 0 \quad (7)$$

Meanwhile the non-dimensional KdV equation and its solution are given by:

$$\begin{aligned} & \text{DSolve}[D[u[t, x], t] + D[u[t, x], \{x, 3\}] - 6u[t, x]D[u[t, x], x] == 0, u[t, x], \{t, x\}] \\ & \{\{u[t, x] \rightarrow \frac{1}{6C[2]} (C[1] - 8C[2]^3 + 12C[2]^3 \text{Tanh}[tC[1] + xC[2] + C[3]]^2)\}\} \\ & \{\{u[t, x] \rightarrow \frac{1}{6C[2]} (C[1] - 8C[2]^3 + 12C[2]^3 \text{Tanh}[tC[1] + xC[2] + C[3]]^2)\}\} \llbracket 1, 1, 2 \rrbracket \\ & \frac{C[1] - 8C[2]^3 + 12C[2]^3 \text{Tanh}[tC[1] + xC[2] + C[3]]^2}{6C[2]} \end{aligned}$$

Solution of modified KdV equation with Mathematica

Shehata and Alzaidy obtained mKdV equation [3]:

$$u_t + 6u_x u^2 + u_{xxx} = 0 \quad (8)$$

Its exact solution is given by:

$$\begin{aligned} & \text{DSolve}[D[u[t, x], t] + D[u[t, x], \{x, 3\}] - D[u[t, x], x]6u[t, x]^2 == 0, u[t, x], \{t, x\}] \\ & \{\{u[t, x] \rightarrow -C[2] \text{Tanh}[xC[2] + 2tC[2]^3 + C[3]]\}, \{u[t, x] \\ & \rightarrow C[2] \text{Tanh}[xC[2] + 2tC[2]^3 + C[3]]\}\} \end{aligned}$$

An implication of the proposed solution is that it is possible to consider hadrons as (a set of) KdV soliton, see for example [8]. This proposition apparently deserves further investigations.

It seems worth mentioning here that there are also other approaches to find solutions of KdV/mKdV equations for example using Backlund transformation [3][4], and also using numerical programming [9].

Concluding remarks

It is known for quite a long time that Self-Dual Yang Mills (SDYM) theory reduce to Korteweg-DeVries equation, but recently Shehata and Alzaidy have proved that SDYM reduces to modified KdV equation. Therefore, this paper discusses an exact solution of modified Korteweg-DeVries equation with Mathematica. An implication of the proposed solution is that it is possible to consider hadrons as (a set of) KdV soliton. This proposition apparently deserves further investigations.

References:

- [1] Jeremy Schiff. Self-Dual Yang Mills and the Hamiltonian Structures of Integrable Systems. arXiv:hep-th/9211070 (1992)
- [2] Keijiro Suzuki. Explorations of a self-dual Yang-Mills hierarchy. Diplomarbeit, Max Planck Institut für Dynamik und Selbstorganisation (Oct. 2006)
- [3] A.R. Shehata & J.F. Alzaidy. Canonical Reduction of the Self-Dual Yang-Mills Equations to Nonlinear Modified Korteweg-deVries Equations with Exact Solutions and its Conservation Laws. Int. Journal of Math. Analysis, Vol. 5, no. 3, 145-155 (2011)
- [4] Richard H. Enns & George C. McGuire. Nonlinear Physics with Mathematica for Scientists and Engineers. Berlin: Birkhäuser, 2001, p. 176-178.
- [5] Sadri Hassani. Mathematical Methods using Mathematica: For Students of Physics and Related Fields. New York: Springer-Verlag New York, Inc., 2003.
- [6] Eric Weisstein, <http://mathworld.wolfram.com/Korteweg-deVriesEquation.html>
- [7] Klaus Brauer. The Korteweg-deVries equation: History, exact solutions, and graphical representation (2000). URL: <http://www.usf.uni-osnabrueck.de/~kbrauer>
- [8] Miftachul Hadi & Hans J. Wospakrik. SU(2) Skyrme Model for Hadrons. Phys. J. IPS C8 (2004) 0514. URL: <http://hfi.fisika.net>
- [9] Mehri Sajjadian. Numerical solutions of Korteweg-deVries and Korteweg-deVries-Burger's equations using computer programming. arXiv:1209.1782 [math.NA] (2012)

Volume 12

10.18052/www.scipress.com/BSMaSS.12

An Exact Solution of Modified KdV (mKdV) Equation as a Reduction of Self-Dual Yang-Mills Theory

10.18052/www.scipress.com/BSMaSS.12.1

DOI References

[3] A.R. Shehata & J. F Alzaidy. Canonical Reduction of the Self-Dual Yang-Mills Equations to Nonlinear Modified Korteweg-deVries Equations with Exact Solutions and its Conservation Laws. Int. Journal of Math. Analysis, Vol. 5, no. 3, 145-155 (2011).

10.12732/ijpam.v94i3.5

[4] Richard H. Enns & George C. McGuire. Nonlinear Physics with Mathematica for Scientists and Engineers. Berlin: Birkhäuser, 2001, pp.176-178.

10.1007/978-1-4612-0211-0

From Sachs-Wolfe Acoustic Theorem to Fractal Laplace-Beltrami Operator

Victor Christianto*

ABSTRACT

According to Czaja et. al. [2], if one considers the acoustic field propagating in the radiation-dominated ($p=\epsilon/3$) universe of arbitrary space curvature ($K=0, \pm 1$), 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 will discuss what Laplace-Beltrami operator for curved space is and how this operator may be extended further to become fractal Laplace-Beltrami Operator. I will also discuss possible implications for dark energy observation.

Key Words: Sach-Wolfe, acoustic theorem, Laplace-Beltrami, fractal operator, dark energy.

