

Casimir-Dark Energy Nano Reactor Design Proposal Based on Fractal

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Abstract – The present paper utilizes the theory of fractal spheres packing as linked to transfinite set theory and nanotechnology in order to develop a conceptual design for a nano-Casimir reactor. One of our main fundamental theoretical results is that quantum spacetime has a latent intrinsic topological pressure equal to the inverse of the Hausdorff dimension of the core space. This leads us to the conclusion that the zero point energy of the vacuum has many manifestations apart of the Casimir effect, including dark energy, Unruh temperature and Hawking’s negative energy fluctuation. In fact invoking Witten’s T-duality it is obvious to conclude that what we called Casimir energy on the very small quantum and nano scale is what we observe indirectly on the very large Hubble cosmic scale and call dark energy.

Keywords – Casimir Reactor, Fractal Sphere Packing, Dark Energy, Casimir-Nano Technology, E-Infinity, Ord Spiral Model, K-Theory Fractal Spacetime, Casimir-Dark Energy Effect, Ord Stochastic Process, T-Duality.

I. INTRODUCTION

In a nutshell the pragmatic engineering part of present work is motivated by a simple fact known to all those who work in nanotechnology, namely that the Casimir forces are a spurious, unwanted effect in the design of all sorts of nano gadgets. By contrast we aim here to amplify the Casimir effect using E-infinity theory [1] to become a Casimir reactor [2]-[6]. As for the deep theoretical part of the present paper, it is in the first line a Witten’s T-duality demonstration that the local very small scale Casimir effect is basically nothing but the very large Hubble cosmic scale dark energy [3]-[9].

Before proceeding any further, we think it is better to develop some intuitive feeling for the Casimir effect as well as dark energy because both subjects are universally regarded as counter intuitive and difficult to build a mental picture of [2]. Since our goal of building a real nano Casimir-dark energy reactor is an engineering project which depends on visualization, such a starting point would be almost impossible without feelings and intuition [3]-[10]. Contrary to expectations and luckily so, we could use several classical mechanics analogies and find at the end that visualizing the Casimir effect is trivial while dark energy is moderately difficult but the only hard thing to swallow, as on countless previous occasions, is the nature of the quantum wave which disturbed Einstein as well as Schrödinger enormously although with the passing of time we tend to accept it without serious questioning as a result of habit and familiarity and by no means as a result of increased understanding [1]-[9]. The Casimir effect, we think, could not strike sea officers or experienced sailors as strange in principle. Navy people in general know well that two large ships should not pass too

near to each other to avoid a collision. Those with some knowledge of hydrodynamics will explain this using two well known hydro dynamical laws. The first and the most important is that the two ships will act like two walls creating between them a quasi harbour effect calmer part of the sea as far as waves are concerned. In the open sea on both of the outer sides of the ships, the waves are normally much stronger and therefore they will push the ships sideways and lead to a dangerous ramming sideways collision of the two vessels. This is more or less what happens to the Casimir plates acting as two ships and the quantum wave or virtual photons of the vacuum state of quantum space act as the wave of the sea. Now since the section of the area separating the two ships is measured almost in nano units compared to the section of the open sea, the velocity of the passing water between the two ships would be much larger between them compared to the outside. From engineering hydraulics we know that this will create a smaller pressure. Consequently the pressure on the outside of the ships will be larger and increase further the collision forces by a suction effect. The same analogy could also be used to explain the possibility a ‘faster than the speed of light’ connected to the Casimir channel effect. This is the intuitive picture behind the present paper and we may now proceed towards the actual conceptual design of a Casimir nano reactor. This will be clear in the next section is closely related to fractal sphere packing on all scales which is a quasi fractal packing of spheres as shown in Fig. 1. The theoretical arguments leading to our conclusion will unfold in Sections 2 to 10 supported by references [1] to [84] which is rather comprehensive. In particular extensive use is made of [84] dealing with kissing point of packed spheres as well as [85]-[86] dealing with Witten’s T-duality.

