International Journal of Innovation in Science and Mathematics
Volume 9, Issue 4, ISSN (Online): 2347–9051

Fuzzy Wilson Loops, Witten's Topological Field Theory and the Golden Mean Number System Theory as the Deep Roots of Hardy's Quantum Entanglement

M.S. El Naschie
Distinguished Professor, Faculty of science, Alexandria University, Alexandria, Egypt.
Corresponding author email id: chaossf@aol.com

Date of publication (dd/mm/yyyy): 03/09/2021

***Abstract* – The present relatively short paper is a rather concise outline of the topological roots of Professor L. Hardy's seminal theory of quantum entanglement and its very deep relation to Professor Edward Witten's path breaking and pioneering work in mathematical physics in general and quantum fields theory in particular as well as the very notable work of Alain Connes who invented non-commutative geometry, Nobel Laureate Sir Roger Penrose's fractal tiling universe, Ed Wilson's loops, Chern Simons' theory and the present author's physical E-Infinity theory. It is also quite relevant for a properly open-minded understanding of the present work to highlight the historical background of the said E-Infinity theory which goes back to astounding classical philosophical and mathematical work conducted at the Greek-Egyptian renowned school of Alexandria-Egypt where the universal guiding lights of Pythagoras, Socrates, Aristotle and Plato shined for the first time and whose ideas have played and still play a central role in the present theory which has invigorated the transfinite set theory of the great universal genius George Cantor. The crowning result of our paper is that of bringing all of the above-mentioned into a coherent synthesis forming a general theory making quantum physics easily understood without any paradoxes and equally easily computable via the almost miraculous golden mean number system first discovered and rediscovered in Alexandria-Egypt. For a swift grasp of the mathematics used, the reader is advised to consult Appendix 1, from which the main message of the present paper becomes apparent namely, that physics and mathematics are unified in wild topology.**

***Keywords* – Wild Topology, Golden Mean Cantor Sets, Solitonic Spirals, Topological Quantum Field, E. Witten, 'tHooft Renormalon, E-Infinity Theory, Unification of the Fundamental Forces, Unification of Science and Arts, Fractal M-theory, Gross' Heterotic Superstrings, Dark Energy, L. Hardy's Quantum Entanglement, Einstein's Relativity, Umov Derivation of Mass-Energy Equation, Golden Mean Number System, Pythagoras Music of Numbers, The Greek-Egyptian School of Alexandria.**

I. INTRODUCTION

It is a well known fact gained from the work of L. Hardy that the probability for a two particle quantum entanglement is almost 9% [1-5]. We also know since sometime that initially Hardy did not notice that his tiny rounding error of his result compared to the exact one which he was the first ever to obtain prevented him from realizing the enormous significance of his exact analysis namely, that it is nothing less than being ϕ^5 where ϕ is the amazing golden mean minor form $(\sqrt{5}\text{-}1)/2$ which is well known from E-Infinity theory [6-18]. Again the first to notice this fact was the notable Cornell teacher and researcher N. David Mermin although the present Author thought wrongly that he was first. The full story of this discovery was reported in several papers by the present Author on Hardy's quantum entanglement and the nature of dark energy as well as the unexpected accelerated cosmic expansion [2], [5].

From the preceding discovery of the role played by the golden mean number in Hardy's quantum entangleme-

-nt and the physical E-Infinity theory, a magnificent web of interconnections unfolded [1-60] which resulted ultimately in the present work as we will explain briefly in the ensuing sections as well as in Appendix 1 which summarizes the quintessence of the paper in one short statement namely that physics and mathematics are unified in topology [42-56].

Last but not least, we must mention that the guiding light of Nobel Laureate Gerardus 'tHooft's research in all of the above could not be sufficiently emphasized [12, 13]. Similarly we must mention the role played by the remarkable Heterotic string theory [36-38] of Nobel Laureate David Gross in developing our ideas [39-60].

In fact, the present work is indebted to almost the entire scientific community and the number of engineers, physicists, philosophers and artists who charted the way for us are too many to mention individually [12-50].

