

Spacetime as a New Frontier Advanced Material with Applications in Physics, Engineering, Chemistry and Cosmology*

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N Tesla's Aether, Einstein's Aether

The starting point of the present work is a theoretical and experimental resolution of one of the most basic fundamental problems of physics, namely the very existence and reality of the Aether [1]-[11]. These basic philosophical and scientific insightful results in theoretical physics and cosmology [1]-[24] are converted here into a serious attempt to actually realizing an old futuristic dream, namely obtaining free energy from empty space or spacetime singularities as thought of by visionaries such as N. Tesla and Sir R. Penrose [2] [5], with undreamed of possibilities in physics, chemistry, engineering and cosmology [25]-[31].

Our mathematical and indirect experimental verdict which was announced recently [29] is that the Aether exists and it can be equated to the empty set of pure mathematics [3] [12] [13] [14] [15] [16]. More precisely the Aether may be understood for all mathematical and physical purposes as being identical to the empty set [8]-[14] underlying the Penrose fractal tessellation universe [17] which obeys the A. Connes' corresponding dimensional function of his non-commutative geometry [18] [19] [20] [21].

From this astounding conclusion it is relatively very easy to conclude from the above that cosmic dark energy is simply the energy stored in the Aether empty set [22] [23] [24] so that the agreement between the theoretical calculation and the numerous accurate cosmological measurements may be taken as an indirect experimental confirmation of this spectacular model for the Aether [10]-[16],

*Dedicated to the memory of Mae-Wan Ho (1941-2016). A great scientist and a great lady.

[22] [23] [24] In fact the mere fact that Penrose fractal tessellation is a well known and valid model for quasi crystals, *i.e.* a real material with five fold symmetry as well as for the cosmos at large [10] [17], is a sufficient fact to reinvigorate an old analogy between photons and phonon [7]-[11]. Not only that but far more importantly, one can look for methods of harnessing the energy of empty spacetime using nanotechnology [25]-[31] as a scientific fact, not fiction.

Seen in this larger imaginative new reality [7], we can go on confidently repeating what we have claimed for many years, that spacetime is physically real and may be regarded as a highly advanced material which can be used to yield practically infinite clean, free energy via what we called a dark energy-Casimir nanotech reactor [15]. As we said earlier on, such a reactor was thought of by many visionaries before but was never given anything like a firm mathematical and experimental justification as we did within the E-infinity theory proposal [21]-[36]. In fact based on these ideas two of the most active researchers in the Romanian chapter of fractal Cantorian spacetime realized as early as in 2007 that nanotechnology is the tool to construct a spacetime Casimir energy reactor [30].

We leave it to the historians of science to relate our findings to that of the Tesla-Einstein discussion about the Aether [5]. However it is interesting to note that while Einstein started by thinking of his theory of relativity as a proof that the Aether could not exist or at a minimum is a totally unnecessary assumption, in his later years Einstein modified his stance and came much nearer to the thinking of legendary Serbian-American N. Tesla who was a firm believer in the reality of the Aether [2] [5] [6] [7].

In what follows and in spite of the limited space of the present work we should and will give at least some mathematical elaboration in addition to the most important equations of our theory [8]-[36]. Proceeding in this way it will become evident that $E = mc^2$ of Einstein implicitly included a recognition of the existence of the Aether by unconsciously including the energy of the Aether, *i.e.* a totally empty spacetime via the energy of the quantum wave as explained by the author on many previous occasions [3] [4] [9]-[18] [34] [35] [36].

This conclusion, as easily reasoned, is a natural consequence of modelling the quantum pre-particle by the zero set [3] [6] [9] [11] and assign to it two dimensions, namely the topological dimension zero as befitting a point particle and the second Hausdorff dimension $\phi = (\sqrt{5} - 1)/2$ as obvious from Sir R. Penrose geometrical tessellation and Prof. A. Connes' dimensional function of the Penrose fractal universe [11] [17] [19] [20]. The pre-quantum wave on the other hand is interpreted in our theoretical model as the cobordism, *i.e.* the surface of the pre-particle [11]-[16]. Consequently it is an empty set and possesses two dimensions, similar to the zero set [4] [8]-[15]. The first is the Menger-Urysohn dimension minus one and the second is the Hausdorff dimension ϕ^2 [11]-[20]. Thus following the rationale of our theory we see that the cobordism of the pre-quantum wave must be given by a topological dimension minus two and a Hausdorff dimension ϕ^3 [10] [11]. On the other hand the average Hausdorff

dimension of spacetime is $4 + \phi^3$ [10] [11] [21]. Consequently the inverse of $4 + \phi^3$ is ϕ^3 [12] [13] [14] [29]-[36]. That means on average the surface of the pre-quantum wave is spacetime itself [12] [13]. That way we may see the quantum particle with its surrounding guiding pre-quantum wave as ripples in spacetime just as phonon are vibrational ripples in the quasi crystal [7]-[16]. Taking a bird's eye view of the entire situation, Aether, quantum field, quantum wave and spacetime become different names for very similar, in fact almost identical physico-mathematical entities [10]-[24]. Since spacetime is an empty set then deep philosophical implications with a bearing in both physics and metaphysics as well scientific philosophy follows. Thus whenever a zero set particle moves the surrounding empty set becomes a non-empty zero set. This is a self referential statement which implies fractals [35]. It also implies zenon paradox about motion being an illusion [36].