II. THE MINI UNIVERSE MODULI OF THE CASIMIR NANO REACTOR AS THE FIRST STEP OF THE PRELIMINARY DESIGN

Let us be guided by the natural dynamics of transfinite Turing machine starting from the well founded theory of the Riemannian tensor used in Einstein’s original 4D theory as well as all related spacetime gravity theories extending that of Einstein [6]. The number of independent components of the Riemannian tensor is given by [48]

$$N = n^2(n^2 - 1)/12 \quad (1)$$

where n is the dimensionality of the embedding space. For $n = 4$ we find the well known result of Einstein’s relativity, namely $N = 20$ which corresponds to the number of isometries or degrees of freedom for pure gravity in the case of $n = 8$ as discussed on previous occasions. Also from the fundamental equation of

isometries of E-infinity theory we have $B = H + G + E$ where B is the bulk, H is the holographic boundary of B, G is gravity and E is $\bar{\alpha} = 137$ of electromagnetism, we have for $B = |E8 E8|$ the well known result $B = 496$ so that one finds [42], [43]

$$\begin{aligned} 496 &= SL(2,7) = R^{(4)} + \bar{\alpha}_o \\ &= 336 + 20 + 137 \\ &\neq 493. \end{aligned} \tag{2}$$

That way we conclude that equality of the above equation is only possible when the fractal fine structure is taken into consideration. This may be achieved via the following transfinite i.e. fractal corrections [43], [64]:

$$\begin{aligned} 336 &\rightarrow 336 + 16k \\ 496 &\rightarrow 496 - (\phi)^2 \\ 137 &\rightarrow 137 + k_o \end{aligned} \tag{3}$$

where $k = \phi^3(1 - \phi^3)$ and $k_o = \phi^5(1 - \phi^5)$. A second result of the above is that [42], [43] [64]

$$R^{(4)} = 20 \tag{4}$$

played the role of super symmetric isometries and similarly is $137 + k_o$ for fuzzy Lie-like symmetry groups. Now let us investigate $R^{(n)}$ in super space $n = 8$ and put this whole thing under a step by step microscope to see hidden interrelationships which are normally glossed over as being of secondary importance or just numbers and thus missing on noticing the Turing computer behind it all which is in our case a transfinite Turing machine as will be transparent shortly. Setting $n = 8$ one finds [26], [43]

$$\begin{aligned} N &= (8)^2(8^2 - 1)/12 \\ &= 8[8(64 - 1)/12] \\ &= 8[8(63)/12] \end{aligned} \tag{5}$$

where 63 are half of the number of particle-like states in the standard model, namely $(2)(63)=126$. Consequently we have [64]

$$N = 8 [504/12] \tag{6}$$

where 504 is the well known number of quantum states in the spectrum of the Heterotic string theory as shown explicitly in detail in M. Kaku's classical treaty on the subject. Proceeding further by writing N as [42], [64], [84]

$$\begin{aligned} N &= \frac{(2)(8)(504)}{(2)(12)} \\ &= \frac{8064}{24} \\ &= 336 \end{aligned} \tag{7}$$

we see that 8064 is the first massless state in the Heterotic spacetime as emphasized in M. Green's famous Scientific American article on string theory where 24 are the number of instantons. The final result is the most notable, namely $N = 336$ which are the isometries of $SL(2,7)$ or the degrees of freedom of Klein's modular curve $\Gamma(7)$ as well as being the kissing number of packed spheres in ten dimensions [84]. To move to the exact transfinite values is a well known procedure by now and was demonstrated in the past in many previous publications where we showed that the following transfinite corrections are valid:

$$8064 \rightarrow 8872.135955 \tag{8}$$

and

$$24 \rightarrow 26.1803396 \tag{9}$$

so that at the end we have the exact transfinite number of kissing spheres in ten dimensions [84]

$$\begin{aligned} N &= \frac{8872.135955}{26.180339} \\ &= 338.8854382 \\ &= 336 + 16k. \end{aligned} \tag{10}$$

These are the degrees of freedom of our holographic boundary representing our universe and in turn our unit moduli mini universe in our Casimir nano reactor that resembles a fractal tree.