A. Introduction

The Sachs-Wolfe theorem contains two separate results formulated for two different equations of state: the first for pressureless matter ($p=0$) and the second for an ultrarelativistic gas ($p=\epsilon/3$) [1]. According to Czaja, et. al. [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 ($p=\epsilon/3$) 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, formulated as a symbolic computation, is presented in the first section of this paper.

* Correspondence: Victor Christianto, Malang Institute of Agriculture, Malang – Indonesia. URL: http://researchgate.net/profile/Victor_Christianto. Email: victorchristianto@gmail.com

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 $x^{\{h,c,J,f\}}$:

$$g_{(\mathcal{RW})} = a^2(\eta) \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & \frac{\sin^2(\sqrt{K}\chi)}{K} & 0 \\ 0 & 0 & 0 & \frac{\sin^2(\sqrt{K}\chi)\sin^2(\vartheta)}{K} \end{bmatrix} \quad (1)$$

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

$$a(\eta) = \frac{\sin(\sqrt{K}\chi)}{\sqrt{K}}. \quad (2)$$

Let us define a new perturbation variable Y with the help of the second-order differential transformation of the density contrast d ,

$$\Psi(x^\sigma) = \frac{1}{\cos(\sqrt{K}\chi)} \frac{\partial}{\partial \eta} \left(\frac{K}{\tan^2(\sqrt{K}\chi)} \frac{\partial}{\partial \eta} \left(\frac{\tan^2(\sqrt{K}\chi)}{K} \cos(\sqrt{K}\chi) \delta(x^\sigma) \right) \right). \quad (3)$$

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

$$\frac{\partial^2}{\partial \eta^2} \Psi(x^\sigma) - \frac{1}{3} \varepsilon \Delta \Psi(x^\sigma) = 0, \quad (4)$$

with the Beltrami–Laplace operator Δ acting in this space,

$${}^{(3)}g = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \frac{\sin^2(\sqrt{K}\chi)}{K} & 0 \\ 0 & 0 & \frac{\sin^2(\sqrt{K}\chi)\sin^2(\vartheta)}{K} \end{bmatrix}. \quad (5)$$

The Beltrami–Laplace operator Δ is defined as follows:

$$\Delta = {}^{(3)}g_{mm} \nabla^m \nabla^n. \quad (6)$$

And it can be considered as an extension of Laplace operator for curved space. I will discuss this operator in the following section.

Sachs-Wolfe Acoustic Theorem

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

Proof of this theorem has been performed with Mathematica by Czaja, Golda, and Woszczyzna [2].

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

C. What is 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:

$$\nabla^2 f = \nabla \cdot \nabla f. \tag{7}$$

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

$$\nabla^2 f = \frac{1}{\sqrt{|g|}} \partial_i \left(\sqrt{|g|} g^{ij} \partial_j f \right). \tag{8}$$

D. Towards Laplace-Beltrami Operator for Fractional Brownian Surface

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]:

$$-\Delta(f) = \sum_{k=1}^{\infty} \lambda_k \langle f, \phi_k \rangle \phi_k, \quad (9)$$

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. Conclusions

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.

Since integrated Sachs-Wolfe effect can be related to dark energy observation, then we can also expect some kind of zigzagging in dark energy caused by fractional Brownian surface. These issues are left for future investigation.

Note:

*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)*

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 suggest here that 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.

Acknowledgement: Special thanks to an anonymous reviewer for his comments to the early version of this paper. This paper is part of unpublished dissertation by this author.

References

- [1] R. K. Sachs and A. M. Wolfe, "Perturbations of a Cosmological Model and Angular Variations of the Microwave Background," *The Astrophysical Journal*, **147**, 1967 pp. 73–90. doi: 10.1086/148982.
- [2] W. Czaja, Z. A. Golda, and A. Woszczyna, "The Acoustic Wave Equation in the Expanding Universe: Sachs–Wolfe Theorem," *The Mathematica Journal*, 2011. dx.doi.org/doi:10.3888/tmj.13–18. URL: <http://www.mathematica-journal.com/data/uploads/2011/10/CzajaGoldaWoszczyna.pdf> ; Also in arXiv:0902.0239 [cs.SC]. The commands can be downloaded from <http://drac.oa.uj.edu.pl/usr/woszcz/kody/acoucticRWcode.nb>
- [3] L. P. Grishchuk, "Discovering Relic Gravitational Waves in Cosmic Microwave Background Radiation." arXiv:0707.3319v4.
- [4] M. White and J. D. Cohn, "Resource Letter: TACMB-1: The Theory of Anisotropies in the Cosmic Microwave Background," *American Journal of Physics*, **70**(2), 2002 p. 106. arXiv: astro-ph/0203120v1.
- [5] U. Seljak and M. Zaldarriaga, "A Line of Sight Approach to Cosmic Microwave Background Anisotropies," *The Astrophysical Journal Supplement*, **469**, 1996 pp. 437–444. <http://arXiv.org/abs/astro-ph/9603033>.
- [6] S. Weinberg. *Cosmology*. New York: Oxford University Press Inc., 2008. URL: <http://meghnad.iucaa.ernet.in/~tarun/pprnt/teach/cosmology-Weinberg.pdf>
- [7] Z. Gelbaum and Mathew Titus, Simulation of Fractional Brownian Surface Spectral Synthesis on Manifolds. arXiv:1303.6377 [cs.CG]
- [8] T. Giannantonio. Measuring dark energy with the integrated Sachs-Wolfe effect. URL: <http://moriond.in2p3.fr/J08/proceedings/giannantonio.pdf>

Exploration

Extending Lehnert's Revised Quantum Electrodynamics to Fractal Media & Cantor Sets

Victor Christianto*

Malang Institute of Agriculture (IPM), Malang, Indonesia

ABSTRACT

In a series of papers, Bo Lehnert proposed a novel and revised version of quantum electrodynamics (RQED) based on Proca equations. However, as far as I know there is no paper yet for extending RQED to fractal media and Cantor Sets. Drawing similarity between Proca and Maxwell equations, I extend RQED further in the present paper based on a recent paper by Zhao *et al.* derived Maxwell equations on Cantor sets from 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. I also extend RQED to anisotropic fractal media based on the work of Martin Ostoja-Starzewski. It is hoped that this paper may stimulate further investigations and experiments for finding physics beyond Standard Model in fractal media. It may be expected to have some impact to fractal cosmology modeling too.

