

Golden Mean Unification Via Fractional Statistics Leading to the Accurate Cosmic Dark Energy Density of a Cosmos with Pointless Geometry

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Abstract – We show that the central core function of noncommutative geometry, topological quantum field four dimensional fusion theory, E-infinity theory and anyonic theory are all unified in a golden mean number theoretical system. Subsequently it is demonstrated how this unification leads to a watertight confirmation of the E-infinity Cantorian theory results for ordinary and dark cosmic energy density of the universe $\gamma(O)=1/22$ and $\gamma(D)=21/22$ respectively. Effort is given to explain why our analysis is fundamentally based on a golden mean fusion function that goes back to the highly original proposal of fractional statistics. This analysis is most appropriate for eliminating gauge anomalies because it is a von Neumann pointless spacetime theory.

Keywords – Fractional Statistics, Anyons, Golden Mean Number System, E-Infinity Cantorian Spacetime and Von Neumann Pointless Continuous Geometry.

I. INTRODUCTION

At least historically the highly important role of fractional statistics in physics started in earnest when F. Wilczek was able to show that the theoretical possibility of two dimensional fractional statistic particles [1]-[3] which are neither fermions nor bosons are realized in nature via the experimental discovery of the fractional hall effect by H. Stormer and D. Tsui [4]. The present work starts with these real quasi particles which were given the name anyons by Wilczek [2] and go on to show how it can be reformulated via four dimensional fusion algebra and non-commutative dimensional function of von Neumann-Connes and E-infinity theory [5-9] to confirm the correctness of the results pertaining to the cosmic ordinary and dark energy densities $\gamma(O)=1/22$ and $\gamma(D)=21/22$ respectively as will be detailed in the coming sections [6-9]. Subsequently we explain how the above conclusions all stem from a unification of the various fundamental theories involved in the very golden mean number system embracing the entire analysis. Finally we stressed the importance of the fact that the geometry of our theory is pointless and this eliminates all gauge anomalies and helps in formulating a sound vacuum state and a consistent Aether theory [9]-[29].

II. ANALYSIS

II.I. Background Information

We start by recalling the results of the ordinary and dark cosmic energy densities obtained previously using numerous methods [6]-[9]. These results were based mainly on the fundamental identification of the pre-quantum

particle and the pre-quantum wave with the zero set and the empty set respectively [4], [8]. In turn the zero set and the empty set are fully fixed by the corresponding value of a dimensional function developed by A. Connes based on the work of von Neumann related to his continuous geometry [5]. It was then a relatively simple matter to show that the corresponding bi-dimensions are given by zero and ϕ for the pre-quantum particle and minus one and ϕ^2 for the pre-quantum wave where ϕ is the inverse golden mean $1/\phi = (1 + \sqrt{5})/2$ [6-9]. Since at this resolution scale densities is a topological volume it was possible to calculate the volume corresponding to the pre-quantum particle density by intersection in five dimensional Kaluza-Klein space-time and similarly but via union operation for the pre-quantum wave [6] - [9]. Proceeding in this way one finds that the energy density of the pre-quantum particle, which is correlated and thus measurable, [6-9] is given by

$$\gamma(O) = (\phi)^5 \tag{1}$$

while for the uncorrelated and thus not directly measurable cosmic dark energy density one finds

$$\gamma(D) = 5\phi^2 \tag{2}$$

The total density is therefore given by [4]

$$\begin{aligned} \gamma &= \gamma(O) + \gamma(D) \\ &= \phi^5 + 5\phi^2 \\ &= 2 \end{aligned} \tag{3}$$

Since it was established that Einstein's $E = mc^2$ represents the maximal energy density possible, i.e. $\gamma=100\%$ corresponding to $\gamma=1$, then to bring the above result in line with $E = mc^2$ where m is the mass and c is the speed of light, then we simply interpret $E = mc^2$ as being $E = (2/2)mc^2$ [6]-[9]. In other words we have

$$\begin{aligned} E &= \left(\frac{\phi^5 + 5\phi^2}{2} \right) mc^2 \\ &= (\phi^5 / 2)(mc^2) + (5\phi^2 / 2)mc^2 \\ &= E(O) + E(D) \\ &= mc^2 \end{aligned} \tag{4}$$

where E(O) is the quantum particle ordinary energy and E(D) is that of the quantum wave dark energy [6]-[9]. Taking rational-integer approximation of the above identities we find

$$E \equiv (mc^2)/22 + (21/22)mc^2 \quad (5)$$

$$= E(\text{Einstein})$$

This result is in astounding agreement with accurate cosmic measurements and observations which assert that E(O) is about 4.5% and E(D) is the rest 95.5% of the total expected energy [6]-[9]. We may summarize the above as

$$\begin{aligned} \gamma(O) &= \phi^5/2 \\ &= 0.04508497197 \\ &\cong 1/22 \\ &\cong 4.5\% \end{aligned} \quad (6)$$

for ordinary cosmic energy density and

$$\begin{aligned} \gamma(D) &= 5\phi^2/2 \\ &= 0.9549150289 \\ &\cong 21/22 \\ &\cong 95.5\% \end{aligned} \quad (7)$$

for the dark energy section which as we know cannot be measured in a direct way without quantum wave non-demolition measuring devices that are technologically not yet available at the time of writing [7],[9].

