THE IMAGINARY NORM

PART I

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§ ABSTRACT

It is known that the direction of rotation of a position vector in Polar Coordinates is not continuous for angles Θ[1]. The fallacy has algebraic origins and as a increases, the direction of the position vector at Θ is oscillating between two opposite discontinuous points we shall call Norms[2]. The pertinent Literature can be argued, as has been done by others in the past that – the direction of a position vector at Θ cannot be real thence must carry an imaginary component also to justify the occurrence of discontinuities along the Polar plane. To understand how Norms oscillate, we propose the "Norm Wave Function" whose exposition we give herein is based on the geometric expansion of Norms. The once speculative Mohammed Abubakr-proposition on Calpanic Numbers, can now find full justification as a fully-fledged proposition. At the end of it all our contribution in the present work – if any; is that we demonstrate that the hypothetical Norm proposed herein, is imaginary and Norms carry unique properties that may have the potential for strong application in Quantum Theory of the Spinning Photon. This current text is part one of two. This text is a proposition of a Norm Wave Function and it discusses the philosophy behind the discontinuities of rotations while part two will apply the formulation in Quantum Mechanics of Spinning Photons.

§ Key Words

Norm, Norm Wave Function, Quantum Boundaries, Calpanic Numbers.

§ INTRODUCTION

We shall here discuss the exactitude which lurks in the direction of position vector $\vec{\emptyset} = (0 \quad 0)$. Its direction in Polar Coordinates is undefined however, according to the Theory of Special Relativity, $\frac{0}{0}$ must be equal[3] to one. The result must be conceived else we must abandon the Theory of Special Relativity as refuted (Barukcic, 2016). Writing in his book "*Cosmos Redefined Witness the Revolution*", (Abubakr, 2008) Mohammed Abubakr revived the almost abandoned line of thought which most view as a pseudo-math because he attempts to assign a Calpanic Number[4] to a Norm using a similar approach adopted for the creation of imaginary numbers. However, this line of thought cannot be abandoned because he is basing his argument on fundamental principles of imaginary numbers. Calpanic numbers neither represent mathematics

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[1] For $\Theta = \pi(a + \frac{1}{2})$, $\sum_{a=0}^{\infty} Tan\, \odot = \sum_{a=0}^{\infty} \frac{(-1)^a}{0}$

[2] Norm – Positive Discontinuity and Anti-Norm – for negative discontinuity

[3] Direction of vector $\vec{\emptyset} = (0 \quad 0)$

[4] $\hat{\omega} = Z_0 + Z_1 \varsigma$ where $\vec{\varsigma} = (0 \quad 1)$

or logic but rather the intuitive power of human reason and imagination. The only limitation of position vector $\vec{\varsigma}$ is that it does not oscillate under geometric expansion[5] therefore Ꞇ̑ may not be considered as a periodic functions i.e.

$$e^{\varsigma Ø} = \begin{pmatrix}0\\1\end{pmatrix}^0 + \begin{pmatrix}0\\1\end{pmatrix}^1 \frac{Ø^1}{1!} + \begin{pmatrix}0\\1\end{pmatrix}^2 \frac{Ø^2}{2!} + \begin{pmatrix}0\\1\end{pmatrix}^3 \frac{Ø^3}{3!} + \begin{pmatrix}0\\1\end{pmatrix}^4 \frac{Ø^4}{4!} + \begin{pmatrix}0\\1\end{pmatrix}^5 \frac{Ø^5}{5!} ..$$

$$e^{\varsigma Ø} = \begin{pmatrix}0^0\\1^0\end{pmatrix} + \begin{pmatrix}0\\1\end{pmatrix} \frac{Ø^1}{1!} + \frac{Ø^2}{2!} + \begin{pmatrix}0\\1\end{pmatrix} \frac{Ø^3}{3!} + \frac{Ø^4}{4!} + \begin{pmatrix}0\\1\end{pmatrix} \frac{Ø^5}{5!} ..$$

$$\text{Re } e^{\varsigma Ø} = \begin{pmatrix}0^0\\1\end{pmatrix} + \frac{Ø^2}{2!} + \frac{Ø^4}{4!} + \frac{Ø^6}{6!} .. \qquad [1]$$

$$\text{Cal } e^{\varsigma Ø} = \begin{pmatrix}0\\1\end{pmatrix} \frac{Ø^1}{1!} + \begin{pmatrix}0\\1\end{pmatrix} \frac{Ø^3}{3!} + \begin{pmatrix}0\\1\end{pmatrix} \frac{Ø^5}{5!} + \cdots .. \qquad [2]$$

