2010
The 3rd International Symposium on Nonlinear Dynamics
Sept. 25-28, 2010, Shanghai, China

Program
The 3rd International Symposium on Nonlinear Dynamics (ISND2010)

Sept. 25-28, 2010
Shanghai, China

In celebration of Prof. M.S. El Naschie's 65th birthday

Dedicated to Prof. M.S. El Naschie for his contributions to incorporate nonlinear dynamics, chaos and fractals in quantum physics and to Prof. C.D. Yang for his original contribution of using complex spacetime in quantum mechanics.
Welcome Address

Ji-Huan He /Chairman of 2010 ISND

Dear distinguished gathering, ladies and gentlemen,

I am immensely pleased and honored to welcome you to Shanghai, which has been developing very fast, and will be strongly impressed on your memory.

2010 ISND is organized as a preeminent event for nonlinear science community and other science communities as well. It is a great pleasure and honor for Donghua University to host this very important conference.

It provides me the greatest honor and pleasure to address you at this very important event, the 2010 ISND conference which is intended to bring together researchers from the industry and academia to discuss theory and applications of deterministic chaos and fractal geometry across natural as well as man-made sciences.

We have come a long way since our major conferences of 2005 and 2007. This time we have again a very special reason to mark E-infinity theory as a special topic in this conference. There are various more than compelling reasons to do that. We may mention in particular the experimental discovery and verification of the golden mean in quantum mechanics by the Helmholtz Centre in Germany in cooperation with the University of Oxford. This hard to overestimate experimental fact is exactly what was predicted by E-infinity theory almost two decades ago. With this experimental confirmation this matter and any genuine controversy are largely settled. Any objective researcher must from now on take it as an indisputable fact that nonlinear dynamics and chaos which manifest themselves geometrically as fractals and Cantor sets provide the missing link between the quantum and the non-quantum relativistic world.

Our group has worked with considerable dedication on this fundamental cutting edge research and made some of the most important contributions to this theory. In particular we were able to establish in the clearest of forms the relationship between the transfinite theory of dimensions and fractals as well as the physical meaning of the empty set of the Menger-Urysohn theory. The golden ratio in this context is of course the finger print of the KAM theorem as well as being the Hausdorff dimension of a Mauldin-Williams random triadic Cantor set. It is also the backbone of A. Connes dimensional function of his noncommutative geometry with its well known relation to quantum mechanics. All of that will be explained in detail at this conference in various invited and contributed papers. For this reason we are extremely happy that the Egyptian engineering scientist and theoretical physicist, Professor M.S. El Naschie accepted our invitation to come to Shanghai especially from London despite his health condition to deliver the opening lecture of this conference.

Unification theory has been working for many years, but rare focus was put on the unification of Newton Mechanics and Quantum mechanics: Newton’s mechanics is deterministic; while Quantum mechanics is probabilistic, they are two sides of a contradiction, no one considered to unify the two contrary theories. Fortunately, we have now ancient Chinese philosophy of Tai Chi. According to this philosophy, Prof. C.D. Yang proposed a new space called the complex space, and his complex mechanics has been caught much attention, and I should emphasize that C.D. Yang’s law is one of the greatest nature law. From C.D. Yang’s complex space, quantum mechanics can be simply derived the complex-extended Newtonian mechanics. Great classics when revisited in the light of modern physics, especially nonlinear dynamics may reveal hidden pearls. For this reason we are extremely happy that Professor C.D. Yang accepted our invitation to come to Shanghai to deliver the opening lecture of this conference and introduce the complex mechanics.

It is not unusual for any revolutionary idea to provoke a counter-revolutionary reaction. E-infinity is a revolutionary idea building upon many other revolutionary ideas like M. Feigenbaum’s universalities, B. Mandelbrot’s fractals and A. Connes’ noncommutative geometry. However these are all scientific revolutions and not political, social revolutions. Opposing such scientific revolutions should only take the form of scientific debates and arguments. To explain what I mean...
let me recount to you what Werner Heisenberg lamented about the attacks by many notable scientists including Nobel laureates in physics on A. Einstein calling his theory of relativity, Semitic non-aryan physics. Heisenberg said he was extremely saddened by the fact that the attacks were not scientific attacks but politically motivated, dishonest attacks. Later on when a book published with the title 'A hundred scientists against Einstein', the great man remarked: "Why one hundred? If I were wrong, one would be sufficient."

We hope that this conference will allow the rest of our scientific community to realize the new and powerful possibilities which nonlinear dynamics, deterministic chaos and fractal geometry provides to not only round up our picture of nature and reality and resolve long outstanding quantum paradoxes such as the two-slit experiment with quantum particles and the wave collapses, but will also give us a handle on useful applications in nano and other new technologies.

I sincerely hope you will find the conference enjoyable and the discussions illuminating and useful. I hope also that you will foster new scientific friendships, helping you in your research.

Hereby, I should express my thanks to Donghua University for their sponsorship of this conference.

It is my greatest honor to invite Prof. M.S. El Naschie and Dr. C.D. Yang to give our audience important plenary lectures, which present an overview of the current status of their fields with a speculative outlook on what are to come out in the future, making the conference extremely accessible to a broad audience.

