# The Physics of Empty Sets and The Quantum*


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**Abstract**

We discuss El Naschie's new proposal for the zero set as a quantum particle and the empty set as the bordism of the particle or the quantum wave. A set theoretical proposal for the classical-quantum interface is outline.



**Keywords:** Quantum sets, measurement, classical and quantum interface, E-infinity, empty set in physics, El Naschie's Cantorian spacetime philosophy.


Set theoretical formulation was pioneered by K.F. von Weizsäcker and David Finkelstein [1]. This was vastly developed in various directions notably by H. Saller [2] and using partially ordered sets by F. Dowker [8] as well as G. Hemion [9]. Whilst these directions have helped achieve a great depth of physical and philosophical understanding, they could not be as effective when it comes to computational problems such as calculating the constants of nature, nor when it comes to a definite resolution of quantum paradoxes such as those posed by entanglement and the wave particle duality. From this view point the approach pioneered by El Naschie [3,4] and his associates using random elementary Cantor sets and the golden binary number system seems to compliment the afore mentioned approaches. A third direction which made very successful use of modern computing facilities in conjunction with symplectic triangulation is due to Ambjorn and R. Loll.

In the present work we use the random Cantor set approach of E-infinity theory and extend the particle wave set of El Naschie, He, Nada and Iovane [3-7] by introducing the classical set of measurement. In other words while the mentioned authors have used for a quantum particle $P_Q$ the dimension of zero set

$$\dim P_Q \equiv (d_{MU}, d_c) \equiv (0\ ,\ \phi)$$

where $\phi = (\sqrt{5} - 1)/2$, $d_{MU}$ is the Menger-Urysohn dimension and $d_C$ is the corresponding Cantorian or Hausdorff dimension. The quantum wave $W_Q$ is represented by the classical empty set

$$\dim W_Q \equiv (d_{MU}, d_c) \equiv (-1\ ,\ \phi^2)\ .$$

We add to that the classical set

$$\dim C \equiv (d_{MU}, d_c) \equiv (1\ ,\ 1)\ .$$

* *Dedicated to Prof. M.S. El Naschie on his 65$^{th}$ birthday.*

Next we reason that the hierarchy of empty sets is produced by the zooming property of fractal Cantor sets. Taken to its ultimate logic it is easily demonstrated that the different sets interact via a simple straight forward algebra like in a chemical reaction to produce the perceived dimensionalities of spacetime as well as the wave collapse. As a simple example let us consider the union and intersection of particle and wave with the classical interface. We start with the union. For the particle one finds using the following obvious algebra that

$$\begin{aligned} \dim (P_Q \cup C) &= (0, \phi) \oplus (1, 1) \\ &= (0 + 1) + (\phi + 1) \\ &= 1 + (\phi + 1) \end{aligned}$$

For the wave on the other hand we have

$$\begin{aligned} \dim (W_Q \cup C) &= (-1, \phi^2) \oplus (1, 1) \\ &= (-1 + 1) + (\phi^2 + 1) \\ &= 0 + (\phi^2 + 1) \end{aligned}$$

The average topological dimension of space follows from

$$\begin{aligned} \dim (P_Q \cup C) + \dim (W_Q \cup C) &= 1 + 1 + \phi + \phi^2 + 1 \\ &= 4 \end{aligned}$$

exactly as it should be. The intersection on the other hand produces a particle and an anti-particle which annihilates each other as will be shown in the main body of the full length paper contributed at this conference in celebration of the 65th birthday of Professor Mohamed Salah El Den Hamad El Naschie or as is correct in the Arabic pronunciation, Elnashaee.

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