In [1] the first term of the geometric expansion $\begin{pmatrix}0^0\\1\end{pmatrix}$ has the component 0^0 also a fallacy with algebraic origins. In Combinatorics the exponent is defined and also there is sizable proof[6] existing in literature (Weisstein, 2008) that proves $0^0 = 1$ therefore [1] can be,

$$\text{Re } e^{\varsigma Ø} = \begin{pmatrix}1\\1\end{pmatrix} + \frac{Ø^2}{2!} + \frac{Ø^4}{4!} + \frac{Ø^6}{6!} .. \qquad [3]$$

In this paper we will adopt the logic behind ς and we will modify it to a Norm $\vec{j} = (0 \quad i)$ and Anti-Norm $\overleftarrow{j} = (0 \quad -i)$ we introduced in Section 1. The exponent of a null matrix, ℕ, is the exponent of the diagonal entries of the matrix (Weisstein, Matrix Exponential, 2004) i.e.

$$e^{\mathbb{N}} = e^{\begin{pmatrix}0 & 0\\0 & 0\end{pmatrix}}$$

$$\begin{pmatrix}e^0 & 0\\0 & e^0\end{pmatrix} = \begin{pmatrix}1 & 0\\0 & 1\end{pmatrix} \qquad [4]$$

Modifying [4] for $\vec{Ø}$,

$$e^{\begin{pmatrix}0\\0\end{pmatrix}} = \begin{pmatrix}0\\0\end{pmatrix}^0 + \begin{pmatrix}0\\0\end{pmatrix}^1 + \frac{\begin{pmatrix}0\\0\end{pmatrix}^2}{2!} + \frac{\begin{pmatrix}0\\0\end{pmatrix}^3}{3!} + \frac{\begin{pmatrix}0\\0\end{pmatrix}^4}{4!} + \cdots$$

$$e^{\begin{pmatrix}0\\0\end{pmatrix}} = \begin{pmatrix}0^0\\0^0\end{pmatrix} + \begin{pmatrix}0\\0\end{pmatrix} + 0 + \begin{pmatrix}0\\0\end{pmatrix} + 0 + \begin{pmatrix}0\\0\end{pmatrix} + \cdots$$

Considering the result from [1],

$$e^{\begin{pmatrix}0\\0\end{pmatrix}} = \begin{pmatrix}1\\1\end{pmatrix} + \begin{pmatrix}0\\0\end{pmatrix} + 0 + \begin{pmatrix}0\\0\end{pmatrix} + 0 + \begin{pmatrix}0\\0\end{pmatrix} + \cdots$$

$$e^{\begin{pmatrix}0\\0\end{pmatrix}} = \begin{pmatrix}1\\1\end{pmatrix} \qquad [5]$$

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[5] Euler Expansion

[6] $0^0 = 0^{a-a} = \frac{0^a}{0^a} = 1$

At the end of the following section, we would have derived two Norm wave functions [9] and [10].

□ Corollary of the Introduction

In-closing the present section, we give the synopsis of the paper. We referenced the Theory of Special Relativity to motivate the ratio $\frac{0}{0} = 1$. In [1] and [2] we demonstrate that the idea of Calpanic Numbers can be justifiable as a fully-fledged proposition but with its own limit of reason. In [4] and [5] we demonstrate that $e^{\binom{0}{0}} = \binom{1}{1}$, which will be a crucial step in proving the validity of identities [9] and [10] in the following sections.