III. FRACTAL SPHERE PACKING (See Fig.1)

Let us remind ourselves of what we did so far. Leaving the fine structure, i.e. the transfinite corrections aside for the moment, we started with a super symmetric Riemannian tensor in $n = 8$ super space having 336 components. Then we relate it to a 336 degrees of freedom Klein modular curve projection on $D = 2$ of an originally $D = n - 1 = 8 - 1 = 7$ dimensional holographic boundary. Finally we rolled the space into a ball of dimensions $D = 10$ of super strings in order to find 336 contact points normally called kissing number of packed spheres [84]. Now in order to build this in 3D and add the fine structure 16k, we simply take a sphere and fill it with 336 smaller spheres then fill the saps between the spheres with spherical powder of different mesh sizes like when we prepare the aggregates for a concrete mixture and produce that way an approximately quasi fractal sphere packing as shown in Fig. 1. This is our moduli from which we can build a tree and from the fractal tree we have the nucleus of a nano Casimir reactor. One final thought about something a little subtle and involved to explain. This may be outlined by the following question, namely are we putting ten, eight and seven dimensions in our three dimensional sphere. The answer is yes and no. The extra dimensions we have appear only at the very small scale and that is why our extra dimensions theories are successful in describing the micro quantum world and by Witten's T-duality also at the very large scale structure of the universe. In our 3D sphere where we are packing 336 plus 16k kissing spheres [84], we are just simulating micro spacetime and making it sufficiently large for us small creatures, imprisoned in an intermediate world of 3 dimensions plus time, to control and work with as we do with any classical reactor.

IV. ZERO POINT VACUUM ENERGY BACKGROUND INFORMATION

It is difficult, if not near impossible to give even a glimpse into the past work done in a vibrant and vast field like the zero point vacuum energy which spans the entirety of fundamental theoretical and experimental physics. So rather than attempting the unfeasible, we have included in the present paper a very large amount of references and

the reader is referred to these publications and the references therein [1]-[66], [68]-[77].

The present paper has two different messages to communicate, a scientific one centered around the quantum vacuum as a source of energy [3-46, 56-59, 61,62,64,66,68, 70-72, 74,76] and a socio-economical, political message that we must invest in this new revolutionary source of energy [47,63,73]. The idea of zero point energy and the fluctuation of vacuum may seem at first glance to be more science fiction than science fact. However there are, and since quite some time, a host of hard core experimental evidence that the vacuum may be more real and fundamental than most of what we habitually consider the materialistic reality of physical phenomenon [3]-[46], [56]-[59], [61], [62], [64], [66], [68], [70]-[72], [74,76]. We just need to mention in this context the Lamb shift, Schwinger correction [2], [60], [65], [69], [77] and the van der Waals forces to realize how physical and real the vacuum is [61], [66], [70], [76]. Nonetheless, and we do not think it is a minority opinion, nothing could be more impressive and inspiring as the Casimir effect [61], [70], [76]. This effect is a natural consequence and fundamental aspect of quantum field theory and could in principle be extended to many fields including that of gravity. There are at least two fundamental interpretations of this miraculous effect [2], [65]. The first is loosely connect to boundary conditions and the zero point quantum vacuum fluctuation which may be the common way of looking at the Casimir effect within the working physicists community. The second, which may be more theoretical and fundamental, is to see Casimir as a source in the mold of J. Schwinger's way of thinking and not far from the Casimir operators of quantum field theory [2], [60], [77]. Thus we could look upon the Casimir effect as a cousin of Hawking's negative energy fluctuation around a black hole or as Unruh's temperature for an accelerated observer in a Rindler wedge universe. Alternatively we could follow Schwinger's ideas and see it as something related to a fundamental mathematical scenario such as the Banach-Tarski theorem advanced for the first time in the cosmology of the big bang by the present author [33], [75].