II. The Role of the Geometry and Topology of Matrices

Contemplating the fundamental role which matrices played in Werner Heisenberg's discovery of his matrix version of quantum mechanics based on N. Bohr's initial philosophical and intuitive insight [19-24], it is not that difficult to infer that since quantum mechanics obeys the non-commutative matrix formulation which came directly from experimentally obtained data, then it must follow that all the bizarre non-classical and counter intuitive features of quantum mechanics are a consequence of its bizarre non-intuitive character of its higher dimensional geometry and topology [5-24]. To understand this somewhat surprising conclusion, we have to regress and point out that we needed to invoke some advanced and non-trivial subtle and intricate mathematics of higher mathematical spaces and topology linked to matrices as indicated in the preceding paragraph of this section [1-60]. For all these reasons, we must expect now that knot theory [6], golden mean wild topology [25], quantum and Wilson loops [26], Witten's topological quantum field theory, fusion algebra [25, 26], zero set quantum particle, empty set quantum wave, fat and thin Cantor sets, the degree of emptiness on an empty set [17-55] and the golden field theory of E-Infinity [27, 28] to form the true deep foundation of quantum mechanics and that our entire mathematical machine is part and parcel of the golden mean number system encoded into the mathematics of the golden mean elementary Cantor sets forming its Leonardo da Vinci's self similar solotinic golden Eddies [17] which are essentially the 'tHooft building blocks of our spacetime [56] and intrinsically coupled to our energy-matter existence [13], [17], [19], [21-28], [29-55].

III. Cantorian Spacetime Analysis where a Particle can be at two Different Points at the Same Time

One of the most remarkable things about E-Infinity Cantorian spacetime theory [1-5], [7-18], [25-28] is that "physics" and "mathematics" melt into each other more or less as if they were one and the same "thing". In this section we have to persuade the reader to embrace this viewpoint wholeheartedly. As a bonus of this unheard of total and radical unification, we find a surreal resolution, as far as simplicity is concerned, of the classical impossibility of the said quantum-Cantorian particle being at two different "spacetime" location points at the very "same time".

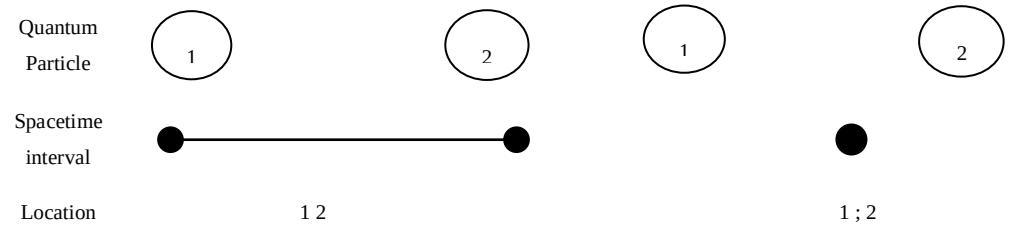
Let us start with a basically simple intuitive model which will give us the same results obtained many years ago using the golden mean number system formalism of E-Infinity Cantorian spacetime theory [1-18].

Imagine that we take a line in spacetime as shown in Fig. 1 and regard its end points as being two quantum p-

-article locations. Next, if we look at the line from above we see two points separated by the length of the said spacetime line. However, if we look at the same line perpendicular to its extension we will see one point or one particle only because the end points are now overlapping. Thus we may argue now on purely and strictly formalistic bases that in some experimental setup, we see only one particle while in another quasi "gedanken" experiment, we see two points and two particles.

In both cases, the fact that we are poised to see one or two points we are assuming (or pretending) that it is not known to us (or at least we are not aware of what has been changed in our two separate observations which changed our point of view). Taking now the simplistic and obvious fact that multidimensional spacetime setting permitting folding and knot-like structure we see that spatial separation is now quite misleading unless we are aware of the complexity of the spacetime we are inhabiting and dealing with [18-28]. Needless to reiterate what we said earlier on, namely that all these results are obtained easily using the mathematics leading to the meantime well-known indistinguishability condition given in various previous publications. [29]. To make this work reasonably self contained, some of the mathematics is given in Appendix 1.

The preceding discussion may be advantageously conducted while following its details using Fig. 1 (a) and Fig. 1 (b) and the corresponding captions. In addition to reading Appendix 1 attentively.



