International Journal of Contemporary Mathematical Sciences
Vol. 18, 2023, no. 1, 1 - 7
HIKARI Ltd, www.m-hikari.com
https://doi.org/10.12988/ijcms.2023.91754

From the Mass-Shell Equation to a Euclidean Geometry for Antimatter with Potential Applications to the Dissolution of Virus/Unhealthy Cells

Gregory L. Light

Providence College
Providence, Rhode Island, 02918 USA

Abstract

Motivated by the limitations of the vaccination paradigm, we propose the use of antiparticles to dissolve any harmful viruses, for which we replicate our published mathematical proof of a left-handed positron to turn into a right-handed electron by Euclidean 3-D rotations, thereby the potential of producing antiparticles more economically than by the existing construct of high-energy pair-production. In the same vein, antimatter annihilation may serve as an alternative to radiotherapy, which has known undersirable side effects.

Mathematics Subject Classification: 81Q05, 81Q99, 81P05, 81R25

Keywords: medical antimatter, antimatter production, baryon asymmetry

1. Introduction

1.1 Pair-annihilation by antiparticles as a supplement to the vaccination paradigm

The world has been witnessing an incomplete success of the vaccination program against Covid-19; specifically, there have been fully vaccinated people who nevertheless caught the virus. Moreover, when any mutations emerge, the medical scientific community must defend the effectiveness of the existing vaccination or else invent other vaccines. As viral mutation is known to happen easily [9], one is thus led to a re-examination of the long-established paradigm of vaccination [3], which could be dated back to 1879 when Louis Pasteur's created the first laboratory vaccine. In this paper, we propose a new way of dealing with harmful viruses by making use of antiparticles, to cause pair-annihilation to neutralize the viruses by destroying the protein coat that protects the virus's DNA or RNA. For conceptualization, one has the following inclusive relationships:

$$\{atoms\} \subset \{small\ molecules\} \subset \{DNA\ or\ RNA,\ protein\} \subset \{a\ virus\} \subset \{a\ cell\}$$

with their approximate dimensionalities (in meters):

$$10^{-10} \le 10^{-10} \le 10^{-9} \le 10^{-7} \le 10^{-5}.$$

Antimatter has been known to be extremely difficult to produce and to store [5, 10], hence economically costly, but we contend that the existing understanding of antiparticles as based on pair-creation can be enriched by a consideration of its underlying geometric motion. We argue that by a spatial transformation of an ordinary particle, one can turn it into its anti-particle; to be exact, a left-handed positron can become a right-handed electron by way of rotations in the familiar three-dimensional Euclidean space [7]. Consequently, we envision abundant production of antimatter through such a procedure. Naturally, we are incidentally presenting an explanation of the anti-baryon asymmetry.

1.2 Limitations of the vaccination paradigm

The idea of immunization is built on the logic that the injection of a small dose of the harmful virus is to trigger an antibody production against the onslaught of a real invasion [1]. However, this has the drawback of side effects of varying degrees of seriousness; in addition, not all viral infections have their vaccines of immunization [4].

1.3 Antimatter as a new technology

The existing procedure of producing antimatter is to create an environment of high energy that engenders pair-creation and then to isolate and store the produced antiparticles in a specialized setup (cf. “Antimatter Factory” of CERN). The basis of this approach traces back to Dirac’s spinor, which is non-Euclidean thanks to the well-known phenomenon of the “720-degree turn.” The algebra that connects this abstract quantum spin to a practical spin polarization such as employed in the material science is by employing the polarization operators (cf. e.g., [2], pp. 257-261). Yet, by *taking the complex conjugates* of the Einstein mass-shell equation instead of taking the square roots as by Dirac, one arrives at a Euclidean geometry for the electron spin, thereby the possibility of replacing the pair-creation construct with a spatial re-orientation of ordinary particles [7]. This then leads to a new mode of producing antiparticles that can be used to destroy the critical components of the viruses, or in general, any unhealthy cells in an organism. Of course, in this connection, genetic engineering has been receiving increasing attention from the scientific community and holds great promises as well [6].