In the present paper however we opted for a rather different point of viewing the Casimir effect as a natural topological necessity of a Cantorian spacetime fabric, which was woven from an infinite number of zero Cantor sets and empty Cantor sets [32]. The zero set is taken following von Neumann-Connes dimensional function to model the quantum particles while the empty set models the quantum wave. Following this road we come we come to realize that the Casimir latent energy is nothing but the universal fluctuation ϕ^3 which gives birth to the core of Cantorian-fractal spacetime by inversion $1/\phi^3 = 4 + \phi^3 = 4.23606797$ where $\phi = (\sqrt{5} - 1)/2$ [43,64]. This is nothing but the difference between the Hausdorff dimension of the particle zero set ϕ and the wave empty set ϕ^2 . The result not surprisingly is almost equal to double the value found using imaginative modification of

the classical Casimir experiment by Zee [77] who found the dimensionless Casimir energy to be $\pi/24 \approx 0.1308$ [77]. Using E-infinity methodological reasoning, the exact value of Zee in the limit must be the ratio of the dimensionality of a Calabi-Yau transfinite manifold $6 + k = 6.18033889$ and the transfinite dimension of bosonic string theory, i.e. 26.18033989 . That means $(6+k)/(26+k) = \phi^3/2$. Needless to say, the division by 2 is due to the subdivision of the 'vacuum' of E-infinity theory and is analogous to dividing Hardy's entanglement $P(H) = \phi^5$ by 2 to obtain the density of the ordinary measurable energy of the cosmos $E(O) = (\phi^5/2)mc^2$.

The dimensional quantity analogous to mc^2 for the Casimir effect is trivially clear to be $\hbar c$ where c is the speed of light and \hbar is the Planck quantum. From this new topological interpretation it becomes obvious that Casimir ϕ^3 is the counterfactual or global part of Hardy's entanglement $P(H) = (\phi^3)(\phi^n)$ where n is the number of quantum particles and is found for $n = 0$. It is therefore closely related to the Unruh temperature where $n = 1$, the Immirzi parameter $n = 3$ as well as Hardy's generic quantum-topological entanglement $n = 2$. These insights are not only simple mathematical insights. It goes far beyond that and suggests that Casimir energy and dark energy are two sides of the same coin, differing only with regard to exo and endo boundary conditions [7,8] which will be made clearer in the main body of the present work. Second, by manipulating the local dimensionality of spacetime using an elaborate and complex set up of Casimir plates system we could build a nano universe and extract its dark energy concentrated at its boundary. The way to do this economically may be five, ten or more years of experimental work using the modern developments of cutting edge nanotechnology [3]. Never the less, the promise of near to infinite, clean, free energy is a goal worth any effort and the financial risks are minimal compared to the possible gains, so let the present modest steps be the first into this new world of a nano, Casimir-dark energy reactor.

Based on his E-infinity Cantorian spacetime theory [5]-[22], [71], it was recently argued by the author that the Casimir effect is a local manifestation of the quantum wave while dark energy is the global manifestation of the same [3]. The only difference is that of the details of the boundary conditions [3], [4]. It was further reasoned by the author that the universe as a whole has a one sided boundary akin to that of higher dimensional Möbius band and consequently the "local" Casimir effect ramifies at this one sided boundary located at infinity to produce the negative gravity pressure of the conjectured dark energy [3-5]. In other words, three rather mysterious physical notions are tied together and explained in terms of each other. At the top resides the quantum wave [71], which is not a mathematical artifact [6]-[9], [71] but according to E-infinity theory of dark energy, a real physical entity fully described by the empty set fixed by Connes-El Naschie bi dimension $(-1, \phi^2)$ where $\phi = 1/(\sqrt{5} + 1)$ [3-9,

71]. On the other hand the gradient caused by different wave energy density in different bounded regions of space compared to the unbounded outside of the same space is behind the Casimir forces which in the limit can be shown to be equal to the difference between the quantum zero set $(0, \phi)$ and the wave empty set $(-1, \phi^2)$ leading to $\phi - \phi^2 = \phi^3$ topological energy pressure [3], [7]-[9]. Finally at the edge of the universe there is only internal Casimir quantum wave pressure not balanced by outside pressure which is the dark energy concentration of 96 percent as per the consequences of Dvoretzky's theorem and the present author's dissection of Einstein's $E = mc^2$ to $E(O) = mc^2/22$ for ordinary energy of the quantum particle and $E(D) = mc^2(21/22)$ for the dark energy of the quantum wave [8], [9].

