Fundamental Theory of reality

"Reality is nothing but a mathematical structure, literally"

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Abstract

In This essay I shall derive the laws of nature from a simple mathematical system from a postulate that reality is indeed a mathematical structure. The system can be simulated by a computer program to generate many results that agree with Quantum mechanics. Also I will show that the system can be put in regular more familiar mathematical formalism. The postulate lead to assume particles are made of random lines were one end originates in a small region representing the particle and it extends to all other points in space and some ending on other particles. The points are really nothing but random numbers, hence reality is nothing but some relation between random numbers. Moreover, the lines are responsible for the interaction by a process of crossing or not crossing or meeting.The start point and the end point of these lines define space and the length of the line is interpreted as energy, time is just a change of state. ***The system unifies space, time, matter, energy and interaction, all in one coherent picture, so particles and the laws of nature governing them appear naturally.*** *The simulations generate some basic Quantum Mechanics results and the 1/r law as in quantum field Theory. There are many other results such as the hydrogen 1s level where the universal constants like c, h, e and their relation that lead to Fine Structure constant automatically fall out of the simulation. Two such simulations are carried out; one is Bohr like model and the other Schrodinger like equations solution and show the equivalency. Also, the mass of the electron appear naturally using a simulation which is an extension of the Bohr model which in turn leads to the predicting the size of the proton. The system automatically displays the non-local behavior and explains the EPR in simple terms and shows the origin of spin. Some interesting formulas connecting proton to electron mass ratio, FSC and electron g-factor are produced. While it is shown that coulomb potential is produced by line crossing, Gravity appears when lines meet at a region of Planck's length(gravity needs more investigation).*

1 Introduction

Since our understanding of nature has grown tremendously in the past hundred years or so, it was the scientists in the field who got to consider that nature looks like it has more than this casual relation with mathematics. It was not just the suggestion of that casual relation but also the deeper understanding of how nature seems to be constructed. While we don't understand a lot of things about nature, it was this comprehendible thing about it that made many scientists to make that connection.

The quote of Wigner's "Unreasonable Effectiveness of Mathematics in the Natural Sciences" is very well known and pointed to as one of the first hints. Another hint you can see in the classic textbook by Wheeler , Misner and Thorne GRAVITATION where the first attempts were made to derive the law of physics by logic which they called pre-calculus. As our knowledge increased more people got to consider it like Wolfram in New Kind of Science, Conway's game of life, all kinds of automata ideas, Fractals and not the least as we got hints from how computers generate virtual realities. But Dr. Tegmark with his MUH was the first to formalize the notion in a very concrete way. So this idea did not happen in one go but in a continuous fashion.

Although this essay contains a fair amout of material from my last essay, however, this one contains more examples that verify the viabilty and elaborate on other concepts. Moreover, for many of the results a link would be provided to programs in JavaScript were the reader can confirm the results and have a much better intuition of the system. Next I will explain the system and give the major results followed by comments and conclusion.

2 Derivation of the Model

Reality exists hence we say it is true. But what is really true besides that more than anything else which we can really trust, it is mathematical facts. So, to my mind I connect both since both seem to be a statement of truth. So I took a guess that reality is something akin to a circle (truth). The relations between the points give you a mathematical structure whereby you get PI which defines the structure of the circle.

It is ironic that the prevailing view is that mathematics is an abstract that we derive from nature, yet at the same time it is said that it is a mental construction, I see that as a contradiction. In this essay we prove the opposite such that the constituent of nature and the laws of nature are derived from mathematics without any regard to experiment. In the minimum it can be seen as a counterexample to the prevailing view.

There are quite few concepts in math, but one of the most fundamental and elementary is relations between the entities, like points and lines, that make up a geometric (like circles and triangles or arithmetic like natural numbers structures). So I got to thinking that if nature has something to do with mathematics, then why not start with these basic concepts and see what relations between what entities could give rise to reality. Please note, in this simple system we take the view that a point represents a quantity and the difference between two points are a diffrence between quantities making up a line. That is all, we will not go into scalar and vector fields or debate things like points and lines "don't" have dimensions, that is all not needed for now at least.

I started out with a very naive simple system like in Figure.1 below. Let's say the system is made up of some relation between triangles, but to simplify we can take the simplest subsystem like two triangles. But now we have to decide on what relation, like the distance (red lines be-tween a vertex and a vertex or center of line to a center or vertex to center or any point to any point. Obviously, there are numerous choices. But why should we choose a triangle, and not a sphere or any arbitrary shape for that matter. Again, there are infinite arbitrary shapes and by what criteria I was going to choose the relations between them, so all this looked confusing.