I also appreciate very much all reviewers for their time and help and mini-symposium organizers, without their help, the success of the conference will be impossible.

As pointed out by Einstein, "The most incomprehensible thing about the world is that it is at all comprehensible", but how do we fully understand incomprehensible things? This conference provides various useful clues. I can ensure you that it will be a mathematically enriching and socially exciting event.
Abstracts of Invited Lectures

Application of chaos and fractals in fundamental physics and set theoretical resolution of the two-slit experiment and the wave collapse

M.S. EL NASCHIE

We present a convincing resolution of the wave collapse and the two-slit experiment based on random fractal sets and the extended Menger-Urysohn transfinite theory of dimensions. We use two component dimensions starting from A. Connes dimensional function of noncommutative geometry

\[ D = a + b\phi, \quad a, b \in \mathbb{Z}, \quad \phi = (\sqrt{5} - 1)/2 \]

We demonstrate the equivalence of Connes function to that of E-infinity bijection formula

\[ d^{(n)} = (1/d^{(0)})^{n+1} \]

where \( n \) is a real integer and \( d^{(0)} = \phi = (\sqrt{5} - 1)/2 \).

The golden ratio \( \phi = (\sqrt{5} - 1)/2 = 0.618033989 \) which was experimentally confirmed a few months ago this year in the Helmholtz Centre in Germany and University of Oxford, England as basic to quantum mechanics arises naturally from the requirement of a random fractal horizon of a noncommutative geometry akin to that of Penrose fractal tiling and the related compactified Klein modular curve. This curve with \( 336 + 3 = 339 \) hierarchal degrees of freedom or isometries is also equivalent to the holographic boundary of E-infinity spacetime.

One of the most important results of the present work is the identification of the empty set with wave-like quantum probability and the vacuum while quantum-like particles are described as a zero set. Consequently the two dimensions relevant to the particle are

\[ \text{dim particle} = P(d_{\text{MU}}, d_H) = P(0, \phi) \]

where \( d_{\text{MU}} \) is the Menger-Urysohn dimension and \( d_H \) is the corresponding Cantorian or Hausdorff dimension. For the quantum wave on the other hand we have

\[ \text{dim wave} = W(d_{\text{MU}}, d_H) = W(-1, \phi^2) \].

Since we have identified the wave which is devoid of energy matter and momentum with the empty set, it follows then as an almost trivial result that any attempt to observe the two-slit experiment while in progress will render the empty set non-empty and instantly lead to what we perceive as a wave collapse, leaving the zero set of the particle as the only observable. Using the preceding conclusion it is then a relatively straightforward and technical analysis which leads us to the form of semi manifold which supports the preceding requirement. It turns out that this semi manifold is a fractal quotient manifold of the Gaussian type with a Hausdorff dimension given by

\[ D_H = \frac{(\phi) + (\phi^2)}{(\phi)(\phi^2)} = 4 + \phi^2 = 4 + \frac{1}{4 + \frac{1}{4 + \frac{1}{4 + \ldots}}}, \]

and a Menger-Urysohn dimension

\[ D_M = \frac{0 + (-1)}{0(-1)} = \infty \]

as well as an average topological dimension equal to

\[ <D> = \frac{(1/2) + (1/2)}{(1/2)(1/2)} = 4 \].

In other words this manifold is nothing else but the core of E-infinity Cantorian spacetime which may be envisaged as an infinite hierarchy of concentric four dimensional cubes.
The present lecture is divided into two parts. We first give a general review of all previous work on the application of chaos and fractals in physics. The second part is subsequently devoted to the resolution of the paradox presented by the two-slit experiment and the associated wave collapse.

**On the Philosophy of Being and Nothingness in Fundamental Physics**

M.S. El Naschie

Humans have an inbuilt intrinsic bias in their psyche against nothingness. Although we fear nothing like nothingness, being associated with death, we still do not regard it as physically real and integrate it on a fundamental level into the foundation of physics. So far we have been content with the zero introduced by the Indians and mediated to Europe by Arab mathematicians who saved our arithmetic and number system from the unbearable heaviness of Roman numbers.

The Author feels that the empty set of the Menger-Urysohn transfinite dimensional theory can do for physics what the zero did for mathematics when we extend the empty set dim $d_{MU} = -1$ to the totally empty set dim $d_{MU} = -\infty$. It may be instructive at this point to connect a little to fundamental philosophical problems which were considered around the middle of the last century in great depth. In that respect we may mention the views of M. Heidegger laid down in his book *Sein und Zeit* and later on the fundamental and famous work of J.P. Sartre, Being and Nothingness. In the somewhat flamboyant language of Sartre, he described the embedding of nothingness in being by liking it to a worm inside an apple. At the core of being nothingness is lurking. The exact mathematical formulation of the foundation of physics could similarly not be complete or consistent without including nothingness in the form of the empty set.

$$d_{MU} = -1$$

and

$$d_{(-1)} = \phi^2, \quad \phi = (\sqrt{5} - 1)/2$$

and the totally empty set

$$d_{MU} = -\infty$$

and

$$d_{(-\infty)} = 0.$$

The distance between $d_{MU} = -1$ and $d_{MU} = -\infty$ is what is termed the degree of emptiness of an empty set. It is highly interesting to note that while too much philosophical interrogation did not help science to start with and a separation between what is empirical and testable and what is idle deep philosophical discussion was recommendable, the situation started changing with relativity and more so with quantum mechanics. Never the less physics did not change in essence with regard to the notion of nothingness. The introduction of the empty set on such a fundamental level clearly shows that our initial reaction to philosophy was misguided. Philosophy is part and parcel of real deep science as will be discussed in some detail in the present paper.