The sources of the ideas contained in the present work go back to many years ago when we attempted to improve on the traditional fast and slow fission reactors using the modern mathematics of fractals and nonlinear dynamics [10]-[18]. The second source is our recent reinterpretation of Einstein's $E = mc^2$ and finally the third source is the unexpected results of the earlier mentioned Dvoretzky's theorem of Banach spaces [5], [7]. However in the final analysis building an actual reactor could not be possible, not even in principle, without having first a sound theory [3]-[46], [56]-[59], [61], [62], [64], [66], [70]-[72], [76] and second the combination of modern nanotechnology and state of the art Casimir effect experimentation [19]-[22], [61], [70], [76]. In addition a reasonable amount of imaginative thinking similar to that of the man who is famed for inventing the 20th century is also recommended [62], [68].

As we mention at the beginning of our introduction, to keep the present paper short and yet to cover the large amount of the needed prerequisites we opted for a condensed presentation coupled to a large number of references. We recommend to start by reading [3] and [47], then it is a personal choice of how to proceed after that.

V. SPACE TIME AS THE BOUNDARY OF THE QUANTUM WAVE AND THE HOLOGRAPHIC BOUNDARY OF THE UNIVERSE

The holographic boundary theory goes back to the pioneering work of 'tHooft and Susskind [23], [24], [72]. On the other hand the principle that the boundary of a boundary is zero goes back to the 'out of the box thinking' of J.A. Wheeler [66]. Pushing their ideas further still, it became obvious to the present author that the boundary of the holographic boundary is not only a zero limit set but actually a hierarchy of empty and emptier still sets ramifying at a most general form of a one sided higher dimensional Möbius band [25]-[29], [66]. This limit set resembles a fundamental polyhedron group or better still, a Schottky-Kleinian group [25]-[29] which changes the topology of our conventional Casimir experiment to that of a sphere with internal Casimir pressure inflating the balloon-like universe and making it expand into the

surrounding "nothingness" fixed by the well known E-infinity formula $d_c^{(-\infty)} = \phi^\infty = 0$ where $\phi = 1/(\sqrt{5} + 1)$ [30]. From the preceding elementary reasoning it is clear that Casimir-effect and dark energy have the same cause, namely the topology of a Banach-spacetime like manifold and the only difference is the difference of local exophysics and global endophysics and the respective associated boundary conditions [3], [4]. There is already a vast body of literature on the subject published in the last three years alone by the present author and his associates [3]-[46], [56]-[59], [61], [62], [64], [66], [70]-[72], [76]. However what we are aiming at in the present paper is to point out the way to move from theory to useful, practical application of which nothing could be more important and pressing than building a free energy reactor, based on real science rather than wishful thinking. Thus we will combine the dreams of visionaries like N. Tesla with hard nosed modern mathematics and physics which were not yet available in the time of Tesla [62].

VI. THE CASIMIR EFFECT INSIDE NANO DEVICES

There has been no want of imaginative experimental set ups for measuring, testing and visualizing the Casimir effect since it was proposed by Dutch physicist, H. Casimir [61], [70], [76]. In recent years nanotechnology invaded all scientific fields and played a significant role in Casimir effect experiments. Thanks to E-infinity we now know that the true physical-mathematical connection between dark energy and the Casimir effect. A natural consequence of this discovered reality of the quantum wave, is rendering it a relatively simple task to find a way to harness dark energy or Casimir energy. Of course this "simple" is extremely difficult but no longer impossible.

We can start with a highly complex sub-structuring of space using nano tubes and nano particles and create that way nanosphere packing modelling the moonshine conjecture which relates superstrings to other fields of theoretical physics. We presently have, in embryonic form, the main idea of constructing a nano universe and extracting dark energy from its nano boundary of its holographic boundary. Our program to actually extract energy from such a nano reactor may still need five or more years but the road is marked and reasonably clear. It is only at the edge of the universe that 96% of the energy resides as dark energy. However we could create many nano universes from which its 96% energy concentration could be extracted without actually reaching the boundary of our universe [5]-[9].