Keywords: Cantor sets, fractional vector calculus, Navier-Stokes, Durand, Maxwell equation, Proca equation, fractal cosmology.

1. Introduction

Conventional electromagnetic theory based on Maxwell's equations and quantum mechanics has been successful in its applications in numerous problems in physics, and has sometimes manifested itself in a good agreement with experiments. Nevertheless, as already stated by Feynman, there are unsolved problems leading to difficulties with Maxwell's equations that are not removed by and not directly associated with quantum mechanics [20]. Therefore QED, which is an extension of Maxwell's equations, also becomes subject to the typical shortcomings of electromagnetic in its conventional form. This reasoning makes a way for Revised Quantum Electrodynamics as proposed by Bo Lehnert.

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

* Correspondence: Victor Christianto, Independent Researcher http://researchgate.net/profile/Victor_Christianto.
Email: victorchristianto@gmail.com

and art. A rapidly growing field is to express electromagnetic wave equations in fractal media. An interesting piece in this regard is a paper by Martin Ostoja-Starzewski, where he is able to derive Maxwell equations in anisotropic fractal media [3]. Therefore it is reasonable to consider an extension of RQED to Cantor Sets and fractal media. That is the purpose of this paper.

In the meantime, it is known that Maxwell himself described his theory of electromagnetism based on elastic ether, therefore it seems worth to re-derive his equations from elasticity theory. Therefore, in the next section I will discuss 3 possible methods to link elasticity theory and Maxwell equations. The third section will discuss Lehnert's RQED. Then I will discuss Maxwell equations on Cantor sets. The fifth section will discuss how to extend Proca equations and RQED on Cantor Sets. The sixth section will discuss how to extend Proca equations and RQED on fractal media. The seventh section will discuss some implications for cosmology including dark matter and massive gravitational wave.

2. Review of 3 methods to derive Maxwell equations from elasticity theory

As far as I know there are at least 3 possible methods to connect elasticity theory and Maxwell equations. Here I will briefly discuss the methods proposed by Algirdas Maknickas, Valery Dmitriyev, and David Zareski.

a. Maknickas's approach [5]:

According to Maknickas, the classical electromagnetic field theory is based on similarity to the classic dynamic of solid continuum media. Therefore he thinks that it is required to consider a *micropolar extension* of electromagnetic field equations based on Cosserat media. In essence, besides the well-known four differential equations of Maxwell, Maknickas proposed additional four Maxwell equations for rotational components using micropolar elasticity analogy [5, p. 5-6]:

$$- \text{Micropolar Gauss's law for electric field: } \nabla \cdot C = \frac{\rho c}{\gamma_0}. \tag{1}$$

$$- \text{Micropolar Gauss's law for magnetic field: } \nabla \cdot G = 0. \tag{2}$$

$$- \text{Micropolar Maxwell-Faraday equation: } \nabla \times C = -\frac{\partial G}{\partial t}. \tag{3}$$

$$- \text{Micropolar Ampere's circuital law: } \nabla \times G = \beta_0 \left(J_G + \gamma_0 \frac{\partial C}{\partial t} \right). \tag{4}$$

b. Dmitriyev's approach [16, p.7]:

According to Dmitriyev, classical electrodynamics was found to correspond to incompressible linear elasticity. And this analogy has formal character. By using a new definition:

$$E = \kappa [c^2 \nabla \times (\nabla \times s) - f], \quad (3)$$

And defining the density j of electric current by

$$\mathcal{J} = -\kappa v \delta(x - x'), \quad (4)$$

Then he obtained the Maxwell equations:

$$\partial_t E - c \nabla \times (\nabla \times A) + 4\pi j = 0, \text{ and} \quad (5)$$

$$\nabla \cdot E = 4\pi q \delta(x - x'). \quad (6)$$

c. Zareski's approach [17-19]:

His model is based on the Navier-Stokes-Durand equation of elasticity, as follows:

$$\text{curl} \frac{C}{2} + (\sigma + \eta) \text{grad}(\text{div} \xi) + \eta \nabla^2 \xi + f = \partial_t (\rho \partial_t \xi). \quad (7)$$

Then he considers the particular case of conservative elasticity where the elastic medium is governed, by the following equation:

$$(\sigma + 2\eta) \text{grad}(\text{div} \xi) + f = 0. \quad (8)$$

From these equations, after some changes of variables, he recovers Maxwell equations. The above are 3 methods to connect elasticity theory to Maxwell's equations. Therefore it is appropriate to generalize them further to Proca equations for massive electrodynamics.

3. Lehnert's Revised Quantum Electrodynamics

Conventional electromagnetic theory based on Maxwell's equations and quantum mechanics has been successful in its applications in numerous problems in physics, and has sometimes manifested itself in a good agreement with experiments. Nevertheless, as already stated by Feynman, there are unsolved problems leading to difficulties with Maxwell's equations that are not removed by and not directly associated with quantum mechanics [20]. Therefore QED, which is an extension of Maxwell's equations, also becomes subject to the typical shortcomings of electromagnetic in its conventional form. This reasoning makes a way for Revised Quantum Electrodynamics as proposed by Bo Lehnert.