So then I thought to simplify more I will just go to a 1D axis instead of geometric shapes in 2D. To simplify even more I have to choose some line segment. But what can exist on a line? The answer is points and shorter line segments within the original line.

Let's first try points on the line, and let's denote arbitrary positions on the line by x1…. xn, to simplify divide the line into any numbers of equidistant. We ask what design is available to us. Not a lot, say I have 50 counts at x1, 43 counts at x2 and so on. But how many points to choose and how many counts to assign for each point. The only solution is to generalize the concept by randomly choosing any point on the line and iterating the process for let's say for J times. Every time we hit a position we update the counter by one for that position. After doing that j times you will see that all the points will have their counter to have roughly same count. But j can be any number (it should be sufficiently large so the natural thing to do is to normalize by dividing the counters by j.

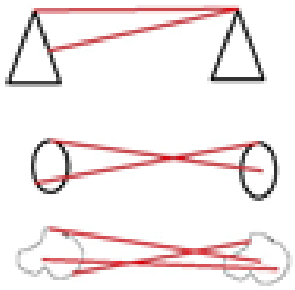

Figure.1

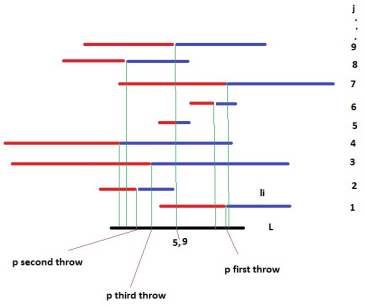

Figure 2

And this will give you the probability of hitting each point which is 1/n. and so, if you sum up all the probabilities they add up to one i.e. n*(1/n)=1, does that remind you of QM? Of course it does, it is the first representation of the photon i.e. the probability is equal throught space. This simple design carries the seed of the design of reality.

Generalizing the above process from points to lines, you will get more complicated Quantum mechanical systems. I will refer to Figure.2 (zoom to see) above to explain the process. Just like in the points example I use a line segment of length L, then in this case I throw **two random** numbers each time. One number **P** denotes the position on the line **L** (just like last time) the other a line segment that extends from that position to the right (blue) and to the left (red), denoted by **li** (we will specify the maximum length later)**.** The green vertical lines denote where a random position hit occurred. And I repeat the process j times.

The only thing that we can do now is to register how many times we hit each **P** position (like 5, 9 in the drawing) and save the counter, and add up the lengths of all the lines of **li** associated for each point and save that in a counter. Then I normalized by dividing by j for the points and multiplying the inverse of totals of the lines by j.

So far I have done the basic operation possible on the line, but what other possible operations are available to us. Well not much only few things.

1. Limit **li** maximum length to **L,** and

A. Put a constraint so that **li** does not go out of **L** on either side, meaning do not register the position and it associate li in that case.
B. Let **li** cross the line on either side. we will ignore this case and leave it to future investigation, although I conjecture that it has something to do with anti-particle.

2. Let **li** go to any distance outside of the line.

Those three options are pretty much the only design that is available to us on the line **L**. But we can complicate the system a bit more, like having two line segments **L**(let's call them **d0 and d1** as in the programs) sitting on a longer line segment **l** which we consider as the universe, so it can be as long as you want. The lines **d0,d1** are interpreted as a particle which can be any number as the Compton wave length . The only other main complication that we can add is to go to N dimensions.

Now for the amazing results:

1. If you simulate using 1A above you will get Schrodinger equation solution for a particle in a box, by again registering the particle **P** position when the constraint is satisfied. Normalizing the number of hits on each position on the line will give you the probability of finding the particle just like SE. adding the lines and normalizing will give you the energy of the particle.

2. If you simulate using 2. Above and using the two lines of L(d0,d1) (with some distance between them) on l.Then the only way that they can interact is by the crossing of the random lines coming out of the two particles. If they don't cross, particle P positions are registered and the lines li are added up just like before with the above mentioned interpretation**.** Doing that will get SE solution for finite potential in case the two lines of **L(d0,d1)** overlap. And when the particles are far away you get some of the results of QFT like the 1/r law and other results mentioned in the abstract, that I will go through later. Some results are not attainable by "mainstream" physics. The system can be generalized to N dimensions like mentioned earlier.