VII. ON REAL AND MENTAL EXPERIMENTS

In noncommutative geometry as well as E-infinity theory, the Penrose universe plays a significant role as a generic concrete model for both theories [42], [43], [59], [64]. On the other hand Penrose universe or Penrose fractal tiling is basically a quasi-crystal mathematical model with the forbidden 5-fold symmetry [44], [64].

This form of matter not found naturally on earth, was produced experimentally by the great Israeli engineer D. Schechtman, who after facing a long period of fierce opposition from high profile scientists, for instance Nobel Laureate Linus Pauling, was rehabilitated and bestowed with a Nobel Prize. The 5 fold symmetry could be thought of theoretically as five Kaluza-Klein dimensions and using nano particles and nano tubes combinations we could build in the lab a nano holographic universe [7]-[9] akin to our own from which energy could be experimented with and extracted. For sure it will be a journey in uncharted seas with many trials and errors but sooner or later we will find out the right road to a Casimir dark energy nano reactor [3], [61]. There are other conceivable ways of producing artificial nano universes with high dimensionality for Dvoretzky's theorem to be applicable. For instance we could use Ji-Huan He's ten dimensional polytope [37] as a skeleton to grow on it a hierarchy of nano particles using the methods applied in the clustering of diffusion limited aggregation. In other words, we can let our scientific imagination run free but checked with E-infinity mathematical rigor and nanotechnological facts. This strategy was indirectly suggested by a remarkable result reported some time ago [84] which shows that the number of Riemannian tensors in 8 dimensions is equal to the number of kissing point of spheres in ten dimensions and more surprising facts.

VIII. THE E-INFINITY THEORY CONCEPTION OF THE TOPOLOGICAL ORIGIN OF THE CASIMIR EFFECT AND DARK ENERGY

It may come as a pleasant mild surprise that exact limits could easily be established for Casimir-dark energy using nothing more than the topology of our E-infinity Cantorian spacetime [46], [47]. We can do this in a variety of ways which are essentially tautologies leading to the same basic conclusion in the limit. Thus we could view the energy density of the space outside the two Casimir plates as that of Einstein's $E = mc^2$ density, i.e. $\gamma(\text{Einstein})=1$. Inside the plate the energy density in the limit could only be a statical, quasi potential energy of the quantum particle, i.e. $E = mc^2/22$ and consequently $\gamma(0)=1/22$. It follows then that the net pressure of the Casimir plates must be $1-(1/22)=21/22$ which is, in the meantime rather well known, as the dark energy density of spacetime. A second way to interpret the same situation and reach the same result is to argue that within the Casimir plates there is no "space" except for the empty set with a Hausdorff dimension ϕ^2 where $\phi=1/(\sqrt{5}+1)$. Outside on the other hand we have the zero set. The difference is a net $\phi-\phi^2=\phi^3$, which is the universal fluctuation of spacetime and simply the reciprocal value of its Hausdorff dimension $(1/\phi^3)=4+\phi^3$ [5], [43], [46]. Finally we could see the situation as the difference of the completely empty set in the limit, i.e. zero between the Casimir plates and the spacetime fluctuation ϕ^3 [47]. That way the

Casimir effect could be set in the limit equal to ϕ^3 and may easily be seen to be a relative to the Immirzi parameter ϕ^6 and the Unruh temperature ϕ^4 apart of Hardy's entanglement ϕ^5 , i.e. a member of a generalized quantum-topological entanglement family [47].