Virtual Experiment	Fig. 1(a). Here we are looking on a one dimensional spacetime element (say a "Cantor" Line) parallel to the plane. That way we may regard the two end points as two particles (1) and (2) at two locations 1 and 2	Fig. 1(b). Now our virtual "cantor" line is rotated to become perpendicular to the plane. That way we see only one end point "because the two end points overlap and we pretend that we do not know this fact" and the line becomes a single point as far as the naive observer is concerned.
Fig 1(a) and (b)	Fig. 1 (a). As explained in the main body of the paper, there is no confusion in Fig. 1 (a) at all and spatial separation is meaningful as in the core of everyday experience of classical mechanic. However, the situation in Fig. 1 (b) is radically different as explained in the text and the caption of Fig. 1 (b)	Fig. 1 (b). Now we have an elementary trivial example of the weird situation of quantum mechanics where spatial separation is meaningless unless we become aware of the true radical change in our observational set up. To reconcile Fig. 1 (a) with Fig. 1 (b) all what we need is a multi-dimensional spacetime with a sufficiently high dimensionality allowing all the ingredients of general topology to take place, like folding and producing wild topology ramifying at a cantor set and consequently permitting the existence of golden mean spirals similar to Leonardo da Vinci's fractal Eddies as mentioned in Ref. [17] and [43-55] (see also Appendix 1).

IV. IS THIS A TERRA NOVA?

To think that connecting fuzzy Wilson loops, 'tHooft's renormalon with Witten's quantum field theories and Hardy's quantum entanglement as well as knot theories and the golden mean number system is a terra nova for theoretical physics in general and quantum physics in particular is undoubtedly a heady project and a daydreaming of the Author but we do have our doubts. The Author's dream is nothing less than claiming that topology and in particular wild topology [25] is all what we need and although it may very well be true, we do not think we are there yet or are we? In all events, we believe we are on the right track but it may well be a long

way to Tipperary and it's still a long way to go to the sweetest science dream we know. All the same, hope is the last thing to go, so let us hope despite all real and imagined doubts.

V. AFTERTHOUGHTS

As we said earlier on, within the main body of this paper, we are genuinely indebted to the entire scientific community as well as to so many philosophers and artists. Nevertheless, we have to admit that being originally an engineer, we were strongly influenced by a strong applied and down to earth attitude which paradoxically led us, slowly but surely, to realize that pure mathematics and particularly topology is the basis of all sciences. Working in non linear dynamics, chaos and fractals we were also well educated to realize that Cantor sets and the like are not simply pure mathematics, but to a far extent we could say applied engineering. In other words, nothing comes from nothing and we feel blessed to have gone in almost the opposite direction of what normally one could have thought, namely from application to abstraction.

VI. CONCLUSION

The present paper has proposed wild topology and golden mean Cantor sets as the true building blocks of Spinoza-Einstein's dream which also happens to be the present Author's dream.

In short, all what you need is the most general form of topology (i.e. wild topology) to understand quantum physics pretty much like love for the greatest modern band of all times (i.e. the Beatles). All you need is topology and topology is all what you need.

ACKNOWLEDGMENTS

The Author is deeply indebted to the late Prof. W.T. Koiter who was a great engineer and a great scientist and who went on to become a high flying active member of the International Union of Theoretical and Applied Mechanics. The same goes to many of my teachers: J.M.T. Thompson, W. Alastair Walker and the late T. Barta, to all of whom I owe more than I can say and moreover without realizing this fact for many years. This in some respect is due to old age which is also a blessing to be able to repent a mistake. Last but by no means not least, I extend my thanks to my colleagues and associates who worked with me on E-Infinity theory for decades and still do and without their contributions, advice and criticism, I would have not been able to develop anything. My thanks go to Profs: Ji Huan He, L. Marek-Crnjac, M. A. Helal, M. Habib, S. Nada and J. S. Olsen.

APPENDIX 1

The Surreal Mathematical Machinery of the Alexandrian Quartet (i.e. Aristotle, Pythagoras, Socrates and Plato)

Although the essence of the golden mean number system was well known to the four exponents of the Greek-Egyptian Alexandria School [11, 17], these were largely philosophical and artistic sweeping generalizations without the details needed for computational sciences such as physics, chemistry and astronomy [23, 43, 53]. On the other hand, we know that the devil is in the details. Consequently, one has to ask how were we able to turn the golden mean number system into a computational tool, equal if not more efficient than the not yet there and potentially very expensive quantum computer, to tackle not only classical mechanics but also quantum mechanics [36-60] as evident by E-Infinity Cantorian-fractal spacetime theory? The short direct answer to this

question was given in the work of the outstanding Fields medalist Alain Connes by applying his non-commutative geometry to Nobel Laureate's Sir Roger Penrose's fractal tiling universe in conjunction with the legendary John von Neumann's pointless « continuous » i.e. fractal geometry [20, 24, 29] [49, 43] [45, 58]. Thus, we say it loud and clear that without the combined efforts of those outstanding pioneers, nothing could have been possible at all as far as the present work is concerned. It is true that we may have understood everything but equally true is that without Connes, Penrose and their colleagues, we could not have computed anything [18-23], [60].

