the general science journal

INDEX - Electromagnetic mechanics of elementary particles

(The Trispatial Model)

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➔ **Cliquer ici pour version française**

➔ **Haga clic aquí para versión en español**

➔ **Hier anklicken für die deutsche Übersetzung**

Research project undertaken in 1998 to demonstrate the validity of the reasoning method by perception of coherences, explained in the research project on general neurolinguistics that emerged from the General Semantics developed by Alfred Korzybski, when the properties of the multilayer neural network of the neocortex are correctly used.

This index is structured as follows. Links to all papers are ordered in reverse order of formal journal publication, starting with the link to the texts of the initial conference presentation and of the paper submitted at Congress-2000 in July of 2000, which are located at the end of the index, except for the series of articles published in 2013 in an engineering journal, which are listed in their order of publication in their separate section.

Except for Noel Coughlin's presentation that leads directly to his videos on Daniel Ari Friedman's YouTube channel, all links lead to a presentation page of the article following which the text of the article is provided. A link to the original article published in a journal or book collection is also present in this entry page, allowing direct access the journal site and to the original article available on their site.

The geometric framework that made the establishment of this corpus possible was not arbitrarily introduced. Maxwell formulated his electromagnetic theory of 1865 directly within Hamilton's quaternion geometric framework that directly accommodated the rigid triple orthogonality of the **E** and **B** fields and the direction of propagation of light energy at velocity **c** in vacuum that he had concluded to. This geometric framework, involving the rigid structural perpendicularity of Hamilton's three unit vectors $i=j=k=\sqrt{-1}=1\angle 90°$, from which emerged the trispatial geometry, was ideally suited for the purpose. When his equations were rewritten in ordinary Cartesian vectors by Heaviside and Gibbs in the 1880s, this foundational rigid structural geometric property and its first breach beyond the complex plane were lost: the unit vectors retained their perpendicularity only by convention rather than by rigid algebraic structure. What the trispatial geometry restores is precisely the rigid quaternionic coordinates structure that Maxwell had encoded from the outset, extending Hamilton's $i=j=k=\sqrt{-1}=1\angle 90°$ minor unit vectors to full 3D major unit space vectors $I=J=K=\sqrt{-1}=1\angle 90°$, mapping normal 3D X-space with major unit vector I and two new 3D configuration spaces Y and Z mapped over with major unit vectors J and K.

A two-semester course, meant for third-year university level that integrates all aspects of the electromagnetic mechanics of elementary particles from first principles, is now freely available: Master Index

Interested students are invited to download all 28 chapters of this course and its master index and store them on a flash drive for easy continued access. In our day and age of fleeting fashion trends, there is no saying how long this course will remain in free access or even outright available. This course is not immune to being dumped as Maxwell's quaternionic geometric treatment of electromagnetic energy was in the 1880's, which led to electromagnetic mechanics to also being dumped in 1907. So, if interested, as the saying goes: Better safe than sorry.

Correlation of the electromagnetic mechanics of elementary particles with Buckminster Fuller's Synergetics

Correlation by Noel Coughlin of the Electromagnetic Mechanics of elementary particles, among other developments by other researchers, with Synergetics, which is the empirical study of systems in transformation developed by Buckminster Fuller, and from which Noel's deep study and further conclusions show how vector sums of close-packed tetrahedral Synergetic structures lead to numerous values corresponding to well established physical constants, and to just as well established characteristic values of the restricted set of stable elementary electromagnetic particles that interact at the subatomic level of magnitude, which convincingly leads to the conclusion that a unified field theory may now be within reach.

It was after Arthur Young, who was the only student of Oswald Veblen, who was the only teacher of relativistic theory at Princeton in 1925, suggested to him that to establish a unified field theory, he should begin by learning the geometric and numerical patterns of Synergetics and then should learn electromagnetic theory in view of clearly linking Synergetics with physical reality, which kept him focused on this unification project.

The successful outcome of his project is summarily described by himself in a conversation with Daniel Ari Friedman presented in the following video (Duration: about one hour and a half).

In particular, Noel explains how the numerical values of the gravitational constant (G=6.673) and Planck's constant (h=6.626) astonishingly emerge from vectorial sums of the tetrahedral complexes of Buckminster Fuller's Synergetics.

- Noel Coughlin: "Origins of gravity, electromagnetism and the inverse square law"

In the following video, Noel explains in particular how the inverse of the fine structure constant ($1/\alpha = 137.0359997$) emerges out of Synergetics vector sums, which in electromagnetic mechanics is the number of times that the Compton wavelength of the electron rest mass energy (λ_c) enters the length of the Bohr orbit of the hydrogen atom $2\pi a_0 / \lambda_c = 1/\alpha = 137.0359997$, whose orbit is located at the mean distance of the ground state orbital of the hydrogen atom.

Squaring this value reveals the figure 18778.86523 which is astonishingly close to the number of times that the energy of the magnetic half of the invariant rest mass of the electron oscillates during one cycle of the Bohr orbit of the electron at its hypothetical electromagnetic velocity (2187647.56821 m/s) per period of 1.51986E-16th of a second (amounting to 1.235589976E20 Hz), which is 18779.24022 times (duration of the video: about one hour):

- Noel Coughlin: "Examining and Rectifying the Error in Heisenberg's Uncertainty Principle"

In summary, Synergetics proposes that all elementary particles and atomic structures existing in the universe could be represented by assemblies of close packed spheres, each enclosing a tetrahedron whose edges would then reach isometric unity and whose vertices would touch each other through the symbolic walls of the spheres, to be addable as unit vector sums if their temperature was brought to absolute zero Kelvin. It is from this idealized configuration of the carbon atom, with its four valance electrons established as the vertices of an idealized tetrahedron circumscribed in an enclosing sphere that the Carbon-60 spherical molecule was discovered in 1985, inspired by Buckminster Fuller's research, and that was given his name to honor his contribution.