IX. THE STOCHASTIC PROCESSES BEHIND CASIMIR EFFECT AS A QUANTUM SPACETIME FLUCTUATION

Normally one proceeds from theory to application, however occasionally one can be inspired by an application to a general theory as we will explain in what follows. It is well known that a Bernoulli process is based on zero and one and that its extension by G. Ord led to the anti-Bernoulli processes zero, one and minus one which gives rise to the spiral model [67] of fractal spacetime quantum mechanics of Ord [67]. It is quite remarkable that reinterpreting this model in E-infinity formalism leads to an unrivalled, lucid picture for quantum spacetime mechanics as well as the Casimir effect, dark energy and the true meaning of the quantum wave. To show this let us recall that zero, one and minus one may be regarded as the Menger-Urysohn topological dimensions of the zero set, the unit set and the empty set respectively. The corresponding K-theory Hausdorff dimensions in a Klein-Penrose holographic universe are given by the von Neumann-Connes dimensional function as ϕ , 1 and ϕ^2 respectively where $\phi=(\sqrt{5}-1)/2$. This result is identical to that of the bijection formula of E-infinity and may be written in bi-dimensional notation as [42,46]

$$\begin{aligned} D(0) &= (0, \phi) \\ D(1) &= (1, 1) \end{aligned} \tag{11}$$

and

$$D(-1) = (-1, \phi^2). \tag{12}$$

We also recall that E-infinity theory identifies the quantum particle with the zero set while the quantum wave is essentially the cobordism or the surface of the quantum wave [45]. In turn the cobordism of the wave is an emptier set which has the bi-dimension $D(-2) = (-2, \phi^3)$. This can go on indefinitely until the cosmic onion reaches a layer $D(-\infty) = (-\infty, \phi^\infty) = (-\infty, \text{zero})$. This is clearly the totally empty set boundary of the holographic boundary of our universe as modeled by the Klein modular curve in the compactified form. On the other hand we know from E-infinity theory that the expectation value for the Hausdorff dimension of Cantorian spacetime is $4 + \phi^3$ and this corresponds to a holographic boundary normed probability $1/(4 + \phi^3) = \phi^3$ which is equal to the topological Casimir effect as well as the dimension of the boundary of the quantum wave. In other words in the holographic projection we have the following simple quantum spacetime, namely a quantum sea given by ϕ^3 and in this sea infinitely many quantum particles are

floating surrounded by their quantum wave (ϕ^2). A detailed analysis of this E-infinity model inspired by the Casimir effect and Ord's picture of Anti-Bernoulli spiral model [67] will be reserved for a forthcoming publication.

X. WITTEN'S T-DUALITY [47] AND THE COMPLIMENTARITY BETWEEN THE CASIMIR ENERGY AND DARK ENERGY

From our previous work on dark energy [44]-[52] as well as Casimir energy [3]-[6] it is quite clear that whether we look at the fractal version of Einstein's spacetime, i.e. $D = 4 + \phi^3$ or at a fractal de Sitter space with $D = 5 + \phi^3$ which is in turn equivalent to a fractal Kaluza-Klein spacetime, the conclusion is the same, namely that the topological Casimir pressure, i.e. topological Casimir energy is the difference between the fractal value and the smooth value of D. That means it is simply $(4 + \phi^3) - 4 = (5 + \phi^3) - 5 = \phi^3$. This was interpreted initially with the original local nano scale Casimir effect experiment as the difference in the topological pressure between the pressure in the nano gap of the two Casimir plates as modeled by the empty set (ϕ^2) and the pressure outside the Casimir plates modeled by the zero set [ϕ]-[4] (ϕ)-[2]-[4]. Consequently the local Casimir pressure is $\phi - \phi^2 = \phi^3$ as expected. Now as the two Casimir are moved an entire Hubble scale universe distance apart, the Witten famous T-duality [85], [86] becomes applicable and the Casimir energy density which is locally equal to $\phi^3 / (5 + \phi^3) = 0.04508497178$ that means equal to the ordinary measurable energy density $E(O) = (\phi^5 / 2)$ transforms per T-duality to $[(5 + \phi^3) - \phi^3] / (5 + \phi^3) = 0.954915$. That means the local Casimir energy transmutes on large cosmic scales via T-duality to the same value of dark energy density $E(D) = (5\phi^2) / 2 = 0.954915$ [44]-[53].