**Complex Mechanics**

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Quantum mechanics is an experimental science defined in the real world, but understanding the how and the why of quantum mechanics requires a viewpoint from the complex space. It may be said that quantum mechanics is intrinsically a complex-valued nonlinear science. The complex space is where a quantum motion takes place, while the real space is where we take the measurement of the motion. Quantum mechanics lays out the distribution and the evolution of the measurement data, while complex mechanics describes the quantum motion in the complex space before it is measured. The projection of the complex motions into the real space automatically recovers and confirms the quantum phenomena observed from the measurement data. In the complex space, quantum motions
are deterministic so that all the existing methods of nonlinear analysis developed from classical mechanics can be applied equally to quantum mechanics. This lecture gives a survey of complex mechanics and introduces the simplicity of solving quantum mechanical problems by complex-extended Newtonian mechanics.

Keywords: Quantum Mechanics, Nonlinear Dynamics, Complex Mechanics

A short comment from the chairman

The importance of the Empty Set Underpinning the Foundations of Quantum Physics

Ji-Huan He

The Chairman admits to having always been fascinated by the works of Prof. A. Connes on noncommutative geometry and Prof. M.S. El Naschie on E-infinity theory. In particular it did not go unnoticed that one of the greatest mathematicians of our time, Alain Connes does not use mathematics in the way it is usually used by almost everyone, namely as a utility to model physics and not much more than that. It seems to me that Connes feels that the ultimate reality is not physical but rather mathematical. Being a mathematical genius made him understand it as if it were physics and this way he discovered the deep physical meaning of fractals and the golden mean which he summed up in his dimensional function

$$D = a + b \phi, \quad a, b \in \mathbb{Z} \quad \text{and} \quad \phi = (\sqrt{5} - 1)/2.$$  

In turn and due to his deep understanding for the work of Penrose on fractal tiling, he was able to discover the physical meaning to his function. On the other hand Mohamed El Naschie seems to proceed from the opposite view point or maybe I should say from a complimentary direction. In E-infinity El Naschie elevates physical observation to the status of mathematical theorem. He is not a mathematician nor in fact a physicist, being an engineering scientist by training. However his vast knowledge of applied and pure mathematics enables him to feel this way, finding the right maths for what we perceive as physics. In this unconventional and fascinating new way of doing fundamental theoretical physics, El Naschie discovered his bijection formula

$$d_e^{(n)} = \left(1/d_e^{(0)}\right)^{n-1}$$

and the golden mean theorem

$$d_e^{(n)} = <d_e> = \sim <n>$$

If and only if $d_e^{(0)} = (\sqrt{5} - 1)/2$ and $n = 4$. It is easily demonstrated that this formulation reproduces Connes' dimensional function and a few more things and leads to essentially the same sweeping conclusions about the fractal reality of our quantum spacetime and the meaning and reasons for many experimental results in quantum mechanics which are commonly perceived as paradoxical.

The Chinese chapter of the E-infinity theory has worked extensively to show the role played by complexity theory in quantum physics. We have given explicit and simple geometrical interpretations to the Hilbert cube and its relation to the exceptional Lie groups, particularly E8. In addition we pointed out the vital importance of the Menger-Urysohn theory of transfinite dimension and the physical deficiency in any fundamental theory which does not include the empty set dimension $\emptyset = (-1, \phi^2)$ which posses a negative Menger-Urysohn dimension $d_{M(U)} = -1$ and a Hausdorff $d_H = \phi^2$ where $\phi = (\sqrt{5} - 1)/2$ is the golden mean. It was the combined work of our group with those working world wide which led to the first mathematical watertight explanation of the quantum particle $P_Q = (0, \phi)$ and the quantum wave $P_W = (-1, \phi^2)$ and the real meaning of the wave collapse at measurement which was previously considered a metaphysical part of quantum mechanics with or without Bohm guidance to use a famous expression coined by one of the pioneers of our approach, namely Prof. G. Ord. The second pioneer we definitely feel our work is
indebted to is undoubtedly Prof. L. Nottale. At the end it was Prof. El Naschie who brought all these different approaches together under the same roof and connected them not only to Connes and Penrose work but to a certain extent to many presently less general but mainstream physics like string theory and loop quantum gravity. We dare say that when string and loop researchers incorporate the empty and the totally empty set, that is to say fractals into their work in a fundamental way, they will immediately notice that the result will be almost identical to the work of Connes and El Naschie.