It is from these idealized potential isometric structures, that would theoretically predate time and space that physical constants and other characteristics of elementary electromagnetic particles surprisingly emerge from vector sums of such assemblies of close packed spheres each enclosing a tetrahedron. These physical constants and characteristics of elementary particles have now been experimentally confirmed, and their electromagnetic structures and interactions at the subatomic level of magnitude are now described by the electromagnetic mechanics of elementary particles.

The most surprising constant that emerges from Synergetics is the "practically exact" electromagnetic oscillation frequency of the magnetic half of the electron rest mass energy previously mentioned, that is, 18778.86523 from Synergetics and 18779.24022 per period of 1.51986E-16th of a second from electromagnetic mechanics, which is the well known invariant frequency of the rest mass energy of the electron 1.235589976E20 Hz.

This separate calculation of the same invariant electromagnetic frequency of the electron rest

mass energy from both geometric Synergetics vector sums and from electromagnetic mechanics is so specific and precise that it is very difficult not to see here a clear causal bridge between electromagnetic mechanics and this apparently underlying synergetic geometry, that needs to be further analyzed, all the more so, since the tetrahedral structure seems to shed new light on the possible origin of fundamental energy.

As put in perspective by Buckminster Fuller, a tetrahedron made of equal sticks is the simplest isotropic volume that cannot collapse on itself. Not collapsing on itself for any structure involves a stress or tension (energy) to maintain the volume. Noel speaks of these sticks as "unit vectors" all of isotropic unit length at zero-Kelvin that all touch each other at their vertices. A vector being defined as "a quantity with a magnitude and a direction", sums of these unit energy vectors may well be the fundamental energy quanta at the origin of the minimum of two 1.022 MeV photons required to initiate the production of matter in the universe, as analyzed in the paper on our Electromagnetic Universe.

But the tetrahedral energy quanta are captive of their non-collapsible individual tetrahedral structures and are not free moving like the energy of electromagnetic photons. More research needs to be made to possibly identify at what level of complexity or temperature some assembly of these close packed spherical structures become unstable enough to collapse and liberate some of this energy along the fracture area.

The only pending issue would then be whether or not life, with the extraordinary engineering feat of the life sustaining energy producing ATP molecule constantly regenerated by means of the mitochondrial electron transport chain and its extraordinary rotating proton engine, as documented by Fritz Lewertoff, can also be emergent from Synergetics.

Example of numerical volumetric measurement simplification

Measuring the series of close packed tetrahedral volumes that are in isotropic vectorial equilibrium, grounded on the Cartesian cube unit Example with 1 meter edge		Measuring the series of close packed tetrahedral volumes that are in isotropic vectorial equilibrium, grounded on the synergetic tetrahedral cubic unit Example with 1 meter edge	
Structures in Isotropic vector equilibrium	Irrational numerical volume value in cubic meters m^2	Structures in Isotropic vector equilibrium	Integer numerical volume value in cubic tetrahedron units
Tetrahedron	0.1178…	Tetrahedron	1
Octahedron	0.4714…	Octahedron	4
Cuboctahedron	2.357…	Cuboctahedron	20
Tetrakaidecahedron	11.313…	Tetrakaidecahedron	96
Truncated tetrahedron	2.7105	Truncated tetrahedron	23
Cube edge √2=1.414214…		Cube edge √2=1.414214…	24
With 2 meters edge		With 2 meters edge	
Tetrahedron	0.9428...	Tetrahedron	8
Octahedron	3.712...	Octahedron	32
Cuboctahedron	18.856...	Cuboctahedron	160
Tetrakaidecahedron	90.508...	Tetrakaidecahedron	768
Truncated tetrahedron	21.684	Truncated tetrahedron	184
Cube edge √8=2.828428…		Cube edge √8=2.82428…	192

YouTube channels on Synergetics

Noel Coughlin: https://www.youtube.com/@noelcoughlin8263

Daniel Ari Friedman: https://www.youtube.com/@danielarifriedman

- Someone had an AI review carried out of this preprint on June 30 of 2025. Here is a link to this AI review

AI Review of "Correlation of the electromagnetic mechanics of elementary particles with Buckminster Fuller's Synergetics"

From $E=m_0c^2$ in normal space to $E=m_0c_Ic_K$ in the complex configuration Spaces

Final synthesis of the electromagnetic mechanics project

Establishment of the electromagnetic oscillation characteristics of the stabilized energy quantum of the electron invariant rest mass and of that of its varying carrying energy within their complex configuration spaces, that admit the presence of no physical singularities, given that all energy quanta of which matter and free moving energy are made reach stable stationary action oscillation states at energy levels way below the range at which singularities could develop.

- ***From $E=m_0c^2$ in normal space to $E=m_0c_Ic_K$ in the complex configuration Spaces***

Michaud, A. (2024) *From $E=m_0c^2$ in normal space to $E=m_0c_Ic_K$ in the complex configuration Spaces.* International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X. July, 2024. Volume 20, Issue 7. PP. 532-572.

- ***De $E=m_0c^2$ dans l'espace normal à $E=m_0c_Ic_K$ dans les espaces complexes de configuration***
- ***De $E=m_0c^2$ en el espacio normal a $E=m_0c_Ic_K$ en los espacios de configuración complejos***
- ***Von $E=m_0c^2$ im Normalraum zu $E=m_0c_Ic_K$ in den komplexen Konfigurationsräumen***

Critical Analysis of the Origins of Heisenberg's Uncertainty Principle

Analysis of the initial stages of the logical process followed by Louis de Broglie in establishing the electron phase wave equation in his 1924 thesis, which triggered the development of Wave Mechanics when Erwin Schrödinger formalized this concept with his vectorial wave equation. This development was soon followed by Quantum Mechanics, when Schrödinger proved that the Matrix Mechanics independently developed by Werner Heisenberg was equivalent to Wave Mechanics; with both theories leaving room for some degree of uncertainty as to the physical localization of the moving electron. This is what led Heisenberg to also formalize the Uncertainty Principle to take this situation into account. We will analyze in this article the reason why the phase-wave velocity established by de Broglie generated this uncertainty in the localization of the moving electron in light of the current state of knowledge on the behavior of the electron in motion, in view of establishing the relevance of maintaining the Uncertainty Principle in the study of the subatomic level of magnitude.