Let us give in this section a limited precise explanation for what we meant by all the ideas addressed in the present paper in general terms but now we will use the clear-cut language of mathematics and will clarify that way the quintessence of the fundamental notions of (1) The Unruh temperature, (2) The Barbero-Immirzi parameter [51] and (3) Hardy's quantum entanglement [45-55]. In order to achieve the above goals, we need to present first some facts and results which we were able to obtain over the last twenty years or so, the details and proof of which were published in numerous papers [2-17] [36-60]. Some of these results were in fact repeatedly referred to in the present work for instance [1-5], [7-18], [25-29] and [36-51]. The first crucial step in this respect is to link the work of Alain Connes to the Author's physical E-Infinity Cantorian spacetime theory. This is done here by recalling the well-established fact that the so-called bijection formula of E-Infinity is just a mathematical tautology of Alain Connes' golden mean dimensional function [29, 21, 24] [35-58]. In that respect Alain Connes had the audacity of writing explicitly a dimensional function for R. Penrose's golden mean fractal tiling universe [5] [43-48]. That way we were in a position to relate certain topological dimensions to the corresponding Hausdorff dimensions of the same mathematical quasi-manifold. The next step was taken by the present author to go even further with Connes-Penrose's scheme and introducing not only a bi-dimension for the zero set denoted $D(o) \equiv (o;\phi)$ and the empty set $D(o) \equiv (-1,\phi^2)$ but we went on to give the zero set and the empty set a definite and profound physical interpretation namely being, the pre-quantum particle and the pre- quantum wave respectively [44]. That way a beautiful mental and physical picture arose out of the above via the theory of Cobordism which simply stated means that the empty set quantum wave is the surface of the zero set quantum particle. This is clearly reminiscent of the De Broglie-Bohm guiding wave theory [8] as well as the L. Pandtl-T. von Karman boundary layer theory of turbulence engineering which is of an enormous importance in aircraft as well as naval ships design [17, 18].

Now we are reasonably equipped to derive Hardy's quantum entanglement in various equivalent ways. First, we start from the five dimensional Kaluza-Klein theory [29] [30] [54]. Assuming the said five dimensions of Umov-Lorentz-Poincare-Einstein's relativity plus a fifth quantum spin dimension, it follows then that there is an intersectional correlated Hausdorff dimension for this Kaluza-Klein space time namely ϕ to the power of 5 giving us the experimentally confirmed Hardy's quantum entanglement ϕ^5 where $\phi = (\sqrt{5}-1)/2$ [1-5]. Invoking fuzzy counting i.e. fractal logic [59], [60] would lead us to think of the same situation in a different way namely, a four dimensional spacetime given by $(\phi)^{4-1} = \phi^3$ joined to two quantum particles given by $\phi\phi = \phi^2$ so that the net result is a topological probability for entanglement equal $(\phi^3)(\phi^2) = \phi^5$ as shown several years ago [1-5]. Let us turn our attention now to the derivation of the Barbero-Immirzi parameter [51]. This is slightly a more tricky task because it is in some sense a fudge factor needed mainly to convert two competing theories to two compatible theories namely the ten-dimensional superstring theory and the four-dimensional loop quantum gra-

-vity theory [1-5], [36-60].

Let us start by dividing the ten dimensions of superstring theory into 4 for gravity and 6 compactified dimensions. Treating the 6 compactified dimensions as akin to the 5 Kaluza-Klein dimension, one finds the "correlated" parameter $(\phi)^6$. This is indeed the exact value as shown several years ago in Reference [51]. Finally, let us look at the topological Unruh topological temperature in a similar vein to the preceding derivation. In this particular case, the topological Unruh temperature may be seen as two pre-quantum particles $\phi\phi = \phi^2$ sharing a single pre-quantum wave ϕ^2, so that the intersectional correlated total is simply $\phi^2\phi^2 = \phi^4$. Seen in this way, we could regard Hardy's quantum entanglement as the Unruh temperature of three pre-quantum particles sharing a single pre-quantum wave so that the total correlated result is $(\phi\phi\phi)(\phi^2) = \phi^5$ as should be [5]. These are only just some of the truly "surreal" results formed from the fuzzy setting of E-Infinity Cantorian spacetime theory in full agreement with the results obtained using the Connes-Penrose theory [9]. Similar results may be found by invoking the fractal picture of Leonardo da Vinci's divine fractal golden mean spirals of fluid turbulence [17].

