# Electromagnetic Gravity and the Quanta[*]

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*Abstract* – We present a proposal for a golden mean number system unification of all interactions. In particular we give a simple proof of the electromagnetic origin of gravity as well as all fundamental forces by utilizing fuzzy logic and fractal counting. Furthermore we give a short account of why Witten's quantum field theory and E-infinity theory are equivalent for zero and negative degrees of freedom.

*Keywords* – Fractal Logic, Fuzzy Counting, Golden Mean Number System, E-Infinity Theory, Fractal M-Theory, Feigenbaum Golden Mean Renormalization Groups.

## I. INTRODUCTION

It may well be that the title of the first reference of the present paper, namely "From the numerics of dynamics to the dynamics of numerics ...." constitutes the best short cut introduction to the subject at hand (see ref 1). The subject is thus deeply intertwined with fractal logic and fractal counting, which was proposed some time ago, [2-3] and which is extended here so as to have a bearing on the classical theory of quantum gravity [4-7] and give it a new twist leading to effectively forming a general theory for the unification of all fundamental forces [8-15]. The rather surprising conclusion of an equally surprisingly short tour de force is that the electromagnetic field could be seen as not only the source of an emergent gravity but also the origin of all fundamental interactions [4-16]. The key to understanding this unexpected conclusion lies in the use of fractal counting related to a new fuzzy logic that is akin to the fuzzy sets of L. Zadeh [17-20] as well as the golden mean renormalization groups of M. Feigenbaum et al and the associated golden mean number system [21-30].

In addition to the main subject of unification addressed in the present paper, we give a brief account of the equivalence of Witten's topological quantum field theory for zero and negative degrees of freedom to E-infinity theory and Cantorian spacetime and explain the rationale behind this equivalence [61-62].

Needless to mention that in our effort to keep this paper relatively short without undermining the ease of smooth reading and quick comprehension, we resorted to a rather larger than usual list of References which we hope is adequate for the present purpose [1-65].

## II. FRACTAL LOGIC AND THE GOLDEN MEAN NUMBER SYSTEM IN A NUTSHELL

The paradoxical completeness of the conventional standard model of high energy physics [2, 3] which comprises the well-known 12 messenger particles given by a combined Lie symmetry groups U(1), SU(2) and SU(3) i.e. [3, 33]

dim (U(1) SU(2) SU(3)

$$= (1 + 3 + 8) \tag{1}$$

$$= 12$$

[*]Dedicated to the memory of Professor Mitchell Feigenbaum, an exceptional person in every respect.

is a very subtle point lurking at the very core of our analysis [2, 3]. This paradox lies in the fact that although the above-mentioned equation (1) does not include on its face value either the Higgs nor the Graviton i.e. 12 + 2 =14, when seen through the fractal logic of fuzzy fractal counting, we are led to the conclusion that a smaller value $12 - 2\phi^4 = 11.70820393$ where $\phi = \left(\sqrt{5} - 1\right)/2 = 0.618033929$ rather than the larger value 12 + 2 = 14 is sufficient to describe all fundamental interactions [1, 2]. In other words the incomplete standard model is actually complete when our number of degrees of freedom 12 is transfinitely correct to become $12 - \phi^4$ where $\phi$ is the classical golden ratio which is well known in nonlinear dynamics in general and KAM theorem [15,16] as well as Feigenbaum's renormalization groups and E-infinity theory in particular [15, 16, 26, 28]. In the light of the above it is bordering on absurdity that the following more than outrageous equation could be stated in the expedient sense of E-infinity fractal Logic as follows [2, 3], [39-44]:

$$12 = 14 = 12 - 2k^2 = 11.708039325 \tag{2}$$

We recall that equation (2) is part and parcel of the transfinite correction techniques of E-infinity theory [15, 16], [22, 41] which may in turn be an expression of the simplecticity of the corresponding Penrose fractal tiling universe [32, 34] modelling our actual cosmos and obeying Von-Neumann-Alain Connes' golden mean dimensional function [15,16], [32-43].

$$D = a + b\phi \tag{3}$$

where a, b $\in$ z and $\phi$ is again the golden mean $\left(\sqrt{5} - 1\right)/2$ as discussed for instance in [15, 16, 34, 38]. Proceeding in this way and minding the expert system consistency [39-41] of the above, we can explain and compute $12 - 2k^4$ in the following four steps:

(a) The photon U(1) is assigned the numerical weight $\phi$ which means Connes'-Hausdorff dimension of the zero set modelling the pre-quantum particle [2, 3, 38].