In a series of papers, Bo Lehnert proposed a novel and revised version of Quantum Electrodynamics, which he calls as RQED. His theory is based on the hypothesis of a nonzero electric charge density in the vacuum, and it is based on Proca-type field equations [20, p. 23]:

$$\left(\frac{1}{c^2} \frac{\partial^2}{\partial t^2} - \nabla^2 \right) A_\mu = \mu_0 J_\mu, \mu = 1, 2, 3, 4 \quad (9)$$

where

$$A_\mu = \left(A, \frac{i\phi}{c} \right), \quad (10)$$

With A and ϕ standing for the magnetic vector potential and the electrostatic potential in three-space. In three dimensions equation (9) in the vacuum results in [20, p.23]:

$$\frac{\text{curl}B}{\mu_0} = \varepsilon_0(\text{div}E)C + \frac{\varepsilon_0\partial E}{\partial t}, \quad (11)$$

$$\text{curl}E = -\frac{\partial B}{\partial t}, \quad (12)$$

$$B = \text{curl}A, \text{div}B = 0, \quad (13)$$

$$E = -\nabla\phi - \frac{\partial A}{\partial t}, \quad (14)$$

$$\text{div}E = \frac{\bar{\rho}}{\varepsilon_0}. \quad (15)$$

These equations differ from the conventional form, by a nonzero electric field divergence equation (15) and by the additional space-charge current density in addition to displacement current at equation (11). The extended field equations (11)-(15) are easily found also to become invariant to a gauge transformation.[20, p.23]

The main characteristic new features of the present theory can be summarized as follows [20, p.24]:

- a. The hypothesis of a nonzero electric field divergence in the vacuum introduces an additional degree of freedom, leading to new physical phenomena. The associated nonzero electric charge density thereby acts somewhat like a hidden variable.
- b. This also abolishes the symmetry between the electric and magnetic fields, and then the field equations obtain the character of intrinsic linear symmetry breaking.
- c. The theory is both Lorentz and gauge invariant.
- d. The velocity of light is no longer a scalar quantity, but is represented by a velocity vector of the modulus c .
- e. Additional results: Lehnert is also able to derive the mass of Z boson and Higgs-like boson.[21-23] These would pave an alternative way to new physics beyond Standard Model.

Now let us extend Lehnert's RQED to Cantor sets and fractal media. Such an extension may be found worthwhile, considering there is already a new proposal to extend QED to inhomogenous anisotropic media.[24] Nonetheless, my approaches as presented here are different from [24].

First we will review Maxwell equations on Cantor sets.

4. Review of 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]. Penrose also discusses Maxwell equations shortly in his book: *The Road to Reality*[10].

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

$$\text{- Gauss's law for the fractal electric field: } \nabla^\alpha \cdot D = \rho, \tag{16}$$

$$\text{- Ampere's law in the fractal magnetic field: } \nabla^\alpha \times H = J_a + \frac{\partial^\alpha D}{\partial t^\alpha}, \tag{17}$$

$$\text{- Faraday's law in the fractal electric field: } \nabla^\alpha \times E = -\frac{\partial^\alpha B}{\partial t^\alpha}, \tag{18}$$

$$\text{- magnetic Gauss's law in the fractal magnetic field: } \nabla^\alpha \cdot B = 0, \tag{19}$$

and the continuity equation can be defined as:

$$\nabla^\alpha \cdot J = -\frac{\partial^\alpha \rho}{\partial t^\alpha}, \tag{20}$$

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

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

$$\nabla^\alpha \cdot u = \text{div}^\alpha u = \frac{\partial^\alpha u_1}{\partial x_1^\alpha} + \frac{\partial^\alpha u_2}{\partial x_2^\alpha} + \frac{\partial^\alpha u_3}{\partial x_3^\alpha}, \tag{21}$$

$$\nabla^\alpha \times u = \text{curl}^\alpha u = \left(\frac{\partial^\alpha u_3}{\partial x_2^\alpha} - \frac{\partial^\alpha u_2}{\partial x_3^\alpha} \right) e_1^\alpha + \left(\frac{\partial^\alpha u_1}{\partial x_3^\alpha} - \frac{\partial^\alpha u_3}{\partial x_1^\alpha} \right) e_2^\alpha + \left(\frac{\partial^\alpha u_2}{\partial x_1^\alpha} - \frac{\partial^\alpha u_1}{\partial x_2^\alpha} \right) e_3^\alpha. \tag{22}$$

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

$$\nabla^\alpha \cdot r = \frac{\partial^\alpha r_R}{\partial R^\alpha} + \frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} + \frac{r_R}{R^\alpha} + \frac{\partial^\alpha r_z}{\partial z^\alpha}, \tag{23}$$

$$\nabla^\alpha \times r = \left(\frac{1}{R^\alpha} \frac{\partial^\alpha r_\theta}{\partial \theta^\alpha} - \frac{\partial^\alpha r_\theta}{\partial z^\alpha} \right) e_R^\alpha + \left(\frac{\partial^\alpha r_R}{\partial z^\alpha} - \frac{\partial^\alpha r_z}{\partial R^\alpha} \right) e_\theta^\alpha + \left(\frac{\partial^\alpha r_\theta}{\partial R^\alpha} + \frac{r_R}{R^\alpha} - \frac{1}{R^\alpha} \frac{\partial^\alpha r_R}{\partial \theta^\alpha} \right) e_z^\alpha. \quad (24)$$

5. Extending Lehnert's Proca Equations on Cantor Sets

Proca equations can be considered as an extension of Maxwell equations, and they have been derived in various ways. 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 derive the Proca equations on Cantor Sets, in accordance with Lehnert's approach as outlined above [20].