1.4 Method of analysis

Our approach here is to replicate the mathematical arguments [7] to show how the Einstein mass-shell equation leads to a Euclidean geometry for spin- ½ particles and how it in turn implies the equality between a left-handed positron and a right-handed electron.

2. Derivations

2.1 From the mass-shell equation to a 3-D motion of the electron wave

We begin with the Einstein mass-shell equation,

$$
\begin{aligned}
E^2 &= m^2 c^4 = m_0^2 c^4 + p^2 c^2 \\
&= m_o^2 c^4 + m^2 c^2 |\mathbf{v}|^2 \qquad (1) \\
&= m_o^2 c^4 + m^2 c^2 |i\mathbf{v}|^2 ,
\end{aligned}
$$

where i as applied to $\mathbf{v}$ alters linear momentum into angular momentum to effect the wave rotation of an electron. Then since $\boldsymbol{mc}^2 \cdot \boldsymbol{mc}^2 = \left(\boldsymbol{m_o c}^2 - \boldsymbol{imc}|\mathbf{v}|\right)\left(\boldsymbol{m_o c}^2 + \boldsymbol{imc}|\mathbf{v}|\right)$ (cf. [8], pp. 524-525, for imaginary mass), one has

$$\boldsymbol{mc}^2 = \boldsymbol{m_o c}^2 \mp \boldsymbol{imc}|\mathbf{v}|. \tag{2}$$

As such [7],

$$\boldsymbol{mc}^2 \boldsymbol{I}_3 = \boldsymbol{m_o c}^2 \boldsymbol{I}_3 \mp \boldsymbol{imc} \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & -1 \end{pmatrix} \begin{pmatrix} 0 & |\mathbf{v}| & 0 \\ |\mathbf{v}| & 0 & 0 \\ 0 & 0 & -|\mathbf{v}| \end{pmatrix}, \tag{3}$$

where the conjugates account for the pair of electron and positron and the columns of the matrices indicate that the electron-wave carries three linear momenta pointing to the directions of y, x, and -z, or a rotation from (x, y, z) = (-1, 0, 0) $\equiv$ W, to (0, 1, 0)$\equiv$N, to (1, 0, 0)$\equiv$E - - at which point the electron-wave turns its linear momentum to -z (by its orientation, but z in the laboratory frame due to the 180-degree rotation on the (x,y)-plane), so that the second 180-degree rotation resumes at E, moving on to (0, 0, 1) $\equiv$T, and back to W. That is, the electron-wave rotates along a pair of perpendicular semi-circles, or a linear transformation of $(x,y,z) \xrightarrow{\pi-radian} (-x,-y,z) \xrightarrow{\pi-radian} (x,-y,-z)$; repeating the same motion, the wave then resumes as $(x,-y,-z) \xrightarrow{\pi-radian} (-x,y,-z) \xrightarrow{\pi-radian} (x,y,z)$, whence returning to its initial state in a 720-degree rotation. The above geometry in fact supports the construct of *Zitterbewegung*, where the electron has its angular momentum alternating in sequence.

2.2 A geometric proof of the changibility of a left-handed positron to a right-handed electron

We next show how a left-handed positron, e_L^+, can turn into a right-handed electron, e_R^-, by the spatial transformation from the above geometry. Here on purpose, we avoid any algebraic calculation to highlight our assertion that antimatter can be produced directly from ordinary matter without resorting to pair-creation. Consider a flat clock, call "A," placed on the x-y plane with its 12 o'clock pointing at N; define flat clock "B" on the x-z plane with its 12 o'clock pointing at T. Then $A \cup B$ depicts a pair of photon-waves intersecting with each other as from the *Breit–Wheeler pair-creation process*. Now, define

$$e_L^- := \left[W \to N \to E \to T \to W\right] \subset A_N \cup B_T, \tag{4}$$