(b) The $w^+, w^-$, and $z_0$ of the electroweak SU(2) are now given by the well-known 16 extra dimensions of Grosse et al heterotic strings [40] multiplied with 'tHooft's renormalization k which in turn is twice the value of Hardy's quantum entanglement $\phi^5$ so that dim SU(2) = 3 is transfinitely corrected to (see refs. 30, 43).

$$16k = 32\phi^5 = 2.88543206 \text{ where } k = \phi^3\left(1 - \phi^3\right) = 2\phi^5 \text{ [36-43].} \tag{4}$$

(c) Furthermore we have the transfinite value corresponding to the 8 gluons of dim SU(3) = 8 [2, 3] namely half the transfinite heterotic string dimension 16 + k i.e. (16 + k)/2 = 8 + (k/2) [36-43].

(d) Now we have to find the fractal number corresponding to one Higgs and one graviton [2, 3]. This was reasoned in previous publications to be at the very same time neither entangled nor disentangled Higgs $k_0 = \phi^5\left(1 - \phi^5\right)$ representing the well-known fractal tail of the theoretical inverse electromagnetic constant $\overline{\alpha_0} = 137 + k_{0s}$ while the intersection of two 'tHooft's renormalizations $k^2 = \left(\phi^3\left(1 - \phi^3\right)\right)^2$ represents the graviton [2-8], [36-43].

In the next section we utilize the union of the above four-step computations to assert the final result and the present claim, namely that all fundamental interactions are originally anchored into the electromagnetic field [39-62].

## III. THE ELECTROMAGNETIC ORIGIN OF ALL FUNDAMENTAL INTERACTIONS INCLUDING GRAVITY

Now we reached the point where we can demonstrate in unheard of simplicity our claim that seen through the golden fractal logic glasses, all fundamental interactions may be straightforwardly shown to be essentially electromagnetic in nature [44-50]. This interpretation is not mere expediency prompted by number theoretical reasoning only but far more than that a clear aspect of the connection between the arrangement of sunflower and the beauty of Hardy's quantum entanglement i.e. the intimate well hidden bond between the micro and macro cosmos [1-50]. To arrive at this startling but very simple and persuasive conclusion, we just need to look at the total fractal numbers of messenger particles just found as being the degree of freedom of an interactive universe which may be viewed as a single photon in a fractal Witten's spacetime [35, 36]. Recalling that the fractal Witten spacetime dimension is simply a Russian doll-like eleven dimensional space with the self-similarity expressed via the inverse of Hardy's quantum entanglement, one finds that [35].

$$
\begin{aligned}
D_f(\text{Witten}) &= 11 + \cfrac{1}{11 + \cfrac{1}{11 + \dots}} \\
&= 11 + \phi^5 \\
&= \frac{1}{\phi^5}
\end{aligned}
\tag{5}
$$

This way we see clearly the union of Witten's fractal M theory spacetime [35] as a single photon inside this space leading to the same weight number of all messenger particles which means that

$$
\begin{aligned}
\sum_1^5 (\text{SM}) &= \phi + (32)(\phi^5) + \left(8 + \frac{k}{2}\right) + k_0 + k^2 \\
&= 12 - 2\phi^4
\end{aligned}
\tag{6}
$$

is exactly equal to the weight given by equation (5) plus a $\phi$ photon as indicated above:

$$
11 + \phi^5 + \phi = 12 - 2\phi^4
\tag{7}
$$

Let us look now at the "self intersectional" intersection of the total number of the messenger particles fractal manifold as given by (6) and (7) and find the result which surpasses our most optimistic number theoretical expectation, namely that [44 - 48]

