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Speculation in Science and Technology: Is the Quantum Wave Nothing More than a Prandtl Boundary Layer?

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***Abstract* – This short communication argues for the possibility of a complete analogy between the propagation of a quantum particle-wave in quantum spacetime and the motion of a bluff body in a perfect fluid. The aim is a deeper physical understanding of the highly mathematical theory of quantum wave collapse. To achieve that we follow E-infinity Cantorian spacetime theory and model spacetime as a multi-fractal fluid while the quantum particle is modelled as a zero set surrounded by an empty set. The fundamental idea is then the possibility that this empty set quantum wave could be said to accurately resemble a boundary layer akin to Prandtl's theory. This crucial step connects pure mathematics with experimental facts of fluid dynamics.**

***Keywords* – The Quantum Wave Empty Set, The Quantum Particle Zero Set, Ludwig Prandtl Boundary Layer Theory, E-Infinity Cantorian Spacetime, Wave Collapse, The Measurement Problem of Quantum Physics.**

I. INTRODUCTION

The first sentence of the title of the present work is really taken to be the name of a remarkable courageous journal [1] founded and edited by an even more remarkable and courageous scientist, Prof. Alan MacKay [1-4] who held the Chair of Crystallography at Birkbeck College of the University of London [2-3]. Birkbeck College also housed many other remarkable scientists who interacted with my friend Alan such as the legendary David Bohm [5-7]. It is a well known fact that Prof. Bohm and Prof. de Broglie independently are the fathers of the pilot wave theory of quantum mechanics [6-9]. The second sentence of the title of this paper is the Author's modest attempt to try to follow the road mapped by these two great scientists and not to shrug from walking alone if necessary to explore unchartered territory and speculate on a scientific basis without the morbid fear of possibly being wrong [10] as long as that could help others to arrive at a better theory and a more accurate description of a capricious nature [11-12].

Consequently the aim of the present note is to suggest at a minimum a likeness or analogy between the fundamental discovery of Prandtl's boundary layer theory [13-15], which revolutionized fluid dynamics and thus aircraft, ships and submarine design [13-20] on one hand and on the other hand relates it all to the meaning and physics behind the highly controversial quantum wave collapse, i.e. state vector reduction of quantum mechanics [21-22] that formed a substantial part of the work and legacy of David Bohm [5-7]. Ultimately Bohm had to escape from the witch-hunt of the McCarthy ear in the USA to the freedom of science and belief in Birkbeck College in England, the promise land in that time [5-7].

II. THE QUANTUM PARTICLE AND THE QUANTUM WAVE ACCORDING TO THE PLATONIC SET THEORY DESCRIPTION

Based upon the eminent work of J. von Neumann [23], A. Connes [24], R. Penrose [25] and combining that with E-infinity Cantorian spacetime golden mean number system it was established that [26-36].

a. The pre-quantum particle is best modelled by the zero set which is fixed by the bi-dimension $D \equiv (o\ ;\phi)$

where $\phi = (\sqrt{5} - 1)/2$ is the golden mean [26-34].

b. The pre-quantum wave is ideally fixed by the bordism of the zero set to be the empty set [26-34] which is given by $D \equiv (-1\,;\ \phi^2)$.

c. E-infinity Cantorian spacetime is basically a multi-fractal infinite layer of empty sets with increasing degrees of emptiness [26-34] starting from the empty set quantum wave [34] $D(-1) = (-1\,;\ \phi^2)$to the absolute nothingness given by $D(-\infty) = (-\infty\,,\ \phi^{\infty}) = (-\infty\,,\ o)$ [33-34].

d. On average E-infinity Cantorian spacetime has an expectation value giving the space the appearance of four dimensional spacetime of Einstein's space D = 4 while every point in the space has the same appearance, namely four dimensional [26-34] so that unlike Einstein's spacetime, this space is scale invariant so that its dimension must be adjusted to [33-34].

$$D = 4 + \phi^3 = 4 + \frac{1}{4+\frac{1}{4+\ldots\ldots}} \tag{1}$$

This corresponds to the inverse of an empty set surrounding the quantum wave empty set and given by the bi-dimension [33-34],

$$\langle D \rangle \equiv (-3\,;\ \phi^3) \tag{2}$$

which means

$$D = (1/\phi^3) = 4 + \phi^3 = 4.2360677989 \tag{3}$$

In other words, spacetime is on average the surface of the quantum wave which is given by the first empty set, i.e. $(-1\,,\ \phi^2)$ [26-34].