Therefore, by using the definitions in equations (21)-(24), we can arrive at Proca equations on Cantor sets from (11) through (15), as follows:

$$\frac{curl^\alpha B}{\mu_0} = \varepsilon_0 (div^\alpha E) C + \frac{\varepsilon_0 \partial^\alpha E}{\partial t^\alpha}, \quad (25)$$

$$curl^\alpha E = -\frac{\partial^\alpha B}{\partial t^\alpha}, \quad (26)$$

$$div^\alpha B = 0, \quad (27)$$

$$div^\alpha E = \frac{\bar{\rho}}{\varepsilon_0}. \quad (28)$$

where:

$$\nabla^\alpha \phi = -\frac{\partial^\alpha \vec{A}}{\partial t^\alpha} - \vec{E}, \quad (29)$$

$$\vec{B} = \nabla^\alpha \times \vec{A}, \quad (30)$$

and Del operator $\nabla^\alpha \phi$ can be defined as follows [11, p.2]:

$$\nabla^\alpha \phi = \frac{\partial^\alpha \phi}{\partial x_1^\alpha} e_1^\alpha + \frac{\partial^\alpha \phi}{\partial x_2^\alpha} e_2^\alpha + \frac{\partial^\alpha \phi}{\partial x_3^\alpha} e_3^\alpha. \quad (31)$$

To my best knowledge so far, the above extension of Lehnert's RQED 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.

One persistent question concerning these Proca equations is how to measure the mass of the photon. This question has been discussed in length by Tu, Luo & Gillies [15]. 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. [15, p.94]

Author (year)	Type of measurement	Limits on m_γ (g)
Ross et al. (1937)	Radio waves transmission overland	5.9×10^{-42}
Mandelstam & Papalexi (1944)	Radio waves transmission over sea	5.0×10^{-43}
Al'pert et al. (1941)	Radio waves transmission over sea	2.5×10^{-43}
Florman (1955)	Radio-wave interferometer	5.7×10^{-42}
Lovell et al. (1964)	Pulsar observations on flour flare stars	1.6×10^{-42}
Frome (1958)	Radio-wave interferometer	4.3×10^{-40}
Warner et al. (1969)	Observations on Crab Nebula pulsar	5.2×10^{-41}
Brown et al. (1973)	Short pulses radiation	1.4×10^{-33}
Bay et al. (1972)	Pulsar emission	3.0×10^{-46}
Schaefer (1999)	Gamma ray bursts	4.2×10^{-44}
	Gamma ray bursts	6.1×10^{-39}

From this table and also from other results as reported in [15], it seems that we can expect that someday photon mass can be observed within experimental bound.

6. Extending Revised Quantum Electrodynamics on Fractal Media

It is worth noting here, that Martin Ostoja-Starzewski has derived Maxwell equations in anisotropic fractal media using a different method.[3] Therefore it is interesting to find out how we can extend Lehnert's RQED to fractal media too.

First let us begin with some basic definitions as given by Ostoja-Starzewski [3]:

$$\nabla^D \phi = e_k \nabla_k^D \phi, \quad (32)$$

$$\text{div} f = \nabla^D \cdot f, \quad (33)$$

$$\text{curl} f = \nabla^D \times f. \quad (34)$$

Based on the above definitions, now I extend Lehnert's RQED to anisotropic fractal media case, as follows:

$$\frac{\text{curl}^D B}{\mu_0} = \varepsilon_0 (\text{div}^D E) C + \frac{\varepsilon_0 \partial^D E}{\partial t}, \quad (35)$$

$$\text{curl}^D E = -\frac{\partial^D B}{\partial t}, \quad (36)$$

$$\text{div}^D B = 0, \quad (37)$$

$$\text{div}^D E = \frac{\bar{\rho}}{\varepsilon_0}. \quad (38)$$

To the best of my knowledge, these extensions of Lehnert's RQED to Cantor sets and fractal media have never been proposed elsewhere before.

7. Some Implications for Astrophysics & Cosmology

Beside RQED's implications to Standard Model of Particles, it seems possible to consider that connecting Maxwell equations and elasticity theory can lead to far-reaching implications, such that new explanation of dark matter [17], possible massive gravitational wave [25], and also new explanation of dark energy as elastic strain fluid [26]. It may be expected to have some impact to cosmology modeling on fractal media too. Another possible direction of further research is micropolar fluid cosmology. It should be clear that applications of elasticity theory to cosmology will be fruitful. [27][28][29]

8. Conclusion

In a series of papers, Bo Lehnert proposed a novel and revised version of Quantum Electrodynamics (RQED) based on Proca equations. However, as far as I know there is no paper yet for extending his RQED to fractal media and Cantor Sets. Drawing similarity between Proca and Maxwell equations, in the present paper I extend RQED further based on a recent paper published at *Advances in High Energy Physics* (AHEP) journal, where 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. I also extend RQED to anisotropic fractal media based on the work of Martin Ostoja-Starzewski. It is hoped that this paper may stimulate further investigations and experiments in particular for finding physics beyond Standard Model in fractal media. 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 physics beyond Standard Model on Cantor sets. Instead, this paper is intended to stimulate further investigations and experiments, and their implications to fractal cosmology modeling.

Acknowledgments: I'd like to thank Dr. George Shpenkov for sending his books and papers. Special thanks to Dr. David Zareski for sending his excellent book too. Nonetheless, the ideas presented here are my sole responsibility.