11.11. *The 4-D Fusion algebra and Wilczek's anyons*

It is well known from topological quantum field theory and its relation to sub factors that there is a dimensional function for an explicit situation called 4-D fusion algebra given by [5], [6].

$$d(1) = d(\epsilon) = 1 \quad (8)$$

and

$$d(x) = d(\beta) = 1/\phi \quad (9)$$

Now, not so incidentally this 4-D function may be taken over to the two dimensional anyon where, as reasoned in the anionic theory [1]-[3] the vacuum is given by one while the anyon itself is given by $1/\phi$. It is not difficult to see the relation between anyon theory vacuum and our empty set on the one side and the anyons and our zero set on the other [6-9]. They differ in magnitude but not in principle while not forgetting for one minute that one is four dimensional and the other is two dimensional. Proceeding formally as in the previous section, we can calculate a volume analogous to that of equation (3), which turned out to be $\phi^5 + 5\phi^2 = 2$ [6]-[9]. This time the contribution of the anyon would be the dominant one, namely

$$\begin{aligned} V(a) &= (2)(1/\phi) \\ &= 2(1 + \phi) \\ &= 2 + 1 + \phi^3 \\ &= 3 + \phi^3 \end{aligned} \quad (10)$$

On the other hand the contribution of the anyon vacuum is given by the simple self-explanatory equation.

$$\begin{aligned} V(v) &= (2)(1) \\ &= 2 \end{aligned} \quad (11)$$

The total is thus

$$\begin{aligned} V &= 3 + \phi^3 + 2 \\ &= 5 + \phi^3 \end{aligned} \quad (12)$$

The corresponding Einstein maximal energy is therefore [6]-[9]

$$\begin{aligned} E &= \left(\frac{5 + \phi^3}{5 + \phi^3} \right) mc^2 \\ &= mc^2 \end{aligned} \quad (13)$$

Dissecting $5 + \phi^3$ into the smooth (integer) part, i.e. 5 and the irrational transfinite fractal portion ϕ^3 which together form a self affine or a self similar fractal Kaluza-Klein spacetime dimension we may write [6-9].

$$E = \left(\frac{\phi^3}{5 + \phi^3} + \frac{5}{5 + \phi^3} \right) mc^2 \quad (14)$$

The reader may attest for himself that $(\phi^3)/(5 + \phi^3)$ and $5/(5 + \phi^3)$ are nothing but exactly the same ordinary and dark cosmic energy densities that we found earlier on in numerous previous publications [6]-[9]. They were given by [6]-[9]

$$\begin{aligned} \gamma(O) &= \frac{\phi^3}{5 + \phi^3} \\ &= \phi^5/2 \end{aligned} \quad (15)$$

and

$$\begin{aligned} \gamma(D) &= \frac{5}{5 + \phi^3} \\ &= 5\phi^2/2 \end{aligned} \quad (16)$$

exactly as should be [6]-[9]. We note on passing the important fact that summing all the four dimensions of the 4-D fusion algebra [7], [9] also leads to the same Kaluza-Klein dimension result, namely

$$\begin{aligned} d(1) + d(\epsilon) + d(x) + d(\beta) &= 1 + 1 + 1/\phi + 1/\phi \\ &= 2 + 3 = \phi^3 \\ &= 5 + \phi^3 \end{aligned} \quad (17)$$

This is evidently the Einstein Kaluza spacetime manifold, which consists of a fractal Einstein space $4 + \phi^3$ inside a Kaluza space leading to a fractal manifold $5 + \phi^3$ as will be explained in the next section.

III. THE GEOMETRICAL TOPOLOGICAL PICTURE AFFORDED BY THE CONTINUED FRACTION

Continued fraction representation of the basic Hausdorff dimension $4 + \phi^3$ is well known in E-infinity theory to give an intuitive picture of a four dimensional space inside another four dimensional space and so on indefinitely. Adding one more large extra dimension then leads to $5 + \phi^3$ which is interpreted in the same vein as a fractal Einstein spacetime inside a Kaluza spacetime leading finally to a fractal Kaluza-Klein spacetime $5 + \phi^3$. Now let us use the same methodology to shed light on the two basic elements in the present theory, namely the zero set quantum particle and the empty set quantum wave. Since the particle has 0 and ϕ as bi-dimension the continued fraction of ϕ , namely

$$\phi = \frac{1}{1 + \frac{1}{1 \dots}} \quad (18)$$

would suggest a string inside a string and so on so that although it is topologically a zero dimensional, Hausdorffly the quantum particle is a fractal extended object resembling a string as in string theory which is naturally one dimensional but with fractal dressing. For the quantum wave given by the empty set -1 and ϕ^2 we have a similar situation because

$$\phi^2 = \frac{1}{2 + \frac{1}{1 \dots}} \quad (19)$$

suggests that it is a two dimensional object surrounding a one dimensional fractal stringy object. This is in superb conformity with our cobordism interpretation of the wave-particle duality and the mental picture we had all the time about a particle-like object while in the very same time we see the wave as being the inseparable surface of the particle as explained in great detail in various papers dealing with the transfinite set theoretical quantum mechanics theory of E-infinity pointless and gauge anomaly free, Cantorian spacetime [13]-[17].