III. The Quantum Particle and Quantum Wave Possible Alternative Description Based on Prandtl's Hydrodynamical Boundary Layer Theory

As we just outlined in the previous section, the quantum wave is mathematically defined as the surface of the quantum particle zero set and constitutes mathematically the empty set. Now although this sounds highly abstract mathematics it is not and it does make a great deal of physical sense although not as physical as the boundary layer theory because using this zero set-empty set dualism to formulate the particle-wave duality to resolve the wave collapse or measurement problem of quantum mechanics is an unheard of simple prescription. The explanation of the above is as follows: Since the empty set is empty any attempt to take a measurement will make the empty set non-empty and so it collapses to a zero et, i.e. the quantum particle. On the other hand we also reasoned that spacetime itself is a multi-layer fractal of empty sets. Consequently the quantum wave is simply another name for the least empty set of spacetime which constitutes the "surrounding" of the zero set particle. This bears a tricky, hard to overlook resemblance to the boundary layer theory of Prandtl and could give an even far more tangible physical meaning to the quantum wave and a far more realistic model than even the pilot wave of D. Bohm [5 - 9]. In the next section we speculate on making this suggestion a real viable inter-

-pretation of the mysterious wave collapse, removing from it once and for all time any undue mystery.

IV. Discussion of the Boundary Layer Proposal for the Quantum Wave and its Collapse - Relation to Dvoretzky's Theorem

Let us start by recalling Dvoretzky's theorem on measure concentration [8], [31]. As the readers of E-infinity Cantorian spacetime would recall, this theorem states that for any manifold with dimension equal or larger than five, i.e. Kaluza-Klein dimensionality, about 96 percent of the volume is concentrated in a thin boundary layer on the surface of the manifold leaving only about 4 percent for the bulk which does not deserve in these circumstances to be called bulk [8], [34]. Actually alone on the power of this magnificent theorem due to the great Ukrainian born Israeli mathematician who is frequently described as the not very successful Director of the renowned Centre of Excellence in the Middle East, namely the Weizmann Institute, dark energy could be a theorem. If this is correct then this would prove that being a mathematical genius is no guarantee for managerial success but this very important point is not the subject of the present work. Wild but maybe correct extrapolation of this magical theorem may take us to speculate on the concentration of minerals and vitamins on the skin of fruits like apples or the relative resilience of the banana skin compared to its soft interior. Speculating along these lines could prompt us to ask if the quantum wave empty set [26-34] given by $(-1\,;\ \phi^2)$ is just the skin layer separating the zero set particle [26-34] given by $(o\,;\ \phi)$ from the rest of the multi empty set spacetime [26-34], i.e. $(-2\ ,\ \phi^3)$, $(-3\ ,\ \phi^4)$ and so on until we reach nothingness as given by $(-\infty,\ o)$? If this is correct, and stringent dark energy calculation showed that it is correct when compared with accurate cosmic measurement [30] discriminating between ordinary cosmic energy $(\sim 4.5\%)$, dark matter cosmic energy $(\sim 22.2\%)$ and pure dark cosmic energy $(\sim 73.3\%)$ [30] then it maybe possible to go even further with our speculation to presume that 96% of the drag that a bluff body experiences in a perfect fluid is due to the boundary layer in the sense of L. Prandtl [13-17]. In such a case the suction technology of boundary layer engineering could be carried over to quantum mechanics and achieve a non-demolition measurement which would in one stroke be a dramatic confirmation of E-infinity platonic theory, Dvoretzky's theorem [8], [34-36] as well as Prandtl's great achievement and the achievement of his students T. von Karman and Schlichting who probably deserve at a minimum a joint Nobel Prize although this great recognition is not awarded posthumously [35-36].

V. Conclusion

Specialization is surely important but at this present time in the history of science and technology interdisciplinary is just as, if not more important. In such a situation scientific and logically founded speculation is more than called for and engineers should be encouraged to build their own mathematics and likewise, mathematicians should naturally be engaged on thinking how to realize their theorems in nature as if they were experimentalists or engineers. At the end of the day the society as a whole could only gain. Prandtl's theory of boundary layer was a magnificent piece of engineering coming from a physicist that revolutionized both science and technology. In the present article we proposed to stretch the Prandtl idea for maybe too far beyond classical mechanics to deal with quantum mechanics and thus showing that both disciplines are only historically divided but they show the same origin for the universe is both at the same time and it is our point of view which allows us to see one thing and not the other at a time and it is our job to overcome this human limitation and help to see all sides simultaneously, no matter how difficult this proves to be in practice.

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AUTHOR'S PROFILE

Pro. 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 adj- -unct 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 is cosmology and elucidation of the secret of dark energy and dark matter as well as for proposing a dark energy Casimir nanoreactor. 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 81 and his i-10 index is 797 and total citations are 36363 according to Google Scholar Citation.