So that is it, reality popping out due to the only possible design on the line using fundamental entity which is the line segment, which generates the mathematical structure we call reality.

Before I present the simulations that produce the claimed results I would like to clarify few points. The programs were originally written in basic and eventually converted to C++ to gain speed, better random number generator and handling large numbers. In the following programs I use **d0** and **d1** to represent the two line segments we denoted by **L** and use **l** instead for the universe size which is not fundamental, just as a reference.

Another issue is whether to use real numbers or integers. Here, we see the old age problem of discrete vs continuum in a new view.The system defaults automatically to two domains, discrete and close to continuum but never quite there, very encouraging. But the system shows a bomb shell. For large distances they are almost equal, but generally I use real numbers they seem to give the best results, however for very short distances the results diverge, this could be useful for checking the model. But also we will see that certain results are only obtained when integers are used as in spin simulation. And for the electron mass and proton size very strange results are obtained when the simulations are done in integers and using real numbers. I will discuss these issues in the simulation section.

2 Basic results that shows how QM arises.

As you will see in the presentation of the results, the system follows very much standard physics. I start out with Schrodinger equation like results for particle in a box and then to more complicated systems. This is the first result that I will present. The program essentially implements the derivation process I have described above. I also converted the program to JavaScript so anybody can run and modify it even to the more complicated programs which I have written in C++. The programs for the basic QM are written in BASIC in the website that need a bit of work on the readers side. However, all other simulations have been converted to JavaScript and the links will be provided.

The particle in a box is generated by throwing a random number denoting a position ("p") on the line and associate a line whose length ("**li**") is also chosen randomly but cannot exceed the length "**l**". A constraint was chosen so that if **li** went out of bound then neither it nor the position associated with it will be registered. Surprisingly this constraint is nothing but the same line crossing we will use in the rest of the programs.

if ((L-p-li)/L < Math.random()) {continue;}....if ((p-li)/L< Math.random()) {continue;}, the constraint

The result is shown in Fig.3, the probability density is a sin^2 wave with the correct amplitude. Note the energy will quadruple as the line becomes half. However, at this stage of this simulation the fundamental constant of nature will not show up, only when we get to the Bohr model. Nonetheless you can still match it to the SE solution. Also, for higher energies it is as simple as dividing by a number and repeating the process, but I will not show the detail because you get minor results and space is limited.

But the real results that give away the model is that when another particle is added inside a bigger particle and then interact by their line crossing you will get particle in finite potential well phenomenology of a particle in a finite potential, with the exponential decay and the tunneling. see figure.4

Multidimensional implantation is so easy just add the constraints for each axis, that is all. See figure.5.

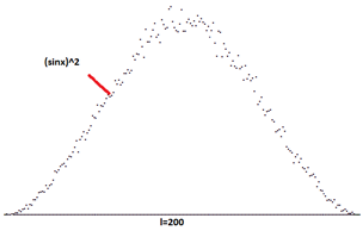

figure.3

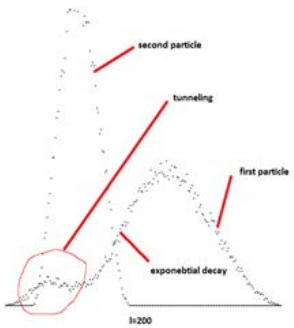

figure.4

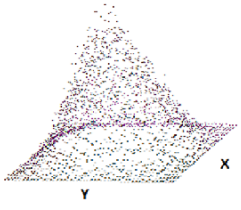

figure.5

3 Description of two particles interacting

In the last section we simulated some the typical particle in an infinite and finite potential. In this section the particles will sit at some distance from each other and the lines from one particle will be allowed to go to the other.

Figure.6 shows 1D implementation. Two particles represented by two line segments d0 and d1 sitting at a distance of dist+d0, d0 represent the added distance from the center of the particles. 1,2 ....j are the number of loops. In each loop two random numbers are thrown for each particle denoting their position (**p, p1**) and length (**li, li1**). If the lines don't cross (star) the positions **p, p1** (the round/square marks) are registered. Then for each particle I have a counter that simply adds the lengths of the corresponding li, li1 line to the previous total for each particle.