IV. THE GOLDEN MEAN UNIFICATION EQUATIONS

We see it as quite instructive to point out explicitly the undeniable self-similarity of the various golden mean dimensional functions at the core of the various fundamental theories probing the present work. At the very beginning we have von Neumann-Connes function for Penrose fractal universe

$$D = a + b \phi \quad (20)$$

where $a, b \in Z$ and $\phi = (\sqrt{5} - 1)/2$ which is based on von Neumann's theorem of continuous geometry stating that every function

$$D^1(a) = \gamma_1 D(a) + \gamma_2 (\gamma_1, \gamma_2 \text{ real numbers}) \quad (21)$$

is a dimension function and every dimension function is of this form. Second we state the result obtained from the topological quantum field theory obtained from sub factors, namely the four dimensional fusion algebra stated and used earlier on. Thirdly we have the profound Fibonacci reformulation of F. Wilczek anyons and their fractional statistics also stated and used in section 2.2. It is really quite difficult not to be impressed by the unifying power of these golden mean based dimensional functions and at the risk of appearing a little inappropriately fatuous, the author is reminded of what the ex-secretary of a famous previous British Minister of the Exchequer, the Right Honourable Dennis Healey said when faced with unacceptable inability to understand the obvious, "silly billy". We feel that calling the power of the golden mean number theory numerology and what ever is meant by that would invite from our side a Dennis Healey comment.

V. DISCUSSION AND CONCLUSION

It is more than reassuring to find that the profound anyons theory [1]-[3] give the same results that E-infinity gave for the central major problem of quantum cosmology, namely that of the supposedly missing dark energy. It was labeled "missing" dark energy because seemingly accurate measurements found only 4.5% of the energy which was expected to be found [6]-[9], [18]-[23]. In short, the present analysis on its own and more so as a confirmation of previous analysis should dispel for ever any lurking doubt about the correctness of our result for the various cosmological energy densities [6]-[9]. Further more because the present computation relies on and connects so many diverse fields of physics and cosmology such as a topological quantum field theory, M-theory, sub-factors, E-infinity theory, anyons and the golden mean number system, it is fair to say that the end result may be viewed at a minimum as a partial unification of physics and quantum cosmology. On the other hand the golden mean as a number system features everywhere in our analysis at key strategic points that we are inclined to say that this system is more than just numbers and may well be the mathematical language chosen by nature. In this connection we may recommend to the interested reader two popular science videos by F. Wilczek [10] and the present author [11] on this and related issues. Furthermore we draw attention to an excellent recent paper by S.K. Chaubey who developed an excellent spacetime manifold setting for work along the subject of the present paper [12]. However it is our firm view that the central role played by the golden mean at the heart of the organizing core of at least four fundamental theories as well as the fact that it was found experimentally makes the case for the lingua franca of nature being the golden mean number system self-evident and should by

now be embraced by all serious but open minded scientists. It is by no means surprising that it is that way since we have known for a long time that symmetry groups are indispensable to high energy physics and cosmology, so if we realized that the golden mean number system is itself maximally symmetric, everything falls into place in the right way [20]-[28].

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AUTHORS PROFILE



Professor **M.S. El Naschie** was born in Cairo, Egypt on 10th October 1943. He received his elementary education in Egypt. He then moved to Germany where he received his college education and then his undergraduate education at the Technical University of Hannover where he earned his (Dipl.-Ing) diploma, equivalent to a Master's degree in Chartered Structural Engineering. After that he moved to the UK where he enlisted as a post-graduate student in the stability research group of the late Lord Henry Chilver and obtained his Ph.D. degree in structural mechanics under the supervision of Professor J.M.T. Thompson, FRS. After his promotions up to the rank of full professor, he held various positions in the UK, Saudi Arabia and USA and was a visiting professor, senior scholar or adjunct professor in Surrey University, UK, Cornell, USA, Cambridge University, UK and Cairo University, Egypt. In 2012 he ran for the Presidency of Egypt but withdrew at the final stage and returned to academia and his beloved scientific research. He is presently a Distinguished Professor at the Dept. of Physics, Faculty of Science of the University of Alexandria, Egypt. Professor El Naschie is well known for his research in structural stability in engineering as well as for his work on high energy physics and more recently for his work is cosmology and elucidation of the secret of dark energy and dark matter as well as for proposing a dark energy Casimir nanoreactor. He is the creator of E-infinity theory, which is a physical theory based on random Cantor sets and can be applied to micro, macro and mesoscopic systems. Professor El Naschie is the single or joint author of about one thousand publications in engineering, physics, mathematics, cosmology and political science. His current h-index is 77 and his i-10 index is 762 and total citations are 32781 according to Google Scholar Citation.