Analysis of the historical use of the wrong frequency that gave rise to the concept of a wave group to represent the electron's momentum energy developed by Louis de Broglie and to the Uncertainty principle developed by Werner Heisenberg.

- **Critical Analysis of the Origins of Heisenberg's Uncertainty Principle**

Michaud, A. (2024) *Critical Analysis of the Origins of Heisenberg's Uncertainty Principle.* Journal of Modern Physics. **15**, No. 6. 765-795.

- Analyse critique des origines du Principe d'incertitude de Heisenberg
- Análisis crítica de los orígenes del Principio de Incertidumbre de Heisenberg
- Kritische Analyse der Ursprünge von Heisenbergs Unschärferelation

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Evolution from the Complex Plane to the Quaternion Coordinate System to the Trispatial Geometry

The object of this article is a comparative analysis of the geometric characteristics of the 2D unit vector set of the complex plane as used in Quantum Mechanics and in the treatment of electric LC circuits, of the 3D unit vector set of Hamilton's hypersphere as used in quantum theory and finally of the 3x3D unit vector set of the trispatial geometry as used in electromagnetic mechanics. Analysis of the implications of extending the use of the hypersphere coordinate system to the treatment of LC circuits and to the traditional 3D Cartesian coordinate system, and of the consequences of using a unique property of the vectorial cross product of the quaternion complex unit vectors of reversing the direction of application of the resulting real unit vector in the development of electromagnetic mechanics by means of the trispatial geometry.

- Evolution From the Complex Plane to the Quaternion Coordinate System to the Trispatial Geometry

Michaud, A. (2024) *Evolution From the Complex Plane to the Quaternion Coordinate System to the Trispatial Geometry.* International Journal of Engineering Research and Development e-ISSN: 2278-067X, **p**-ISSN: 2278-800X. March 2024. Volume 20, Issue 3. pp. 108-130

- Évolution du plan complexe vers le système de coordonnées du Quaternion jusqu'à la géométrie trispatiale
- Evolución del plano complejo al sistema de coordenadas del cuaternión y a la geometría tresespacial
- Entwicklung von der komplexen Ebene zum Quaternion-Koordinatensystems zur dreiräumlichen Geometrie

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Electromagnetic and Kinematic Mechanics Synchronized in their Common Vector Field: A Mathematical Model

Final version

Final expanded version of an article formally published in May of 2023 republished upon invitation in September 2023 that was meant to establish the clear mathematical relations that exist between kinematic mechanics and electromagnetic mechanics, in accordance with Wilhelm Wien's project formulated in 1901. This harmonization was made possible by the integration in kinematic mechanics of the mass increase of the electron as a function of its velocity, as measured by Walter Kaufmann by means of his bubble-chamber experiments, which was confirmed by H. A. Lorentz and all the leading edge physicists who analyzed his data; and the establishment the electromagnetic

structures and mutual interactions of the restricted set of stable elementary particles within the framework of trispatial vector geometry, which emerges naturally from the triply orthogonal relationship that Maxwell discovered between the magnetic field, the electric field and the direction of motion of light in a vacuum. Description of the local trispatial vector complexes of the restricted set of stable elementary particles, of their stable combinations up to the atomic level and finally, of the four stable stationary resonance levels of the trispatial vector field. Analysis of the experimental confirmation of the magnetic nature of the electron spin; and establishment of its relation with the concept of magnetic monopole, of covalent molecular bounding, of the filling of electronic orbitals by electron pairs, of the generation of Cooper pairs, and of the related interpretation of the Stern-Gerlach experiment.

- **Electromagnetic and Kinematic Mechanics Synchronized in their Common Vector Field**

Michaud, A. (2023) *Electromagnetic and Kinematic Mechanics Synchronized in their Common Vector Field: A Mathematical Relation*. In: Dr. Madogni Vianou Irenee, Editor. Current Perspective to Physical Science Research Vol. 3. November 23, 2023, Page 55-131

- **Mécaniques électromagnétique et cinématique synchronisées dans leur champ vectoriel commun**
- **Mecánicas Electromagnética y Cinemática Sincronizadas en sus Campo Vectorial Común**
- **Elektromagnetische und kinematische Mechaniken synchronisierten in ihrem gemeinsamen Vektorfeld**

Introduction to synchronized kinematic and electromagnetic mechanics

Introduction to fundamental physics according to the parallel harmonization of kinematic and electromagnetic mechanics, in accordance with Wilhelm Wien's project, which involved the integration in kinematic mechanics of the mass increase of the electron as a function of its velocity, as measured by Walter Kaufmann with his bubble-chamber experiments, and analyzed and confirmed by H. A. Lorentz and all the leading edge physicists who then re-analyzed this data.

Description of the four stationary intensity levels of the trispatial vector field and of their vector complexes.