Received March 04, 2016; Accepted March 15, 2016

References

- [1] Mandelbrot, B.B. 1989. Fractal geometry: what is it, and what does it do? *Proc. R. Soc. Lond. A.* 423, 3-16, URL: http://users.math.yale.edu/~bbm3/web_pdfs/fractalGeometryWhatIsIt.pdf; [1a] Mandelbrot, B.B. Fractals and the Geometry of Nature. *Encyclopedia Britannica*, URL: http://users.math.yale.edu/~bbm3/web_pdfs/encyclopediaBritannica.pdf
- [2] Zhao, Y., Baleanu, D., Cattani, C., Cheng, D-F., & Yang, X-J. 2013. Maxwell's equations on Cantor Sets: A Local Fractional Approach. *Advances in High Energy Physics* Vol. 2013 Article ID 686371, <http://dx.doi.org/10.1155/2013/686371>, <http://downloads.hindawi.com/journals/ahep/2013/686371.pdf>
- [3] Ostoja-Starzewski, Martin. 2012. Electromagnetism in anisotropic fractal media. *Z. Angew. Math. Phys.*(ZAMP)DOI 10.1007/s00033-012-0230-z . URL: http://mechanical.illinois.edu/media/uploads/web_sites/82/files/zamp_2012.20121002.506b39d642e987.85850489.pdf:[3a] Also in arXiv: 1106.1491 [math-ph], URL: <http://arxiv.org/pdf/1106.1491.pdf>.
- [4] Tajmar, M. 2008. Electrodynamics in Superconductor explained by Proca equations. arXiv:cond-mat/0803.3080
- [5] Maknickas, Algirdas. 'Spooky action at a distance' in the Micropolar Electromagnetic Theory. Dec. 5, 2014. <http://vixra.org/pdf/1411.0549v4.pdf>
- [6] Gondran, Michel. 2009. Proca equations derived from first principles. arXiv:0901.3300 [quant-ph], URL: <http://arxiv.org/pdf/0901.3300.pdf>
- [7] Blackledge, Jonathan M. 2007. An Approach to Unification using a Linear Systems Model for the Propagation of Broad-band Signals. *ISAST Transaction on Electronics and Signal Processing*, Vol. 1, No. 1, 2007. URL: <http://eleceng.dit.ie/papers/100.pdf>
- [8] Demir, Suleyman. 2013. Space-time algebra for the generalization of gravitational field equations. *Pramana* Vol. 80 No. 5 (Indian Academy of Sciences), May 2013, 811-823. URL: <http://www.ias.ac.in/pramana/v80/p811/fulltext.pdf>
- [9] Schwinger, Julian, DeRaad, Jr., Lester L., Milton, Kimball A., & Tsai, Wu-yang. 1998. *Classical Electrodynamics*. Reading, Massachusetts: Perseus Books. 591 p.

- [10] Penrose, Roger. 2004. *The Road to Reality: A Complete Guide to the Laws of the Universe*. London: Jonathan Cape. 1123 p. URL: <http://staff.washington.edu/freiz/penrose.pdf>
- [11] Yang, X.-J., Baleanu, D., & Tenreiro Machado, J.A. 2013. Systems of Navier-Stokes on Cantor Sets. *Mathematical Problems in Engineering* Vol. 2013, Article ID 769724, <http://dx.doi.org/10.1155/2013/769724>, URL: <http://www.hindawi.com/journals/mpe/2013/769724/>, or URL: http://recipp.ipp.pt/bitstream/10400.22/3455/1/ART_TenreiroMachado_2013_DEE.pdf
- [12] Christianto, Victor. 2014. A derivation of Gravitoelectromagnetic Proca equations in fractional space. *Prespacetime Journal*, May 2014. URL: www.prespacetime.com.
- [13] Christianto, Victor. 2015. London-Proca-Hirsch equations for electrodynamics of superconductors on Cantor Sets. *Prespacetime Journal*, November 2015. <http://www.prespacetime.com>
- [14] Baleanu, D., Tenreiro Machado, J.A., Cattani, C., Baleanu, M.C., & Yang, X.-J. 2014. Local Fractional Variational Iteration and Decomposition Methods for Wave Equation on Cantor Sets within Local Fractional Operators. *Abstract and Applied Analysis* Vol. 2014, Article ID 535048, <http://dx.doi.org/10.1155/2014/535048>; <http://downloads.hindawi.com/journals/aaa/2014/535048.pdf>
- [15] Tu, L.-C., Luo, J., & George T. Gillies. 2005. The mass of the photon. *Rep. Prog. Phys.* 68:77-130. (Institute of Physics Publishing), doi:10.1088/0034-4885/68/1/R02
- [16] Dmitriyev, Valery P. 2004. *Elasticity and electromagnetism*. URL: <http://aether.narod.ru/elastic1.pdf>
- [17] Zareski, David. 2015. Is Dark Matter a Particular State of the Ether?, *Intr. Res. J. Pure and Appl. Physics* Vol. 3 No. 3, pp. 1-7, Dec. 2015.
- [18] _____. 2015. *Unification of Physics by the Ether Elasticity Theory*. Saarbrücken, Germany: LAP Lambert Academic Publishing, 2015.
- [19] _____. 2014. Unification of Physics Theories by the Ether Elasticity Theory. *Global Journal of Science Frontier Research: A Physics and Space Science* Vol. 14 Issue 6, 2014.
- [20] Lehnert, Bo. 2012. A way to Revised Quantum Electrodynamics. *Progress in Physics*, April 2012, Vol. 2, <http://www.ptep-online.com>
- [21] _____. 2013. Higgs-Like Particle due to Revised Quantum Electrodynamics. *Progress in Physics*, July 2013, Vol. 3. <http://www.ptep-online.com>
- [22] _____. 2013. Potentialities of Revised Quantum Electrodynamics. *Progress in Physics*, October 2013, Vol. 4. <http://www.ptep-online.com>
- [23] _____. 2014. Mass-Radius Relations of Z and Higgs-like Bosons. *Progress in Physics*, Vol. 10 Issue 1, January 2014, <http://www.ptep-online.com>
- [24] Lopez, Adrian E. Rubio, & Fernando C. Lombardo. 2015. Quantum Electrodynamics of inhomogeneous anisotropic media. EPJ. Also in arxiv:1411.7758 [hep-th].
- [25] Radicella, N., & Tartaglia, A. 2009. Massive gravitational waves from the Cosmic Defect Theory. Arxiv:0911.3365 [gr-qc]
- [26] Radicella, N., Sereno, M., & Tartaglia, A. 2012. Dark energy as an elastic strain fluid. MNRAS Advanced Access, Dec. 5, 2012
- [27] Levrino, L., & Tartaglia, A. 2012. From the elasticity theory to cosmology and vice versa. arXiv:1205.5577 [gr-qc].
- [28] Altenbach, H., & Eremeyev, V.A. 2013. Cosserat Media. <http://www.researchgate.net>
- [29] Maugin, G.A. & Metrikine, A. V. 2010. *Mechanics of Generalized Continua: One Hundred Years after the Cosserats*. Germany: Springer Science+Business Media, 2010

Article

A Derivation of GravitoElectroMagnetic Proca-type Equations in Fractional Space

Victor Christianto*

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 Del 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 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 ± 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 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 [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.