At this point we must also stress the importance of our resolution of the major quantum paradox of non-locality and the contra intuitive notion of quantum particle being at two different spacetime points at the very same time as mentioned in section 3 of the present paper [48-60].

In concluding, we may emphasize the main message of the present paper and the appendix in one "simple" equation namely that: Physics U Mathematics $\equiv$ Wild Topology.

REFERENCES

[1] Mohamed S. El Naschie. Quantum entanglement a consequence of Cantorian micro spacetime geometry. Journal of Quantum Information Science. 1(2), 2011, pp. 50.
[2] Mohamed S. El Naschie. Resolution of Hardy's paradox within spacetime physics and the Ithaca interpretation of quantum mechanics. World Journal of Condensed Matter Physics. 8(2), 2018, pp.23-29.
[3] Mohamed S. El Naschie three quantum particles Hardy's Entanglement from the topology of Cantorian fractal spacetime and Casimir effect in dark energy. A great opportunity for Nanotechnology. American Journal of Nano Research and Application. Published online February 3(1), 2015, pp. 1-5.
[4] M.S. El Naschie and Scott A. Olsen. When zero is equal one: A set theoretical resolution of quantum paradoxes. Fractal spacetime, Non-commutative geometry and quantum high energy physics. 1(1), 2011, pp.25-38.
[5] M.S. El Naschie. Hardy's entanglement as the ultimate explanation for the observed cosmic dark energy and accelerated cosmic expansion. International Journal of High Energy physics. 1(2), 2014, pp. 13-17.
[6] V. Johns. A polynomial invariant for knots via Van Neumann's Algebra. (Reprinted in New Development in the Theory of Knot). Edited by T. Kcheno. World Scientific Singapore (1989).
[7] M.S. El Naschie. A review of E-Infinity and the mass spectrum of high energy particle physics. Chaos, Solitons & Fractals, 19(1), 2004, pp. 209 – 236.
[8] M.S. El Naschie. The De Broglie-Bohm pilot wave theory via E-Infinity Cantorian spacetime interpretation. International Journal of Applied Science and mathematics. 8(3), 2021, pp. 19-22.
[9] M.S. El Naschie. Struggling to understand the fundamental role played by the golden mean number system in Science and Art: Speculation on Penrose's fractional tiling in Art, high energy physics and quantum cosmology. International Journal of Innovation in Science and Mathematics. 9(3), 2021, pp. 25-30.
[10] M.S. El Naschie. The answer to life, the universe and everything is not the Forty two of D. Adam's Hitchhiker Guide to the Galaxy but it is the golden mean square root of five minus one divided by two. International Journal of innovation in Science and Mathematics. 9(2), 2021, pp. 14-17.
[11] Scott Olsen, L. Marek-Crnjac, Ji-Huan He and M.S. El Naschie. A grand unification of sciences, arts and consciousness: Rediscovering the Pythagorean Plato's Golden mean number system. Journal of Progressive Research in Mathematics. 16(2), 2020, pp. 2888-29311.
[12] M.S. El Naschie. Cellular automata based on the golden mean number system as a foundation for artificial intelligence and artificial life. International Journal of Artificial Intelligence and Mechatronics, 8(6), 2020, pp. 53-58.
[13] M.S. El Naschie. Cantorian micro-type black holes as the fundamental building blocks of spacetime. International Journal of Innovation in Science and Mathematics 8(6), 2020, pp. 259-261.
[14] M.S. El Naschie. Demonstrating the basic equivalence of a wide class of fundamental theories of high energy physics and quantum cosmology via transfinite number theoretical fine-tuning. International Journal of Innovation in Science and Mathematics. 8(4), 2020, pp. 145-153.
[15] L. Marek-Crnjac and M.S. El Naschie. The hydrodynamics of quantum spacetime. The minimal essential of a new quantum theory. Journal of Progressive Research in Mathematics. 17(2), 2020, pp. 41-53.