- **Introduction to synchronized kinematic and electromagnetic mechanics**

Michaud, A. (2023) *Introduction to synchronized kinematic and electromagnetic mechanics*. Journal of Modern Physics, **14**, 876-932

- **Introduction à la mécanique cinématique et électromagnétique synchronisée**
- **Introducción a la mecánica cinemática y electromagnética sincronizada**

- Einführung in die synchronisierte kinematische und elektromagnetische Mechanik

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Demystifying the Lorentz Force Equation

The Lorentz force equation $F = q(\boldsymbol{E} + \boldsymbol{v}\times\boldsymbol{B})$, which has been used by the engineering community since the early 20th century to control the motion of electrons on free trajectories in a wide range of technical applications, is a generalized equation that was originally developed by Hendrik Antoon Lorentz at the beginning of the 20th century, and that treats in a single formulation, two very different aspects of the behavior of free-moving electrons. This article aims to put in perspective the historical context in which the equation was developed, and to clarify in which ways its two different aspects can be clearly separated for practical computational purposes and use in fundamental research in physics, to help reconcile classical/relativistic mechanics and quantum mechanics with electromagnetism, and in particular how its first term can be related to gravitation while its second term can be related to measurable mass from the electromagnetic perspective.

- Demystifying the Lorentz Force Equation

Michaud, A. (2022) *Demystifying the Lorentz Force Equation*. Journal of Modern Physics, Vol.13 No.5, May 2022, 776-838 DOI: 10.4236/jmp.2022.135046

- Démystification de l'équation de force de Lorentz

- Desmistificación de la ecuación de fuerza de Lorentz

- Entmystifizierung der Lorentz-Kraftgleichung

Our Electromagnetic Universe

Hypothesis of the progressive establishment and growth of the Universe, strictly from electromagnetic considerations, as suggested by Einstein towards the end of his life. Discussion of the conflicting relations observed between the various current black holes and Big Bang theories. Discussion of the possibility of a progressive adiabatic energy increase in the universe from a hypothetical zero energy level in vacuum at the beginning of the universe, as an alternate solution to the Quantum Field Theory (QFT) postulated stable conservative zero-point energy level in vacuum. Proposal of an alternate process for the origin of the Universe grounded on an expanded space geometry emerging from Maxwell's initial interpretation of the relation between the electric and magnetic **E** and **B** fields, leading to a new perspective on the objective and subjective aspects of the time dimension.

An expanded version of an article initially published in 2016 was republished upon invitation in 2021 as a book chapter as an expanded final version under the title "*Our Electromagnetic Universe*" in book titled "*Newest Updates in Physical Science Research Vol. 12*" which is part of a collection that pre-selects papers deemed worthy of attention in the global offer, to make them more immediately available to the community.

- Our Electromagnetic Universe

Michaud, A. (2021) *Our Electromagnetic Universe*. In: Dr. Mohd Rafatullah, Editor. Newest Updates in Physical Science Research Vol. 12. 23 July 2021, Page 64-82. https://doi.org/10.9734/bpi/nupsr/v12/11459D

- Notre univers électromagnétique

- Nuestro Universo electromagnético

- Unser elektromagnetisches Universum

The last challenge – Final version

An expanded version of an article published in 2017 that provided an overview of the the last remaining challenge in fundamental physics was republished upon invitation in 2021 as a book chapter in a final completed version under the title "*The Last Challenge of Modern Physics: Perspective to concept and model analysis*" in book titled "*Newest Updates in Physical Science Research Vol. 4*" which is part of a collection that pre-selects papers deemed worthy of attention in the global offer, to make them more immediately available to the community:

An **Appendix A** was added to the republished version, summarizing Maxwell's synthesis of the electromagnetic equations set and introducing the first level forms of these equations that are applicable to individual elementary electromagnetic particles as extensions of Maxwell's fourth equation for electromagnetic photons and of the Lorentz force equation for elementary particles such as the electron.

- Last Challenge of Modern Physics: Perspective to concept and model analysis

Michaud, A. . (2021). *The Last Challenge of Modern Physics: Perspective to Concept and Model Analysis*. In: Dr. Jelena Purenovic, Editor. Newest Updates in Physical Science Research Vol. 4, 1–29.

- Dernier défi de la physique moderne: Perspective en matière d'analyse des concepts et des modèles

- Último reto de la física moderna: Perspectiva sobre el análisis de conceptos y modelos

- Letzte Herausforderung der modernen Physik: Perspektive zur Konzept- und Modellanalyse

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Adiabatic processes - Final version

An expanded version of an article about adiabatic processes at the subatomic level initially published in 2016 was republished upon invitation in 2021 as a book chapter in a final version under the title "*On adiabatic processes at the subatomic level*" in book titled "*Newest Updates in Physical Science Research Vol. 4*" which is part of a collection that pre-selects papers deemed worthy of attention in the global offer, to make them more immediately available to the community.

- On adiabatic processes at the subatomic level

Michaud, A. (2021). *On Adiabatic Processes at the Subatomic Level*. In: Dr. Jelena Purenovic, Editor. Newest Updates in Physical Science Research Vol. 4, 30–62.

-Sur les processus adiabatiques au niveau subatomique

- Sobre los procesos adiabáticos al nivel subatómico

- Über adiabatischen Prozessen auf subatomarer Ebene

De Broglie photon - Final version

An augmented version of a seminal paper concerning the possible internal structure of localized electromagnetic photons, originally published in 2016, was republished by invitation in 2021 as a book chapter as a final version under the title "*De Broglie's Double Particle Photon*" in book titled "*Newest Updates in Physical Science Research Vol. 4*" which is part of a collection that pre-selects papers deemed worthy of attention in the global offer, to make them more immediately available to the community.

As a tribute to the contribution of Paul Marmet to the development of the electromagnetic mechanics of elementary particles, an **Appendix A** was added to the republished version, highlighting his contribution to science and incidentally the "high esteem" that was manifested for the accomplishments of this outstanding researcher and experimentalist by his colleagues and the authorities of the *University of Ottawa*, and by the *Natural Science and Engineering Research Council of Canada*:

- De Broglie's Double-Particle Photon

Michaud, A. (2021). *De Broglie's Double-Particle Photon*. In: Dr. Jelena Purenovic, Editor. Newest Updates in Physical Science Research Vol. 4, 63–102.