$$
\begin{aligned}
\left(\sum_1^5 \text{SM}\right)^2 &= \left(12 - 2\phi^4\right)^2 \\
&= 144 + 8\phi^8 - 4\phi^4 \\
&= 137.082039325 \\
&= 137 + k_0 \\
&= \overline{\alpha_0}
\end{aligned}
\tag{8}
$$

where $\overline{\alpha_0}$ is the well known E-infinity theoretical value of the inverse electromagnetic constant [46-49]. In turn,

the experimental value of $\overline{\alpha_0}$ at the ordinary scales was shown on many previous occasions to be a projection of $\overline{\alpha_0} = 137 - k$ namely $\overline{\alpha_0} = 137.06$ [44].

## IV. THE GLOBAL LOGICAL UNITY OF THE PROPOSED COMPUTATIONAL SCHEME

Physics and cosmology as computation was considered in various earlier E-infinity publications [15, 16, 23, 25, 27, 30, 31]. In this section we aim at recalling a few facts to attest to the monolithic unity and irreducible logical oneness of our present number theoretical and physical mathematical schemata [31-34]. To take this viewpoint, we can do nothing better than restate the following well-known and documented facts gained from E-infinity applications to high energy physics and quantum cosmology of dark energy as well as accelerated cosmic expansion of which the following concise listings are nothing more than some of many other examples [1], [31-50].

(1) First and foremost we should mention the reconstruction equation of $\overline{\alpha_0}$ using the methodology of the golden quantum field equation of E-infinity [23-27]. It is essentially a renormalization equation, which uses three integers and the ideal inverse coupling to determine $\overline{\alpha_0}$. These inverse couplings are $\overline{\alpha_1} = 60$ of electromagnetism, $\overline{\alpha_2} = \overline{\alpha_1}/2 = 30$ of the weak force, $\overline{\alpha_3} = 8 + 1 = 9$ of the strong force and $\overline{\alpha_4} = 1$ of the plank scale [23-27]. The Clebsh factor in this equation is not the classical one and interestingly is the inverse of the golden mean $\phi$ namely $(1/\phi) = 1 + \phi$ [1, 2], [23-27], [39].

That way the fundamental equation reads [31-38]

$$\begin{aligned}
\overline{\alpha_0} &= \overline{\alpha_1}(1/\phi) + \overline{\alpha_2} + \overline{\alpha_3} + \overline{\alpha_4} \\
&= (60)(1/\phi) + 30 + 9 + 1 \\
&= 137 + k_0 \\
&= 137 + \phi^5(1 - \phi^5) \\
&= 137.082039325
\end{aligned} \tag{9}$$

exactly as should be [44-47].

(2) The second most important example may be the generation of the transfinite heterotic super strings hierarchy from $\overline{\alpha_0}/2$ by golden mean scaling as follows [15,16]:

$$\begin{aligned}
(\overline{\alpha_0}/2)(\phi) &= 42 + 2k \simeq \\
(\overline{\alpha_0}/2)(\phi^2) &= 26 + k \simeq \\
(\overline{\alpha_0}/2)(\phi^3) &= 16 + k \simeq \\
(\overline{\alpha_0}/2)(\phi^4) &= 10 \\
(\overline{\alpha_0}/2)(\phi^5) &= 6 + k \simeq \\
(\overline{\alpha_0}/2)(\phi^6) &= 4 - k \simeq
\end{aligned} \tag{10}$$

(3) Next we must mention the remarkable and exact result of Hardy's quantum entanglement [31] namely $\phi^5$ and the corresponding total dark energy density of the universe which is given simply by [39-43]

$$\frac{(\overline{\alpha_0}/2)(\phi^6)}{4} = (4-k)/4 \tag{11}$$
$$= 95.4915\%$$

in full agreement with measurements and observations [40].