[16] M.S. El Naschie. On the complementarity of spectral and renormalization dimension of quantum spacetime. International Journal of Artificial Intelligence and Mechatronics. 9(3), 2020, pp. 64-66.
[17] M.S. El Naschie. Fluid turbulence road to quantum cantorian spacetime via nested Solitonic golden Eddie's chaos implied by Batchelor's Law: A possible rationale for the mysterious fine tuning of the cosmos. International Journal of Applied Science and Mathematics. 7(4). 2020, pp. 98-108.
[18] M.S. El Naschie. Fluid turbulence Batchelor's law implies spacetime unification of classical and quantum physics. International Journal of Applied Science and Mathematics. 7(3), 2020, pp.85-91.
[19] G. 'tHooft. Under the spell of the gauge principle. World Scientific, Singapore, 1994.
[20] Alain Connes. Non-commutative geometry. Academic Press, San Diego, USA. 1994.
[21] Sir Roger Penrose. The Road to Reality. Jonathan Cape, London, 2004.
[22] M.S. El Naschie, O.E. Rossler and L. Prigogine (Editor). Quantum mechanics, diffusion and chaotic fractals. Pergamon Press. Elsevier. Oxford, 1995.
[23] Paul Davies (Editor). The New Physics. Cambridge University Press. Cambridge, 1989.
[24] Alain Connes and Matilde Marcolli. Non-commutative geometry, quantum fields and motives. American Mathematical Society, 2008. Printed in USA under license from Hindustan Book Agency.
[25] M.S. El Naschie. Wild topology, hyperbolic geometry and fusion of high energy physics, Chaos, Solitons & Fractals, 13(9), 2003, pp. 1935-1945.
[26] M.S. El Naschie. Quantum loops, wild topology and fat Cantor sets in transfinite high energy physics. Chaos, Solitons & Fractals, 13(5), 2002, pp. 1167-1174.
[27] M.S. El Naschie. An outline for a quantum golden field theory, Chaos, Solitons & Fractals, 37(2), 2008, pp. 317-323.
[28] M.S. El Naschie. Quantum golden field theory: Ten theorems and various conjectures. Chaos, Solitons & Fractals, 36(5), 2008, pp 1121-1125.
[29] M.S. El Naschie. An exact mathematical picture of quantum spacetime. Advances in Pure Mathematics. 5(9), 2015, pp. 560-570.
[30] Paul Halpern. The Great Beyond. John Wiley and Sons Inc. New Jersey, USA, 2004.
[31] Lawrence B. Crowell. Quantum fluctuations of spacetime. World Scientific. Singapore, 2005.
[32] Steven Weinberg. The Quantum Theory of Fields. Volume III. Cambridge, UK, 2000. (See also Volumes I and II).
[33] Michio Kaku. Introduction to superstrings and M Theory. Springer, New York, USA, 1999.
[34] S.K. Donaldson and P. B. Kronheimer. The Geometry of Four-Manifolds. Oxford Science Publishing, Oxford, UK. First published 1990. Reprinted in paperback 2001
[35] John D. Barrow and Frank J. Tipler. The Anthropic Cosmological Principle. 1986. Reprinted in paperback in 1990.
[36] Mohamed S. El Naschie. From the Heterotic string quartet to cosmic dark matter, dark energy and ordinary energy symphony. American Journal of Astronomy and Astrophysics. 5(2), 2017, pp. 21-24.
[37] Mohamed S. El Naschie. A Combined Heterotic String and Kahler manifold elucidation of ordinary energy, dark matter, Olber's paradox and pure dark energy density of the cosmos. Journal of Modern Physics 8(7), 2017, pp. 1101-1118.
[38] M.S. El Naschie. The crystallographic space groups and Heterotic string theory. Chaos, Solitons & Fractals, 41(5), 2009, pp.2282-2284.
[39] Mohamed S. El Naschie. The Aether of spacetime physics is the empty set of pure mathematics. Natural Science, 9(9), 2017, pp 289-292.
[40] Leila Marek Crnjac. Cantorian spacetime theory: The physics of Empty sets in connection with quantum entanglement and dark energy. Published by LAP Lambert Academic Publishing. Saarbrucken, Germany. ISBN 978-3-659-12876-9. January 2013.
[41] Mohamed S. El Naschie. Speculation in Science and Technology: Is the quantum wave nothing more than a Prandtl boundary layer? International Journal of Engineering Innovation and Research. 9(3), 2020, pp 137-141.
[42] Mohamed S. El Naschie. Dark energy and its cosmic density from Einstein's relativity and gauge fields renormalization leading to the possibility of a new 'tHooft quasi particle. The Open Astronomy Journal 8, 2015, pp. 1-17.