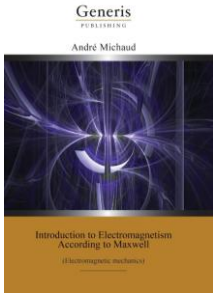
- Le photon à double-particule de de Broglie

- El fotón de doble partícula de De Broglie

- De Broglies Doppelteilchen Photon

Final monograph

Introduction to Maxwell's initial electromagnetics theory with deeper analysis leading to the establishment at the subatomic level of clear mechanics of electromagnetic photons emission and absorption and of electron stabilization in atoms. The resulting discovery of the adiabatic nature of the energy induced in all elementary charged particles, related to Maxwell's first equation, tends to confirm the conclusion that Einstein reached towards the end of his life that gravitation seems to follow the pattern of electromagnetism.



Introduction to Electromagnetism According to Maxwell

Maxwell's initial interpretation - Final version

A very positive recent development has occurred regarding the three articles reproduced and completed as Chapter 1, Chapter 2 and Chapter 3 of this book, that can only hasten the re-familiarization of the community with Maxwell's initial interpretation and thus contribute to the better understanding of physical reality that it seems to favor.

The paper titled "*Electromagnetism according to Maxwell's Initial Interpretation*" reproduced and expanded as **Chapter 1** was chosen to be republished with a new title to account for the clearer explanation given in the book of the the reason why Einstein suspected that gravitation was related to electromagnetism, in the book titled "*New Insights into Physical Science Vol. 10*", which is part of a collection that pre-selects articles deemed worthy of attention from the global offering, to be put at the disposal of the community.

The original article was initially published in January 2020 in the *Journal of Modern Physics* and is referred to further on.

- Emphasizing Electromagnetism according to Maxwell's Initial Interpretation

Michaud, André (2020) *Emphasizing the Electromagnetism according to Maxwell's Initial Interpretation*. In: Dr. Thomas F. George, Editor. Chapter 4 In New Insights into Physical Science Vol. 10. West Bengal, India: Book Publisher International. 2020.

(PROMOTIONAL VIDEO)

- Mise en évidence de l'interprétation initiale de Maxwell de l'électromagnétisme

- Subrayando la interpretación inicial de Maxwell sobre el electromagnetismo

- Hervorhebung von Maxwells ursprünglicher Interpretation des Elektromagnetismus

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An Overview of The Hydrogen Atom Fundamental Resonance States - Final version

The paper titled "*The Hydrogen Atom Fundamental Resonance States*" reproduced as **Chapter 2** was chosen to be republished as a chapter of the Book titled "*New Insights into Physical Science Vol. 6*", by "*Book Publisher International*", whose aim is to provide the global academic community with works that its editors identifies as belonging to the highest level of scholarly research in the global offering. The title of this republication was changed to "*An Overview of The Hydrogen Atom Fundamental Resonance States*" due to its having been expanded to include some sections from the articles being reproduced as Chapter 1 and Chapter 3. These new sections cover the mechanics of photon emission and absorption initially published in Reference [9], object of Chapter 1, and the analysis and resolution from the trispatial perspective of the "*absolute motion / relative motion*" conundrum previously published in Reference [15].

- Overview of the Hydrogen Atom Resonance States

André Michaud. (2020) *An Overview of The Hydrogen Atom Fundamental Resonance States.* In: Dr. Mohd Rafatullah, editor. New Insights Into Physical Science Vol. 6. West Bengal, India: Book Publisher International. 2020.

(PROMOTIONAL VIDEO)

- Vue d'ensemble des états de résonance de l'atome d'hydrogène

- Visión general de los estados de resonancia del átomo de hidrógeno

- Überblick über die Resonanzzustände des Wasserstoffatoms

Gravitation, QM, Equilibrium states – Final version

Finally, the paper titled "*Gravitation, Quantum Mechanics and the Least Action Electromagnetic Equilibrium States*" reproduced and expanded in **Chapter 3** was chosen to be republished as one of the chapters of the eBook titled "*Prime Archives in Space Research*", by *Vide Leaf Prime Archives*, whose aim is to promote scientific research in the world by making research results considered state-of-the-art available to young researchers to facilitate their application in their research practices.

- Gravitation, Quantum Mechanics and the Least Action Electromagnetic Equilibrium States

Michaud, A. (2020) ***Gravitation, Quantum Mechanics and the Least Action Electromagnetic Equilibrium States***. In: Amenosis Lopez, editor. Prime Archives in Space Research. Hyderabad, India: Vide Leaf. 2020.

Photon emission and absorption Final synthesis

It is well established that classical electrodynamics, quantum electrodynamics (QED) as well as Quantum Field Theory (QFT) are grounded on Maxwell's wave theory and on his equations, but it is much less well understood that they are not grounded on his initial interpretation of the relation between the **E** and **B** fields, but are rather grounded on Ludvig Lorenz's interpretation of this relation, with which Maxwell disagreed.

Maxwell considered that both fields had to mutually induce each other cyclically for the velocity of light to be maintained while Lorenz considered that both fields had to synchronously peak at maximum at the same time for this velocity to be maintained, both interpretations being equally consistent with the equations. Two recent breakthroughs however now allow confirming that Maxwell's interpretation was correct because, contrary to the Lorenz interpretation, it allows to seamlessly reconcile Maxwell's electromagnetic wave theory, so successfully applied at our macroscopic level, with the electromagnetic characteristics that apply at the subatomic level to localized electromagnetic photons and to all localized charged and massive elementary electromagnetic particles of which all atoms are made, and finally allows establishing a clear mechanics of electromagnetic photon emission and absorption by electrons during their interactions at the atomic level.