* Correspondence: Victor Christianto, <http://www.sciprint.org>, <http://independent.academia.edu/VChristianto>
Email: victorchristianto@gmail.com or admin@sciprint.org. Phone: (62) 341-403205.

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]:

$$\operatorname{div}_D D = \rho_v, \tag{1}$$

$$\operatorname{div}_D B = 0, \tag{2}$$

$$\operatorname{curl}_D E = -\frac{\partial B}{\partial t}, \tag{3}$$

$$\operatorname{curl}_D H = J + \frac{\partial D}{\partial t}, \tag{4}$$

and the continuity equation in fractional space as:

$$\operatorname{div}_D J = -\frac{\partial \rho_v}{\partial t}, \tag{5}$$

where div_D and curl_D are defined as follows [1]:

$$\operatorname{div}_D F = \nabla_D \cdot F = \frac{\partial F_x}{\partial x} + \frac{1}{2} \frac{(\alpha_1 - 1) F_x}{x} + \frac{\partial F_y}{\partial y} + \frac{1}{2} \frac{(\alpha_2 - 1) F_y}{y} + \frac{\partial F_z}{\partial z} + \frac{1}{2} \frac{(\alpha_3 - 1) F_z}{z}, \tag{6}$$

$$\operatorname{curl}_D F = \nabla_D \times F = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \frac{\partial}{\partial x} + \frac{1}{2} \frac{\alpha_1 - 1}{x} & \frac{\partial}{\partial y} + \frac{1}{2} \frac{\alpha_2 - 1}{y} & \frac{\partial}{\partial z} + \frac{1}{2} \frac{\alpha_3 - 1}{z} \\ F_x & F_y & F_z \end{vmatrix}, \tag{7}$$

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]

$$\nabla \cdot \vec{E} = \frac{\rho}{\epsilon_0} - \kappa^2 \phi, \quad (8)$$

$$\nabla \cdot \vec{B} = 0, \quad (9)$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}, \quad (10)$$

$$\nabla \times \vec{B} = \mu_0 j + \epsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} + \kappa^2 \vec{A}, \quad (11)$$

where:

$$\nabla \phi = -\frac{\partial \vec{A}}{\partial t} - \vec{E}, \quad (12)$$

$$\vec{B} = \nabla \times \vec{A}, \quad (13)$$

$$\kappa = \frac{mc_0}{\hbar}. \quad (14)$$

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:

$$div_D \vec{E} = \frac{\rho}{\epsilon_0} - \kappa^2 \phi, \quad (15)$$

$$div_D \vec{B} = 0, \quad (16)$$

$$curl_D \vec{E} = -\frac{\partial \vec{B}}{\partial t}, \quad (17)$$

$$curl_D \vec{B} = \mu_0 j + \epsilon_0 \mu_0 \frac{\partial \vec{E}}{\partial t} + \kappa^2 \vec{A}, \quad (18)$$

where:

$$\nabla_D \phi = -\frac{\partial \bar{A}}{\partial t} - \bar{E}, \quad (19)$$

$$\bar{B} = \text{curl}_D \bar{A}, \quad (20)$$

and Del operator ∇_D can be defined as follows [1]:

$$\nabla_D = \left(\frac{\partial}{\partial x} + \frac{1}{2} \frac{\alpha_1 - 1}{x} \right) \hat{x} + \left(\frac{\partial}{\partial y} + \frac{1}{2} \frac{\alpha_2 - 1}{y} \right) \hat{y} + \left(\frac{\partial}{\partial z} + \frac{1}{2} \frac{\alpha_3 - 1}{z} \right) \hat{z}. \quad (21)$$

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):

$$\nabla \cdot \vec{E}_g = -\rho_e - \kappa_g^2 \phi, \quad (22)$$

$$\nabla \cdot \vec{H}_g = 0, \quad (23)$$

$$\nabla \times \vec{E}_g = -\frac{\partial \vec{H}_g}{\partial t}, \quad (24)$$

$$\nabla \times \vec{H}_g = -J_g^e + \frac{\partial \vec{E}_g}{\partial t} + \kappa_g^2 \vec{A}_g^e, \quad (25)$$

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 κ_g represents the inverse Compton wavelength of the graviton, [8]

$$\kappa_g = \frac{m_g c}{\hbar}. \quad (26)$$

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:

$$\text{div}_D \vec{E}_g = -\rho_e - \kappa_g^2 \phi, \quad (27)$$

$$\text{div}_D \vec{H}_g = 0, \quad (28)$$

$$\text{curl}_D \vec{E}_g = -\frac{\partial \vec{H}_g}{\partial t}, \quad (29)$$

$$\text{curl}_D \vec{H}_g = -J_g^e + \frac{\partial \vec{E}_g}{\partial t} + \kappa_g^2 \vec{A}_g^e, \quad (30)$$

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]:

$$\nabla_D^2 E - \mu\epsilon \frac{\partial^2 E}{\partial t^2} = 0, \quad (31)$$

$$\nabla_D^2 H - \mu\epsilon \frac{\partial^2 H}{\partial t^2} = 0. \quad (32)$$

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:

$$\nabla_D^2 = \frac{\partial^2}{\partial x^2} + \frac{\alpha_1 - 1}{x} \frac{\partial}{\partial x} + \frac{\partial^2}{\partial y^2} + \frac{\alpha_2 - 1}{y} \frac{\partial}{\partial y} + \frac{\partial^2}{\partial z^2} + \frac{\alpha_3 - 1}{z} \frac{\partial}{\partial z}. \quad (33)$$

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 Mendeleev'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.