§ DERIVATION OF THE NORM WAVE FUNCTION

For the position vector $\boldsymbol{j} = (\cos\odot \quad i\sin\odot)$ where ʘ = π (a $+\frac{1}{2}$), the direction of position vector $\boldsymbol{j}$ demonstrate the following behavior for integer values of $a \geq 0$,

Norm $\vec{j} = \binom{\cos\odot}{i\sin\odot} = \binom{0}{i}$ | for even *a*

Anti-Norm $\overleftarrow{j} = \binom{\cos\odot}{i\sin\odot} = \binom{0}{-i}$ | for odd *a*

In general, $\boldsymbol{j} = \sum_{a=0}^{\infty} \binom{\cos\odot}{i\sin\odot} = \sum_{a=0}^{\infty} \binom{0}{(-1)^a i}$ [6]

Well outside the domains and confines of Polar Space, we can expand the Norm geometrically as,

$$e^{\binom{0}{i}\bar{\varnothing}} = \binom{0}{i}^0 + \binom{0}{i}^1 \bar{\varnothing} + \frac{\binom{0}{i}^2 \bar{\varnothing}^2}{2!} + \frac{\binom{0}{i}^3 \bar{\varnothing}^3}{3!} + \frac{\binom{0}{i}^4 \bar{\varnothing}^4}{4!} + \frac{\binom{0}{i}^5 \bar{\varnothing}^5}{5!} + \cdots$$

$$e^{\binom{0}{i}\bar{\varnothing}} = \binom{1}{1} + \binom{0}{i}\bar{\varnothing} - \frac{\bar{\varnothing}^2}{2!} - \frac{\binom{0}{i}\bar{\varnothing}^3}{3!} + \frac{\bar{\varnothing}^4}{4!} + \frac{\binom{0}{i}\bar{\varnothing}^5}{5!} - \cdots \quad [7]$$

, and the expansion of the Anti-Norm,

$$e^{\binom{0}{-i}\bar{\varnothing}} = \binom{0}{-i}^0 + \binom{0}{-i}^1 \bar{\varnothing} + \frac{\binom{0}{-i}^2 \bar{\varnothing}^2}{2!} + \frac{\binom{0}{-i}^3 \bar{\varnothing}^3}{3!} + \frac{\binom{0}{-i}^4 \bar{\varnothing}^4}{4!} + \frac{\binom{0}{-i}^5 \bar{\varnothing}^5}{5!} + ..$$

$$e^{\binom{0}{-i}\bar{\varnothing}} = \binom{1}{1} - \binom{0}{i}\bar{\varnothing} - \frac{\bar{\varnothing}^2}{2!} + \frac{\binom{0}{i}\bar{\varnothing}^3}{3!} + \frac{\bar{\varnothing}^4}{4!} - \frac{\binom{0}{i}\bar{\varnothing}^5}{5!} - \cdots \quad [8]$$

Adding [7] and [8]

$$e^{\binom{0}{i}\bar{\varnothing}} = \binom{1}{1} + \binom{0}{i}\bar{\varnothing} - \frac{\bar{\varnothing}^2}{2!} - \frac{\binom{0}{i}\bar{\varnothing}^3}{3!} + \frac{\bar{\varnothing}^4}{4!} + \frac{\binom{0}{i}\bar{\varnothing}^5}{5!} - \cdots$$

$$+$$

$$e^{\binom{0}{-i}\bar{\varnothing}} = \binom{1}{1} - \binom{0}{i}\bar{\varnothing} - \frac{\bar{\varnothing}^2}{2!} + \frac{\binom{0}{i}\bar{\varnothing}^3}{3!} + \frac{\bar{\varnothing}^4}{4!} - \frac{\binom{0}{i}\bar{\varnothing}^5}{5!} - \cdots$$

$$e^{\binom{0}{i}\bar{\varnothing}} + e^{\binom{0}{-i}\bar{\varnothing}} = 2\binom{1}{1} - 2\frac{\bar{\varnothing}^2}{2!} + 2\frac{\bar{\varnothing}^4}{4!} - 2\frac{\bar{\varnothing}^6}{6!} + \cdots \ldots$$

 $$\frac{e^{\binom{0}{i}\bar{\varnothing}} + e^{\binom{0}{-i}\bar{\varnothing}}}{2} - \binom{1}{1} = -\frac{\bar{\varnothing}^2}{2!} + \frac{\bar{\varnothing}^4}{4!} - \frac{\bar{\varnothing}^6}{6!} - \cdots \ldots$$

 $$\frac{e^{\binom{0}{i}\bar{\varnothing}} + e^{\binom{0}{-i}\bar{\varnothing}}}{2} - \binom{1}{1} = \text{Cos}\bar{\varnothing} - 1$$

 $$\text{Cos}\bar{\varnothing} = \frac{e^{\binom{0}{i}\bar{\varnothing}} + e^{\binom{0}{-i}\bar{\varnothing}}}{2} - \binom{1}{1} + 1$$