- Electromagnetism according to Maxwell's Initial Interpretation

- Michaud, A. (2020) *Electromagnetism according to Maxwell's Initial* Interpretation. Journal of Modern Physics, 11, 16-80. **https://doi.org/10.4236/jmp.2020.111003.**

- L'électromagnétisme selon l'interprétation initiale de Maxwell

- El electromagnetismo según la interpretación inicial de Maxwell

- Elektromagnetismus nach der ursprünglichen Maxwellschen Interpretation

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Hydrogen atom resonance states

Ever since Schrödinger proposed a wave function to represent the least action resonance states that electrons stabilize into in atomic orbitals, research has been unsuccessful in reconciling the Schrödinger wave function with the electromagnetic properties of electrons. This article identifies and discusses the electromagnetic harmonic oscillation properties that the electron must possess as a resonator in order to explain these resonance states, as well as the electromagnetic interactions between the elementary charged particles making up atomic structures that explain electronic and nucleonic orbitals stability. An unexpected benefit of the expanded space geometry required to establish these properties and interactions is that the fundamental symmetry requirement is respected by structure for all aspects of the distribution of energy within electromagnetic quanta.

- The Hydrogen Atom Fundamental Resonance States

- Michaud, A. (2018) *The Hydrogen Atom Fundamental Resonance States*. *Journal of Modern Physics*, **9**, 1052-1110. doi: 10.4236/jmp.2018.95067.

- Les états de résonance fondamentaux de l'atome d'hydrogène

- Los estados fundamentales de resonancia del átomo de hidrógeno

- Die fundamentale Resonanzzustände des Wasserstoffatoms

Gravitation, QM, Equilibrium states

The trispatial model proposes an alternate foundation of physical reality that establishes the ultimate foundation as a hypothetical uniform zero energy level in space at the beginning of the universe, instead of the hypothetical uniform zero-point-energy excitation level of the quantum vacuum which is the foundation of the quantum field theory (QFT).

The major difference is that instead of quantizing the interaction by means of assumed natural quantum vacuum fluctuations, this model proposes a continuous infinitesimally progressive interaction alternative that offers mechanical solutions that QFT does not provide. Namely, Maxwell equations compliant descriptions of the internal self-sustaining mutual induction of the electric and magnetic fields of the energy quanta constituting each individual localized electromagnetic elementary particle, a mechanical explanation to orbital stability in atomic structures, hints at the possibility that the methods of quantum mechanics can be applied to describing nucleons inner resonance states in a manner more satisfactory than QCD, reconciles the wave function with permanent localization of the electron captive in orbital resonance states and finally mechanically relates quantum mechanics to gravitation:

- Gravitation, Quantum Mechanics and the Least Action Electromagnetic Equilibrium States

- Michaud A (2017) *Gravitation, Quantum Mechanics and the Least Action Electromagnetic Equilibrium States.* J Astrophys Aerospace Technol 5: 152. doi:10.4172/2329-6542.1000152

- Gravitation et mécanique quantique vs les états d'équilibre électromagnétique de moindre action

- Gravitación y mecánica cuántica vs los estados de equilibrio electromagnético de mínima acción

- Gravitation/Schwerkraft, Quantenmechanik und die elektromagnetischen Gleichgewichtszustände der stationären Wirkung

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The last challenge

The following paper puts in perspective the manner in which a new trispatial space geometry allows establishing a mechanics of elementary electromagnetic particles that integrates all conversion processes that are possible between electromagnetic energy and mass at the submicroscopic level, as well as the sequence of trispatial LC equations that stems from this space geometry, and clarifies how mass, velocity, pressure and charge can only be emergent properties due to the presence of kinetic energy.

- The Last Challenge of Modern Physics

- Michaud A (2017) *The Last Challenge of Modern Physics*. J Phys Math

8: 217. doi: 10.4172/2090-0902.1000217**.**

- Le dernier défi de la physique moderne

- El último reto de la física moderna

- Die letzte Herausforderung der modernen Physik

Adiabatic processes

Some aspects of the model require clear understanding of the relation between the initial and irreversible adiabatic acceleration phase of newly created massive particles and the Principle of conservation of energy, and of the factors that must be taken into account to calculate the least action electromagnetic equilibrium states that determine the resonance states revealed by Quantum Mechanics. An analysis of these aspects of particle physics is carried out in the following paper:

- On Adiabatic Processes at the Elementary Particle level

(2016) J Phys Math 7: 177. doi:10.4172/2090-0902.1000177

- Analyse des processus adiabatiques au niveau des particules élémentaires

- Análisis de los procesos adiabáticos al nivel de las partículas elementales

- **Analyse von adiabatischen Prozessen auf der Elementarteilchenebene**

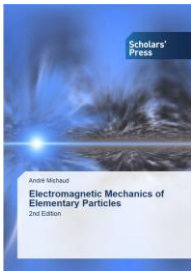
First monograph

First described in a popularization work in 1999 **[**2], a summary overview of this new space geometry was formally presented at CONGRESS-2000, "*Fundamental Problems of Natural Sciences*" [3], St. Petersburg State University, St. Petersburg, Russia on July 5 of 2000.

