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The Three Page Guide to the Most Important Results of M. S. El Naschie's Research in E-Infinity Quantum Physics and Cosmology

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ABSTRACT

In this short survey, we give a complete list of the most important results obtained by El Naschie's E-infinity Cantorian space-time theory in the realm of quantum physics and cosmology. Special attention is paid to his recent result on dark energy and revising Einstein's famous formula $E = mc^2$.

Keywords: Review of E-infinity; Summary of Cantorian Space-Time; El Naschie Nottale and Ord Fractal Space-Time; Rindler Space-Time; Revising Einstein Theory; Dark Energy Revealed

1. Introduction

The present letter could have been entitled a short history of space-time. It is mainly concerned with space, time and matter and gives an almost exhaustive list of the most important results obtained by El Naschie using his Cantorian-fractal theory of space-time [1-85].

In a 2012 conference in the Bibliotheca Alexandrina [84] E_1 Naschie announced the revision of Einstein's special relativity energy-mass formula $E = mc^2$ to $E = mc^2/22$ and showed that it is the sum of the energy of the quantum particle $E_1 = mc^2/22$ and the energy of the quantum wave $E_2 = mc^2$ (21/22) [53-63]. He also showed that the speed of light is an exact expectation value in classical three plus one dimensions.

2. Guide to the Most Important Results of E-Infinity Theory in Physics and Astrophysics

El Naschie's E-Infinity theory E^{∞} has clearly shown that random Cantor sets are the basic building blocks of quantum space-time. The intrinsic topological dimension of these building blocks is zero; its Hausdorff fractal dimension is the inverse of golden ratio (0.618033989…) and its embedding dimension is unity [21,24,25].

El Naschie made it plausible that because orthodox quantum mechanics is totally insensitive to fractals and does not consider the Cantorian nature of quantum space-time, many paradoxes following [1,4,71].

El Naschie proved that quantum space-time is described fully by not one but three dimensions. First, a topological (Menger-Urysohn) dimension equals to exactly 4. Second, a Hausdorff dimension equals to 4 plus the inverse of the golden ratio to the power of 3 which means 4.236067977… This is effectively a 4*D* cube inside a 4*D* cube and so on ad infinitum. Third, a formal dimension equals to infinity. In other words, our quantum space-time is an infinitely dimensional but hierarchal Cantor set of measure zero [64].

Many of the fundamental constants of nature were derived by El Naschie from first principles. This includes the coupling constant of quantum gravity as well as the electromagnetic fine structure constant and Newton's gravity constant. In particular a fundamental equation was established relating the Bulk (*E*8*E*8) with the holographic boundary and gravity from which $\bar{\alpha} = 137$ was derived [4,15,23,35,45].

An exact renormalization equation was constructed

which derived quarks confinement as an exact result [41-43].

The relationship between Lie symmetry groups as well as two and three Stein spaces and high energy physics was outlined. In particular the role played by *E*8 in this respect was analyzed. The total number of elementary particles in an extended standard model was shown to be 137 particles. This includes 10 space-time quasi dimensions. E-infinity P-Adic reasoning was also employed [16,44,45].

The stationary state of quantum mechanics was shown to be that of the VAK, *i.e*. the vague attractor of Kolmogorov [78].

The theory predicted the existence of 8 dimensional Higgs field with at least one Higgs particle or five Higgs particles becoming manifest. The Higgs mass was determined to be approximately 169 GeV [6].

The Euler characteristic as well as the curvature of the quantum space-time was shown to be equal to $26 + k \cong 26$. In addition, arguments were given to show that our universe is likely to be compact. An alternative theory using instanton density to calculate the first massless particle-like states corrected the classical well-known solution of Heterotic string theory, namely 8064 to the exact solution 8872 [25].

It is reasoned that in a totally disjointed infinitely dimensional but hierarchal Cantor-like space time manifold, calculus must be replaced by Weyl-like golden mean scaling which effectively represents a new version of quantized calculus [25,38,56].

El Naschie made several suggestions regarding a Banach-Tarski-like big bang theory based on paradoxical decomposition of spheres [51].

Mohamed El Naschie and his group proved the equivalent of his basic equations of E-infinity theory and the dimensional function of von Neumann's continuous geometry and A. Connes' non-commutative geometry [33,34,49].

A quantum particle may be modelled as a fractal point is represented by the two dimensions of a zero set dim *P* $(0,\ \phi)$ where $\phi = \left(\sqrt{5}-1\right)/2$. The quantum wave is the surface of a fractal point, *i.e*. a fractal surface and may be represented by the two dimensions of an empty set *dim* $W \equiv \left(-1, \phi^2\right)$. The empty set accounts for the paradoxical outcome of the two-slit experiment and the disappearance of the interference fringes [26].

It explained quantum entanglement as a zero measure fractal geometry [60].

It showed that dark energy is the negative energy of the quantum wave $E_2 = E(D) = mc^2(21/22)$ which agrees completely with measurements [54-68].

It explained the meaning of the Immirzi parameter and Unruh temperature [53,54].

In agreement with the work of Magueijo and Smolin [70], El Naschie showed that the speed of light is not constant but a constant expectation value [58].

Making a distinction between temporal chaos as an initial value problem and spatial chaos as a boundary value problem helped to arrive at fractal space-time, KAM space-time, the importance of the empty set, negative dimensions, Finkelstein quantum sets, Gödel theorem and the reality of the wave function [8,9,18-20,71, 72].

It derived the density of dark energy Nash embedding of Witten's fractal M-Theory [85].

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