[43] Mohamed S. El Naschie and Leila Marek-Crnjac. Set theoretical foundation of quantum mechanics, NASA's EM drive technology and minimal surface interpretation of the state vector reduction of the quantum wave collapse. Chaos and Complexity Letters. 12(2), 2018, pp. 85-100.
[44] Mohamed S. El Naschie. Platonic network theory for high energy physics and quantum cosmology. Global Journal of Science. Frontier Research. A Physics and Space Science. 20(7), version 1. year 2020 online ISSN 2249-4626 and printed ISSN 0575-5896 pp. 1-4.
[45] M.S. El Naschie. Topological, geometrical and physical interpretation of the dark energy of the cosmos as a "halo" energy of the Schrodinger quantum wave. Journal of Modern Physics. 4(5), 2013, pp. 591-596.
[46] M.S. El Naschie. The self referential pointless universe geometry as the key to the resolution of the black hole information paradox. International Journal of Innovation in Science and Mathematics. 3(5), 2015, pp. 254-256.
[47] M.S. El Naschie. Gravity looks like electromagnetism when seen through fractal logic glasses. International Journal of Innovation in Science and Mathematics. 7(4), 2019, pp 180-185.
[48] M.S. El Naschie. Fredholm operators and the wave-particle duality in Cantorian space. Chaos, Solitons & Fractals, 9(6), 1998, pp 975-998.
[49] M.S. El Naschie. Looped light on dark energy. Journal of Quantum Information Sciences. 7(2), 2017, pp 43-47.
[50] M.S. El Naschie. QED dark energy density using Schwinger-Fredkin and E-Infinity theory. Journal of Applied Mathematics and Physics 6(4), 2018, pp. 621-627.
[51] M.S. El Naschie, The quantum gravity Immirzi parameter-A general physical and topological interpretation. Gravitation and Cosmology, 19(3), 2013, pp.151-155.
[52] M.S. El Naschie, The Casimir effect as a pure topological phenomenon and the possibility of a Casimir nano reactor-a preliminary conceptual design. American Journal of Nano Research and Applications, 3(3), 2015, pp.33-40.
[53] M.S. El Naschie, The Casimir topological effect and a proposal for a Casimir-dark energy nano reactor. World Journal of Nano Science and Engineering, 5(01), 2015, p.26-33.
[54] M.S. El Naschie, From Nikolay Umov E= kmc 2 via Albert Einstein's E = γmc 2 to the Dark Energy Density of the Cosmos E = (21/22) mc 2. World Journal of Mechanics, 8(04), 2018, p.73-81.
[55] M.S. El Naschie, Spacetime as a New Frontier Advanced Material with Applications in Physics, Engineering, Chemistry and Cosmology. Advances in Materials Physics and Chemistry, 7(09), 2017, pp.347-352.
[56] M. S. El Naschie. 'tHooft ultimate building blocks and spacetime as an infinite dimensional set of transfinite discrete points. Chaos, Solitons & Fractals, 25, 2005, pp. 521-524.
[57] M.S. El Naschie. The Fibonacci code behind super strings and P-Branes: An answer to M. Kaku's fundamental question. Chaos, Solitons & Fractals, 31(3), 2007, pp. 537-547.
[58] M.S. El Naschie. The cosmic da Vinci code for the big bang-a mathematical toy model. International Journal for nonlinear sciences an-

-d numerical simulation. 8(2), 2007, pp. 191-194.
[59] M.S. El Naschie, S. Olsen, J.H. He, S. Nada, L. Marek-Crnjac and A. Helal. On the need for fractal logic in high energy quantum physics. International Journal of Modern Nonlinear Theory and Application. 1(3), 2012, pp. 84-92.
[60] Mohamed S. El Naschie. High energy physics and cosmology as computation. American journal of computational mathematics. 6, 2016, pp. 185-199.

AUTHOR'S 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 Engineering plus being a professional chartered engineer. 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 adju--nct 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 in 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. 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 84 and his i-10 index is 809 and total citations are 38585 according to Google Scholar Citation.