The electromagnetic mechanics that underlies this model is described in a monograph published by *Scholars' Press*, Les *Éditions universitaires européennes* y el *Editorial académia española*:

Electromagnetic Mechanics of Elementary Particles

Scholars' Press



Mécanique électromagnétique des particules élémentaires

Éditions universitaire européennes

Mecánica electromagnética de las partículas elementales

editorial académica española

De Broglie's double-particle photon

The seminal considerations that gave rise to the 3-spaces model and its fundamental space geometry are detailed in the following paper, which was accepted by the reviewers and editors of the Journal of Physical mathematics as conforming to Maxwell's equations and was published in the 2016 issue No. 7 of the Journal:

- **On de Broglie's Double-Particle Photon Hypothesis**

(2016) J Phys Math 7: 153. DOI:10.4172/2090-0902.1000153

- **À propos de l'hypothèse du photon à double corpuscule de Louis de Broglie**

- **Sobre la hipótesis de Louis de Broglie respecto al fotón a partícula doble**

- **Über die Hypothese des Doppelpartikelphotons von Louis de Broglie**

Model Dependant papers

The critical sequence

Series of model dependant papers describing a seamless series of clearly defined interaction sequences providing an uninterrupted path of causality from:

1) From the quantities of unidirectional (that is, translational) kinetic energy that sustain the momentum of charged and massive elementary electromagnetic particles and of their electromagnetic complement that are adiabatically induced in them by the Coulomb acceleration,

2) to the release as a free-moving electromagnetic photon of any quantity of this energy that becomes in excess of the precise amount allowed by some stable or metastable electromagnetic equilibrium state, for example, when an electron becomes captive of the resonance state of an atom's available orbital after having accumulated this energy now in excess while accelerating to reach this equilibrium state,

3) to the creation of electron-positron pairs from the destabilization of electromagnetic photons of energy 1.022 MeV or more,

4) to the creation of protons and neutrons from the interaction of thermal electrons and positrons forced into groups of three involving both types, in sufficiently small volumes of space, with insufficient energy to escape mutual capture,

5) to the final shedding in the form of neutrino energy of momentary metastable excess mass (different from velocity related momentary relativistic mass increment) as overexcited newly created massive elementary particles are forced by local electromagnetic equilibrium states to reach their lowest possible and henceforth stable and invariant rest mass.

Note that the following series of papers should be read in sequence for the uninterrupted causality link between state 1) and state 5) to become totally clear.

Steps 1) and 2), while not being model dependant, nevertheless belong to the same interaction sequence and are described in **Sections 3** and **4** of the following paper:

1) + 2) - The Corona Effect

International Journal of Engineering Research and Development. e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 7, Issue 11 (July 2013), PP. 01-09

- L'effet Corona

- El efecto Corona

- Der Korona-Effekt

Before proceeding to the analysis of steps **3)**, **4)** and **5)**, it would be important to clearly understand the internal cyclic motion of the energy making up localized photons, motion that arises from Louis de Broglie's hypothesis on the double-particle photon being applied to the 3-spaces model. This motion, which was already described in the seminal paper previously mentioned, is integrated in a more detailed manner into the causality sequence in the following article:

- Expanded Maxwellian Geometry of Space Geometry and the Photon Fundamental LC Equation

International Journal of Engineering Research and Development, e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 6, Issue 8 (April 2013), PP. 31-45.

- La géométrie maxwellienne augmentée de l'espace et l'équation LC fondamentale du photon

- La geometría maxwelliana aumentada del espacio y la Ecuación LC fundamental del fotón

- Die erweiterte Maxwellsche Geometrie des Raums und die fundamentale LC-Gleichung des Photons

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3) - The Mechanics of Electron-Positron Pairs Creation in the 3-Spaces Model

International Journal of Engineering Research and Development, e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 6, Issue 10 (April 2013), PP. 36-49.

- La mécanique de création de paires électron-positron dans le modèle trispatial

- La mecánica de creación de pares electrón-positrón en el modelo tresespacial

- Die Mechanik der Elektron-Positron-Paarbildung im Dreiräume-Modell

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4) - The Mechanics of Neutron and Proton Creation in the 3-Spaces Model

International Journal of Engineering Research and Development. e-ISSN: 2278-067X, p-ISSN : 2278-800X. Volume 7, Issue 9 (July 2013), PP.29-53.

- Mécanique de création de Protons et Neutrons dans le modèle trispatial

- Mecánica de creación de protones y neutrones en el modelo tresespacial

- Mechanik der Protonen- und Neutronenbildung im Drei-Räume-Modell

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5) - The Mechanics of Neutrinos Creation in the 3-Spaces Model

International Journal of Engineering Research and Development. e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 7, Issue 7 (June 2013), PP.01-08

- Mécanique de création des neutrinos dans le modèle des 3-espaces

- Mecánica de creación de los neutrinos en el modelo de los tres espacios

- Mechanik der Neutrino-Erzeugung im 3-Räume-Modell

Other papers – Not model dependant

The foundation

Although not model dependant, the following papers account for all observed phenomena in light of the conclusions imposed by the 3-spaces model. They can be read in any order.

1- Field Equations for Localized Individual Photons and Relativistic Field Equations for Localized Moving Massive Particles

International IFNA-ANS Journal, No. 2 (28), Vol. 13, 2007, p. 123-140, Kazan State University, Kazan, Russia.

- Уравнения поля для локализованных фотонов и релятивистских уравнений поля для локализованных движущихся массивных частиц

- Also available: **Extended abstract** from the Kazan SU site.

- Équations de champs pour photons localisés et pour particules massives en mouvement.

- Ecuaciones de campos para fotones localizados y ecuaciones relativistas de campos para partículas masivas en movimiento

- Feldgleichungen für lokalisierte Photonen und relativistische Feldgleichungen für bewegende lokalisierte massive Teilchen

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2 - From Classical to Relativistic Mechanics via Maxwell

International Journal of Engineering Research and Development, e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 6, Issue 4 (March 2013), PP. 01-10.