It remains only to quantify the situation. Putting the five fold quasi crystal symmetry which was thought not long ago to be forbidden [37] [38] in a Kaluza-Klein five dimensional manifold we find a five dimensional zero set topological volume ϕ^5 [16]-[21]. Thus the surface of ϕ^5 is clearly an additive five dimensional area equal $5\phi^2$ representing the pre-quantum wave [3] [4] [10]-[16]. Now we have shown in many previous publications [10]-[16] that ϕ^5 is related to the ordinary measurable energy density of the universe and is found from the ordinary formula of classical kinetic energy when we let the velocity tend to that of light and find that $E(O) = (1/2)(m = \phi^5)(c^2)$ where $c = \phi$ is the topological speed of light which amounts to about 4.5% of the energy density of special relativity, namely $E = mc^2$ divided by 22 [10]-[16] [22] [23] [24]. As for the pre-quantum wave which is what gives us the dark energy sector and which cannot be measured directly because an empty set becomes non-empty and collapses on measurement [10]-[16] [22] [23] [24], one finds

$E(D) = (1/2)(m = 5)(c^2)$ which amounts to 95.5% of Einstein's density [12]-[24] that is approximately equal to Einstein's maximal density mc^2 multiplied by 21 and divided again by 22.

The beauty of the present theory is summarized in unexpected confirmation of Einstein's famous formula, namely [22]-[24]

$$\begin{aligned}
 E &= E(O) + E(D) \\
 &= \left[(\phi^5/2)mc^2 + (5\phi^2/2)mc^2 \right] \\
 &= (1/2)(\phi^5 + 5\phi^2)mc^2 \\
 &= (1/2)(2)mc^2 \\
 &= E(\text{Einstein})
 \end{aligned} \tag{1}$$

Note that the most important point in all of the above results is in complete agreement with the accurate cosmic measurements [11]-[16] [22] [23] [24]. Consequently our theory is an accurate model of reality [21]-[36].

Finally the present theory may be refined to account for dark matter energy and pure dark energy as well [23] [24]. That way we can rewrite Equation (1)

using the fractal Kaluza-Klein spacetime theory which replaces 5 by $5 + \phi^3$ as the sum of not two but three energy sectors densities as follows:

$$E + E_1 + E_2 + E_3 \quad (2)$$

where [22] [23] [24] [28] [29]

$$\begin{aligned} E_1 &= E(O) \\ &= \left(\frac{\phi^3}{5 + \phi^3} \right) mc^2 = 0.04508497178 mc^2 \end{aligned} \quad (3)$$

while E_2 is the energy density of dark matter in the universe given by

$$E_2 = \left(\frac{1 + \Delta}{5 + \phi^3} \right) (mc^2) = 0.2218033994 mc^2 \quad (4)$$

and $\Delta = 0.1613776766$ is a coupling constant as explained elsewhere [28] [29]. Finally E_3 is the pure dark energy in the universe and is given by [22] [23] [24] [28] [29]

$$E_3 = \left(\frac{4 - \Delta}{5 + \phi^3} \right) (mc^2) = 0.7331116289 mc^2 \quad (5)$$

It was the great German material scientist and physicist at Clausthal University who noticed first explicitly that the ordinary energy density when inversed gives the exact dark matter percentage [31]. This is of course implicitly understood from the E-infinity relations between the various fundamental equations of the golden mean harmony [32] [33] [34].

From the preceding result we see that there is no doubt that the Aether exists and that it is basically a five dimensional empty set akin to the Penrose tessellation universe which is described by A. Connes' dimensional function of his noncommutative geometry as we indicated earlier on [17] [18] [19].

As for the actual design of the reactor, we stress yet again this is actually a nanotechnology problem of restructuring empty space as we indicated earlier on and is basically building nano universes using nano fullerene buckyballs [39] particles in a way not dissimilar to what we discussed in some preliminary design proposals (see for instance Fig. 4 of Ref. [25]).

In conclusion, on an optimistic note, we should be glad to see that we have come a long way from Tesla's dreams [5] to a Nobel winner in physics saying that spacetime is a material [7] and from forbidden 5 fold symmetry to a Nobel Prize for quasi crystals and buckyballs [37] [38] [39].

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