References

- [1] Zubair, M., Mughal, M.J., Naqvi, Q.A., & Rizvi, A.A. 2011. Differential Electromagnetic Equations in Fractional Space. *Progress in Electromagnetic Research*, Vol. 114, 255-269. URL: <http://www.jpier.org/PIER/pier114/15.11011403.pdf>
- [2] Tarasov, Vasily E. 2008. Fractional vector calculus and fractional Maxwell equations. *Annals of Physics* 323, 2756-2778, URL: <http://theory.sinp.msu.ru/~tarasov/PDF/AP2008.pdf>; [2a] also in arXiv: 0907.2363 [math-ph], URL: <http://arxiv.org/abs/0907.2363>
- [3] Ostoja-Starzewski, Martin. 2012. Electromagnetism in anisotropic fractal media. *Z. Angew. Math. Phys.* (ZAMP) DOI 10.1007/s00033-012-0230-z . URL: http://mechanical.illinois.edu/media/uploads/web_sites/82/files/zamp_2012.20121002.506b39d642e987.85850489.pdf; [3a] Also in arXiv: 1106.1491 [math-ph], URL: <http://arxiv.org/pdf/1106.1491.pdf>.
- [4] Tajmar, M. 2008. Electrodynamics in Superconductor explained by Proca equations. arXiv:cond-mat/0803.3080
- [5] de Matos, C.J., & Tajmar, M. 2006. Gravitomagnetic London Moment and the Graviton Mass inside a Superconductor. arXiv:gr-qc/0602591
- [6] Gondran, Michel. 2009. Proca equations derived from first principles. arXiv:0901.3300 [quant-ph], URL: <http://arxiv.org/pdf/0901.3300.pdf>
- [7] Blackledge, Jonathan M. 2007. An Approach to Unification using a Linear Systems Model for the Propagation of Broad-band Signals. *ISAST Transaction on Electronics and Signal Processing*, Vol. 1, No. 1, 2007. URL: <http://eleceng.dit.ie/papers/100.pdf>
- [8] Demir, Suleyman. 2013. Space-time algebra for the generalization of gravitational field equations. *Pramana* Vol. 80 No. 5 (Indian Academy of Sciences), May 2013, 811-823. URL: <http://www.ias.ac.in/pramana/v80/p811/fulltext.pdf>
- [9] Schwinger, Julian, DeRaad, Jr., Lester L., Milton, Kimball A., & Tsai, Wu-yang. 1998. *Classical Electrodynamics*. Reading, Massachusetts: Perseus Books. 591 p.
- [10] Penrose, Roger. 2004. *The Road to Reality: A Complete Guide to the Laws of the Universe*. London: Jonathan Cape. 1123 p. URL: <http://staff.washington.edu/freitz/penrose.pdf>
- [11] Zubair, M., Mughal, M.J., & Naqvi, Q.A. 2011. On electromagnetic wave propagation in fractional space. *Nonlinear Analysis: Real World Applications*. doi:10.1016/j.nonrwa.2011.04.010.
- [12] Shpenkov, George P. 2013. *Dialectical View of the World: The Wave Model (Selected Lectures)*. Volume I: Philosophical and Mathematical Background. URL: <http://shpenkov.janmax.com/Vol.1.Dialectics.pdf>
- [13] _____. 2006. An Elucidation of the Nature of the Periodic Law, Chapter 7 in "*The Mathematics of the Periodic Table*", Rouvray, D. H. and King, R. B., ed., Nova Science Publishers, NY, pp. 119-160

- [14] Shpenkov, George P. & Kreidik, Leonid G. 2005. Schrödinger's error in principle. *Galilean Electrodynamics* Vol. 16, No. 3, 51-56, (2005); URL: <http://shpenkov.janmax.com/Blunders.pdf>
- [15] Kreidik, Leonid G., & Shpenkov, George P. 2002. Important Results of Analyzing Foundations of Quantum Mechanics. *Galilean Electrodynamics & QED-EAST*, Vol. 13, Special Issues No. 2, 23-30; URL: <http://shpenkov.janmax.com/QM-Analysis.pdf>
- [16] Christianto, Victor. 2014. A Review of Schrodinger Equation and Classical Wave Equation. To appear at *Prespacetime Journal*, May 2014. URL: www.prespacetime.com. Also available at: <http://vixra.org/abs/1404.0020>
- [17] Tarasov, Vasily E. 2005. Wave Equation for Fractal Solid String. *Mod. Phys. Lett. B*, Vol. 19, No. 15, 721-728. URL: <http://theory.sinp.msu.ru/~tarasov/PDF/MPLB2005-1.pdf>
- [18] Hu, Ming-Sheng, Agarwal, Ravi P., & Yang, Xiao-Jun. 2012. Local Fractional Fourier Series with Application to Wave Equation in Fractal Vibrating String. *Abstract and Applied Analysis* Vol. 2012, Article ID 567401, 15p. doi:10.1155/2012/567401. URL: <http://downloads.hindawi.com/journals/aaa/2012/567401.pdf>
- [19] He, Ji-Huan, & Li, Zheng-Biao. 2012. Converting Fractional Differential equations into Partial Differential Equations. *Thermal Science*, Year 2012, Vol. 16, No. 2, 331-334, URL: <http://thermalscience.vinca.rs/pdfs/papers-2011/TSCI110503068H.pdf>