[4] We could not conclude this short list by anything better than demonstrating how golden mean scaling converts $\overline{\alpha}_0$ to the transfinite dimension of the remarkable fuzzy version of the exceptional Lie symmetry groups.

$$\textbf{dim } E8E8 = (3+\phi)(\overline{\alpha}_0) = 495.9692860 \cong 496 \,. \tag{12}$$

On the strength of the above mentioned examples alone, we are more than confident that at a minimum, nature obeys to the letter fuzzy fractal counting and speaks with a golden mean tongue and sings to a golden mean music and harmony [42], when quantum mechanics is involved at the scales of interest [30, 32, 37, 39].

## V. ON THE EQUIVALENCE BETWEEN THE TOPOLOGICAL QUANTUM FIELD THEORY AND E-INFINITY THEORY

The intuitive and rather obvious conjecture that in zero and negative dimensions both Witten's topological quantum field theory and our E-infinity Cantorian spacetime theory ought to be equivalent was an idea floating in the back of our minds for quite a long time. In this section we would like to push these ideas further and go beyond a mere conjecture along the lines laid down in some of our previous publications [61, 62]. For the sake of simplicity we decided to start here not from the fully fledged Witten's topological quantum field proper, but rather from the related theory of pure gravity [61]. Let us recall that the degrees of freedom of pure gravity, similar to that of the massless graviton is given by

$$D^{(d)} = d(d-3)/2 \tag{13}$$

consequently for one, three, and four dimensions we find the remarkable result that the degrees of freedom are

$$D^{(3)} = 0, D^{(2)} = -1, D^{(1)} = -1 \tag{14}$$

Interpreting $D^{(d)}$ as Menger-Urysohn topological dimension, we see that $D^{(3)} = 0$ may be seen as the zero set pre-quantum particle while $D^{(2)} = D^{(1)} = -1$ may be viewed as the empty set pre-quantum wave. Recalling that the corresponding Hausdorff dimensions are $\phi$ and $\phi^2$ we see that in such a case we have a complex fractal theory equivalent to E-infinity [55-62].

The previous arguments are for sure less than a mathematical proof but equally for sure they are more than a conjecture testifying to our conviction regarding the equivalence between the topological quantum field theory and our topological E-infinity theory and this is in total accord with the dimension function of Connes' non-commutative Penrose universe [61]. From that theory we know that the zero set is described by a bi-dimension $(0, \phi)$ where $\phi = (\sqrt{5}-1)/2$ and the empty set is given by $(-1, \phi^2)$. In other words $D^{(3)}$ resembles a zero set "particle" while the world sheet and world line $D^{(2)}, D^{(1)}$ resembles an empty set "wave" in a quantum spacetime sense of string theory [63-65].

## VI. Conclusion

In a nutshell the main message of the present work is that counting is the most unifying strata which makes two men and two trees intimately related by being two or for that matter any number. However integers are too rudimentary to be efficient to quantum natural phenomena. On the other hand the golden mean number system can handle any counting no matter how complex or fuzzy [41].

With the benefit of long-term hindsight and contemplative retrospective looking back with "amazement", one must admit that much of the ideas underlying our E-infinity theory as well as the present analysis have been out there and around for a long time and not in a minor measure implicit or explicit in the work of at least two great scientific giants who are free spirited and courageous pioneers, namely Zadeh, the American-Persian father of Fuzzy Set Theory [17, 18] and the man who is credited with the discovery of the Golden Mean Renormalization Groups and the Universalities of Chaotic as well as Deterministic Mathematical and Physical systems, the exceptional American of Polish Jewish descent, the late Professor Mitchell Feigenbaum [22].

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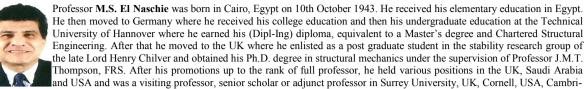
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-dge University, UK and Cairo University, Egypt. In 2012 he ran for the Presidency of Egypt but withdrew at the final stage and returned to academia and his beloved scientific research. He is presently a Distinguished Professor at the Dept. of Physics, 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 and a fuelless interstellar spaceship powered by the quantum forces of empty spacetime.

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 79, his i-10 index is 779 and his citations according to Google Scholar is 34120.