XI. CONCLUSION

We started with E8E8 which describes the universe via super string theory using 496 massless gauge bosons before reducing to the standard model energy scale. After that we reduce the 496 bulk by the 339 holographic boundary which turned out to be the exact transfinite number of independent components of the Riemannian tensor in 8 dimensional super space and kissing points of spheres in ten dimensions [84] leading indirectly to the design concept of our Casimir nano reactor. This is fully fixed by the dimensional function of von Neumann-Connes. From this point onwards we deal with infinitely many sets between plus infinity to minus infinity. However these sets can easily be reduced to only three floating in a Cantorian spacetime sea with a latent Casimir

energy that can be harnessed in principle by restructuring classical spacetime. It is almost too beautiful to be real.

It would be a gross error to place the present nano reactor proposal within the context of science fiction. There is definitely a trivial element of speculation and trial and error but that is all. Exploding stars and galaxies are scientific facts. Consequently to presume that these are only topological defects in to near infinitely large spacetime is not outlandish nor science fiction [54]-[56]. In fact the near identity of the Casimir effect and dark energy and the fact that both originate from the quantum wave aspect of quantum mechanics clearly shows to any open minded scientific thinker that to pursue clean free energy is a scientific real and reachable aim. The 4.5% of ordinary energy in the universe is nothing but the multiplicative volume of a five dimensional K-K zero set while the 95.5% dark energy is the additive volume of the same 5D Kaluza-Klein empty set [30]. Seen that way we think that making humanity free from oil and traditional sources of energy is a higher and moral aim worth investing heavily in for what is a million or even billion dollar research grant funding compared to the three trillion dollar Iraq war [73]. In fact the highly enlightened rules of the United Arab Emirates are already looking towards a future free of oil based energy [63]. It was Nobel Laureate in Economics, Prof. J. Stiglitz who calculated with Prof. L. Bilmes the true cost of the Iraq war for the USA. The staggering three trillion dollars do not actually include the loss and destruction for the economy of the entire world. The author dares to say with a tongue in cheek, that the mere sight of only one trillion dollars funding for our nano Casimir-dark energy reactor is sufficient to make this reactor spontaneously pop out of spacetime like virtual particles!

Undoubtedly those scientists who were born and raised in the Middle East with its unrivalled rich history and unparalleled chequered present day politics would feel morally obliged to call all the governments of the region to participate in a new dawn of science and life far away from the truly science fiction evil and fanaticism which has become a frequent reality today as we see in many parts of the world particularly in civil war torn countries with a measure of disbelief and helplessness.

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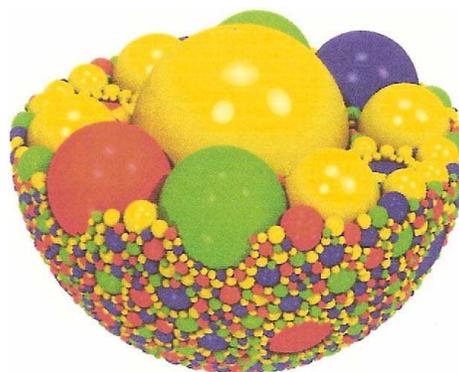


Fig. 1

A crucial step in arriving at our concept of a Casimir-dark energy nano reactor is an appreciation of the deep meaning of kissing spheres number [84]. The fractal Kissing problem in ten dimensions is 336 plus $(16)(k) = (16)(0.18033989)$ which adds to $N(K) \cong 339$. On the other hand we have two dimensional analogues for $N(K)$, namely $\dim \Gamma(7) = 336$ for the original Klein modular space and $\dim \Gamma(7) \cong 339$ for the compactified version. Similarly in eight dimensions the number of independent components of the Riemann tensor is $R^{(8)} = 336$ and when "compactified", one finds $R^{(8)} \cong 339$. Using the holographic principles for $R^{(4)} = 20$ and $|E8 E8| = 496$ one finds that $\bar{\alpha}_0 = 496 - [339 + 20] = 137$ of electromagnetism [84]. From these non-coincidental results one can proceed logically to the present preliminary design concept of our nano Casimir reactor by maximizing the inherent Casimir effect. This could possibly be achieved by using Fullerene nano particles.