¶ $$\text{Cos}\bar{\varnothing} = \frac{e^{\binom{0}{i}\bar{\varnothing}} + e^{\binom{0}{-i}\bar{\varnothing}}}{2} + 1 - \binom{1}{1}$$

If we let ${}_1^1\text{Ɣ} = 1 - \binom{1}{1}$, then

¶ $$\text{Cos}\bar{\varnothing} = \frac{e^{\binom{0}{i}\bar{\varnothing}} + e^{\binom{0}{-i}\bar{\varnothing}}}{2} + {}_1^1\text{Ɣ}$$ [9]

Subtracting [7] and [8] gives

$$e^{\binom{0}{i}\bar{\varnothing}} = \binom{1}{1} + \binom{0}{i}\bar{\varnothing} - \frac{\bar{\varnothing}^2}{2!} - \frac{\binom{0}{i}\bar{\varnothing}^3}{3!} + \frac{\bar{\varnothing}^4}{4!} + \frac{\binom{0}{i}\bar{\varnothing}^5}{5!} - \cdots$$

$$-$$

$$e^{\binom{0}{-i}\bar{\varnothing}} = \binom{1}{1} - \binom{0}{i}\bar{\varnothing} - \frac{\bar{\varnothing}^2}{2!} + \frac{\binom{0}{i}\bar{\varnothing}^3}{3!} + \frac{\bar{\varnothing}^4}{4!} - \frac{\binom{0}{i}\bar{\varnothing}^5}{5!} - \cdots$$

$$e^{\binom{0}{i}\bar{\varnothing}} - e^{\binom{0}{-i}\bar{\varnothing}} = 2\binom{0}{i}\bar{\varnothing} - 2\frac{\binom{0}{i}\bar{\varnothing}^3}{3!} + 2\frac{\binom{0}{i}\bar{\varnothing}^5}{5!}$$

$$e^{\binom{0}{i}\bar{\varnothing}} - e^{\binom{0}{-i}\bar{\varnothing}} = 2\binom{0}{i}\left(\bar{\varnothing} - \frac{\bar{\varnothing}^3}{3!} + \frac{\bar{\varnothing}^5}{5!} - \cdots.\right)$$

¶ $$\text{Sin}\,\bar{\varnothing} = \frac{e^{\binom{0}{i}\bar{\varnothing}} - e^{\binom{0}{-i}\bar{\varnothing}}}{2\binom{0}{i}}$$ [10]

 Corollary of our Derivation

Now we must bear carefully in mind that a mathematical description of this kind i.e. [9] and [10] physically has ambiguous meaning unless we are quite clear as to what it means in the physical domain. In the following section, we will modify the Standing Wave Equation, using [9] and [10].

§ THE STANDING NORMs

If we envisage the Norm and the Anti-Norm as two imaginary vectors behaving as if they were two stationary boundaries $\mathbb{Z} = [\vec{J}, \overleftarrow{J}]$ in their imaginary state. If we trap a fictitious particle inside $\mathbb{Z}$, its direction will oscillate back and forth as *a* increases[7]more or less the analogy of the

[7] $a \geq 0$ for $\Theta = \pi(a + \frac{1}{2})$

Gravitational Post[8] or a Quantum Tunnel. The particle will describe a standing wave of the form

$$\Psi(x,t) = \binom{0}{i} 2A\ Sinkx\ Cos\omega t \qquad [11]$$

$$\Psi^{\dagger}(x,t) = \binom{0}{-i} 2A\ Sinkx\ Cos\omega t \qquad [12]$$

Let us split $\Psi(\mathrm{x},\mathrm{t})$ into its space and time components, $\Psi(x,t) = \phi_x \phi_t$, then