where the wave of a left-handed electron rotates along the northern half of A and the top half of B, with its reverse flow being the right-handed electron,

$$e_R^- = \left[W \to T \to E \to N \to W\right]. \tag{5}$$

By Equation (3), the left-handed positron then has its wave motion

$$e_L^+ = \left[E \to S \equiv (0,-1,0) \to W \to B \equiv (0,0,-1) \to E\right] \subset A_S \cup B_B, \tag{6}$$

moving along the southern half of A and the bottom half of B. Rotate $A_S \cup B_B$ by 180 degrees *counterclockwise* with respect to the y-axis and then rotate it further by 90 degrees *clockwise* with respect to the x-axis; then we have

$$\begin{aligned} e_L^+ &= \left[\, E \to S \to W \to B \to\right] E \\ &\to \left[W \to S \to E \to T \to\right] W \\ &\to \left[W \to T \to E \to N \to\right] W \quad {}_{\bar{R}}, \end{aligned} \tag{7}$$

the right-handed electron.

3. Results and Discussion

In this note, we have shown the possibility of an alternative approach to the production of antimatter by presenting a 3-dimensional Euclidean geometry, which potentially can be more efficient and economical. We reckon with the fact that our proposed procedure - - that of a spatial re-orientation of ordinary particles - - is devoid of any engineering details. In addition, the use of antiparticles to annihilate any harmful elements of a material substance is to release a great amount of energies by $2E = 2mc^2$; how to channel this $2E$ would be a serious technical concern. Nevertheless, antimatter has already been used in medical imaging. As such, if laboratories can produce them much more easily by the above-proposed frame transformation, then this technology may serve as a solution to many hitherto intractable problems.

References

[1] R. Anderson, R. May, The logic of vaccination, *New Scientist*, **96** (1982), 410-415. https://pubmed.ncbi.nlm.nih.gov/11655494

[2] V. Barone, P.G. Ratcliffe, *Transverse Spin Physics*, World Scientific, London, 2003.

[3] C.S. Benn, A.B. Fisker, A. Rieckmann, S. Sørup, P. Aaby, (2020). Vaccinology: time to change the paradigm? *The Lancet Infectious Diseases*, **20** (2020), 274-283. https://doi.org/10.1016/S1473-3099(19)30742-X

[4] M.E. Bottazzi, P. Hotez, Vaccine Nation: 10 most important diseases without a licensed vaccine - Baylor College of Medicine Blog Network (bcm.edu), World Vaccine Congress DC, 2013.

[5] J. Chen, D. Keane, Y.-G. Ma, A. Tang, Z. Xu, Antinuclei in heavy-ion collisions, *Physics Reports,* **760** (2018), 1-39. https://doi.org/10.1016/j.physrep.2018.07.002

[6] S. Dai, X. Wei, A.A. Alfonso, L. Pei, U.G. Duque, Z. Zhang, G.M. Babb, R.N. Beachy, Transgenic rice plants that overexpress transcription factors RF2a and RF2b are tolerant to Rice tungro virus replication and disease, *Proceedings of the National Academy of Sciences,* **105** (2009), 21012-21016. https://doi.org/10.1073/pnas.0810303105

[7] G.L. Light, Pauli matrices immersion, *Materials Science and Engineering: B* **264** (2021), 114910 (1-6). https://doi.org/10.1016/j.mseb.2020.114910

[8] A.H. Taub, Quantum equations in cosmological spaces, *Physical Review,* **51** (1937), 512-525. https://doi.org/10.1103/PhysRev.51.512

[9] R. Sanjuán, P. Domingo-Calap, Mechanisms of viral mutation, *Cellular & Molecular Life Sc.*, **73** (2016), 4433-4448.
https://doi.org/10.1007/s00018-016-2299-6

[10] O.G. Semyonov, (2017). Diamagnetic antimatter storage. *Acta Astronautica*, **136** (2017), 190-203. http://dx.doi.org/10.1016/j.actaastro.2017.03.012

Received: June 3, 2025; Published: June 26, 2023