- De la mécanique classique à la mécanique relativiste via Maxwell

- De la mecánica clásica a la mecánica relativista vía Maxwell

- Von der klassischen Mechanik zur relativistischen Mechanik via Maxwell

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3 - Unifying all Classical Force Equations

International Journal of Engineering Research and Development, e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 6, Issue 6 (March 2013), PP. 27-34

- Unification des équations de force classiques

- Unificación de las ecuaciones de fuerza clásicas

- Vereinheitlichung aller klassischen Kraftgleichungen

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4 - Deriving εo and μo from First Principles

International Journal of Engineering Research and Development. e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 7, Issue 4 (May 2013), PP. 32-39.

- Dérivation de ε_0 et μ_0 à partir des principes premiers

- Derivación de ε_o y μ_o a partir de los principios fundamentales

- Herleitung von ε_0 und μ_0 aus Grundbegriffe

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5 - On the Einstein-de Haas and Barnett Effects

International Journal of Engineering Research and Development. e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 6, Issue 12 (May 2013), PP. 07-11.

- À propos des effets Einstein-de Haas et Barnett

- Sobre los efectos Einstein-de Haas y Barnett

- Über die Einstein-de Haas- und Barnett-Effekte

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6 - On the Electron Magnetic Moment Anomaly

International Journal of Engineering Research and Development. e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 7, Issue 3 (May 2013), PP. 21-25.

- A propos de "l'anomalie" du moment magnétique de l'électron

- Sobre la "anomalía" del momento magnético del electrón

- Über die "Anomalie" des magnetischen Moments des Elektrons

7- Proposal of an invariant mass reference for the kilogram

- Proposition pour une référence de masse invariante pour le kilogramme

The General Science Journal 2011

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8 - The Corona Effect

International Journal of Engineering Research and Development. e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 7, Issue 11 (July 2013), PP. 01-09.

- L'effet Corona

- El efecto Corona

- Der Korona-Effekt

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9 - Inside Planets and Stars Masses

International Journal of Engineering Research and Development. e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 8, Issue 1 (July 2013), PP. 10-33.

- L'intérieur des masses planétaires et stellaires

- Dentro de las masas de los planetas y de las estrellas

- Das Innere der Planeten- und Sternmassen

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10 - On the Magnetostatic Inverse Cube Law and Magnetic Monopoles

International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X. Volume 7, Issue 5 (June 2013), PP.50-66.

(Grounding Experiment)

- Sur la loi de l'inverse du cube et les monopôles magnétiques

- Sobre la ley de lo inverso del cubo y los monopolos magnéticos

- Das magnetostatische inverse Würfelgesetz und magnetische Monopole

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11- The Birth of the Universe and the Time Dimension

American Journal of Modern Physics. Special
Issue: Insufficiency of Big Bang Cosmology. Vol. 5, No. 4-1, 2016, pp. 44-52.
doi: 10.11648/j.ajmp.s.2016050401.17

Formal presentation of the new space geometry that underlies the trispatial model

Presentation text for the article titled "*On an Expanded Maxwellian Geometry of Space*". Presented on July 7, 2000 in plenary session of the Congress-2000 event at St Petersburg State University, Russia. The article was published on pages 291 to 310 of the congress proceedings.

- Presentation in plenary session at CONGRESS-2000

- Présentation en session plénière à l'événement CONGRESS-2000

- Presentación en sesión plenaria en el CONGRESS-2000

- Vortrag in Plenarsitzung auf dem CONGRESS-2000

Conference paper published in the proceedings of Congress-2000.

Definition of an expanded Maxwellian geometry of space that allows description of a possible mechanics 1) of motion of photons; 2) of conversion of a photon of energy 1.022 MeV or above to a pair electron/positron as it passes close to a nucleus as well as re-conversion of such a pair to a single photon through Coulomb interaction close to a nucleus; 3) of creation of protons and neutrons from the capture within a volume of space of diameter 2.116708996E-10 meter of 2 electrons plus one positron, or alternately, of 2 positrons plus one electron, possessing insufficient energy to escape from that volume against mutual Coulombian interaction; 4) of gravitation.

- On an Expanded Maxwellian Geometry of Space

Proceedings of Congress-2000 – Fundamental Problems of Natural Sciences and Engineering. (2000). Volume 1, St-Petersburg, Russia. pages 291-310.

- A propos d'une géométrie maxwellienne augmentée de l'espace

- Sobre una geometría maxwelliana ampliada del espacio

- Über eine erweiterte Maxwellsche Geometrie des Raums

References

[1] A. Einstein, E. Schrödinger, W. Pauli, L, Rosenfeld, M. Born, I. & F. Joliot-Curie, W. Heisenberg, H. Yukawa, et al. ***Louis de Broglie, physicien et penseur***. Éditions Albin Michel, Paris, 1953.

[2] Michaud, A. (1999) ***Theory of Discrete Attractors***, Canada, SRP Books, 1999. https://www.smashwords.com/books/view/159189

[3] Michaud, A. (2000) ***On an Expanded Maxwellian Geometry of Space*.** Proceedings

of Congress-2000 – Fundamental Problems of Natural Sciences and Engineering. (2000) Volume 1, St.Petersburg, Russia, pages 291-310.

https://www.researchgate.net/publication/357527119_On_an_Expanded_Maxwellian_Geometry_of_Space

[4] Michaud A (2004). ***Expanded Maxwellian Geometry of Space***. 4th Edition, SRP Books.

https://www.smashwords.com/books/view/163704

[5] De Broglie L (1993) ***La physique nouvelle et les quanta***, Flammarion, France 1937, 2nd Edition 1993, with new 1973 Preface by Louis de Broglie. ISBN: 2-08-081170-3.

[6] Lewertoff, F. (2021) ***On the Importance of ATP Energy in Biology with Regard to Viruses***. *Open Journal of Biophysics,* **11**, 225-232. doi: 10.4236/ojbiphy.2021.113008.

https://www.scirp.org/journal/paperinformation?paperid=109418

Other articles in the main project:

- **INDEX - General Neurolinguistics (Conceptual Thinking)**