$\phi(\mathrm{t}) = \frac{e^{\binom{0}{i}wt} + e^{\binom{0}{-i}wt}}{2} + {}^{1}_{1}\gamma$ and $\phi(\mathrm{x}) = 2\binom{0}{i}\mathrm{Sin}\ kx = e^{\binom{0}{i}kx} - e^{\binom{0}{-i}kx}$

$$\Psi(x,t) = \left(e^{\binom{0}{i}kx} - e^{\binom{0}{-i}kx}\right) . \left(\frac{e^{\binom{0}{i}wt} + e^{\binom{0}{-i}wt}}{2} + {}^{1}_{1}\gamma\right), \text{ for A = 1} \qquad [13]$$

§ THE TIME BOUNDARY

So far we came up with [13] but we are still not yet confident of the function as a wave function. For us to fully understand the function, boundary conditions must be set and we must take into account that all our judgments in which time plays a part are always judgments before and after an event occurs. Let us keep the space function at constant amplitude while we find out the behavior of $\phi(\mathrm{t})$ for t = 0 i.e before we observe an Eigen state.

- $\phi(\mathrm{t}) = \frac{e^{\binom{0}{i}wt} + e^{\binom{0}{-i}wt}}{2} + {}^{1}_{1}\gamma$, if t = 0 then,
- $\phi(0) = \frac{e^{\binom{0}{0}} + e^{\binom{0}{0}}}{2} + {}^{1}_{1}\gamma = \frac{2e^{\binom{0}{0}}}{2} + {}^{1}_{1}\gamma$
- $e^{\binom{0}{0}} + {}^{1}_{1}\gamma = \binom{e^0}{e^0} + {}^{1}_{1}\gamma$, according to [5],
- $= \binom{1}{1} + {}^{1}_{1}\gamma$ but ${}^{1}_{1}\gamma = 1 - \binom{1}{1}$, then
- $= \binom{1}{1} + 1 - \binom{1}{1} = 1$

Thence $\phi_t(0) = 1$ and likewise $\phi_x(0) = 0$ [14]

Corollary of the Time Boundary

Evidently the two equations we derived for the harmonics of a particle confined in $\mathbb{Z}$ must express exactly the same thing since both equations are equivalent to the Cosine and Sine functions irrespectively. We have managed to ease to our furthest reaching the mathematical dilemma associated with [4] and [5]. Equation [9] and [10] have periodic origins as we demonstrated in [14], therefore we hereby define [9] and [10] as:

¶ $\mathrm{Cosj}\bar{\varnothing} \equiv \frac{e^{j\bar{\varnothing}} + e^{-j\bar{\varnothing}}}{2} + {}^{1}_{1}\gamma$ [15]

¶ $\mathrm{Sinj}\bar{\varnothing} \equiv \frac{e^{j\bar{\varnothing}} - e^{-j\bar{\varnothing}}}{2j}$ [16]

§Properties of Identities [15] and [16]

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[8] *The Earth Tunnel Harmonics*

- $\mathrm{Cosj}(0) = 1$
- $\mathrm{Sinj}(0) = 0$

DISCUSSIONS & CONCLUSIONS

Clearly, there is a plethora of work we have demonstrated here in Part I of our proposition. On one, the achievements of the present proposition gives an important outcome i.e. we demonstrated that the Cosj and Sinj identities have non- primitive hyperbolic origins. Despite the fact that we have tried to distance the Norm representation from the Calpanic Formality, it is very much a part of it. What we have done is basically modified the Calpanic number and represented it in a formality were it can expand geometrically, since discontinuities in discussion behave the same way. In-closing, allow us to say that the main purpose of this work has been to justify that the direction of a position vector located at $\mathbf{0}$ is discontinuous and must be represented by an imaginary Norm. Allow us to also say that we do not claim to have solved the rotational discontinuity problem or refute Polar Coordinates but we merely believe that what we have presented herein is merely an imaginary representation of these discontinuities. In conclusions we say this:

Assuming the present philosophy has been conceived by mathematicians, we hereby make the following conclusion:

1. Discontinuities in rotations are Imaginary Norms
2. If proof [14] is correct, then the following identities must also be formalized:
   $0^0 = 1$ and $e^{\binom{0}{0}} = \binom{1}{1}$

§ REFERENCES

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