I do that (loops) a billion, sometimes a 100 trillion times. Then I normalize to the number of throws. The totals of the lines (normalized) are the energy. The numbers of hits for each position is operated on to get the expectation values. Normalized position hits are the probability densities that are the ones we get from the "squaring" of the wavefunction. Without interaction the expectation value is the midpoint of the particle, but when interaction happens, the expectation value moves. Let's say to left in the left particle and right in the right particle that denotes repulsion. You can also get attraction with different (opposite) logic. But more on the logic part later.

Then the particles are moved to a different distance and the operation is repeated. I explain the code in more detail in the website. It is very important to understand the mechanism here because all other simulations are based on it.
Also, in the abstract we mentioned that space time energy and the interaction are born together, I hope you can see that now. The P,P1 points represent points of space. When we use real numbers we can throw random numbers to any accuracy our hearts desire and make space real dense almost continuum, however, note that the random numbers cannot hit all the points on the real line! hence no true continuum but as dense as you like to be. While integer it is just that, but what is this minimum distance represent, we will explain shortly. Moreover, a big surprise! the space between the particles are filled with points that lines(li,l) radiate from them to the particles. The energy associated with these points are so low which match the standard physics of space being full of the "virtual particles" with very low energy as in cosmological constant. Just astonishing!

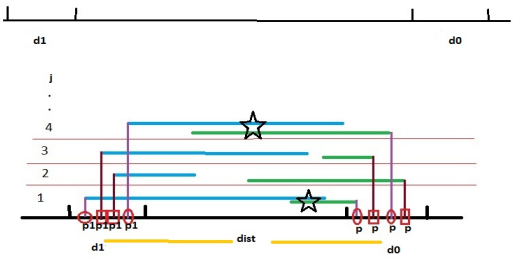

figure.6

4 The simulation of the Bohr model for the hydrogen atom 1s level.

In the last section the interaction for two particles in the system was explained. Here we present one of the most important results of the theory by making the particles interact at a Bohr radius, then we find that Fine structure constant, c, h_bar, charge e2 all fall out of the system with usual relation, ultimately producing the correct energy relation automatically. program link

The simulation leads to the following data for two runs (1 hour each)

D0	distance	potential energy	expectation 1	expectation 1
1823	249801	1.2009548424e-005	2.2159720335	-2.218201416
1823	249801	1.2009565477e-005	2.2152697050	-2.218144778

The distance is the Bohr radius

1/(m*alpha)=1/(.00054858*.007297352569) = 249801.3, m=1/1823

Average of all expectation values=2.2159720335 +2.218201416 +2.2152697050+2.218144778

EV = 2.216896983125

After inspection I find that expectation value, EV= 1/(2mc^2)

Solving for c^2=1/(2m*EV)=1/(2*(1/1823)* 2.216896983125) = 411.16028, so c= 20.277087

Charge e^2= distance *Potential energy =249801 * 1.2009548424e-005=2.9999972 almost 3

But dividing e^2/c^2= 3/411.16028 = **0.00729642**

The number .00729642 looks very much like alpha(FSC)

So that means c =h_bar,

also from standard physics c*h_bar=alpha/e^2=.007297352569/3=411.108,

the rest will follow Bohr model , V^2=c^2*alpha^2 =411.16028 *0.00729642=0.021889246

K.E.=.5*m*V^2=6.00363304e-6

2* K.E.= 1.2007266e-5 almost equal to the potential energy 1.2009548424e-005

All errors are due to simulation accuracy.

THAT MEANS THAT OUR SYSTEM PRODUCED THE MAIN CONSTANTS OF NATURE, WITH NO INPUT FROM EXPERIMENT. However, there is much more to be said about the constants, especially when the real numbers are used, not enough space available for this important topic.

5 Fine Structure Constant from the simulation of the Bohr model

In the previous simulation of the Bohr model the particles we sitting alpha*m_e apart. Here we use the same program and put a simple condition before the interaction takes place by calculating the numbers of the random lines that reach the other particle directly, implemented with these lines of code

```
if ((st1 + p1 + li1 > st0 + 0) && (st1 + p1 + li1 < st0 + d0) ){

q=q+1; }
```

then we calculate 1/alpha = 1/(q/f)-1
This behavior is interpreted in the standard physics as the probability of an electron emmiting a photon, so these lines would be equivelant. And there have been conjecture in physics that alpha is the result of such process, we have the proof for it. Also that establishes the viability and the confirmation of this system. program link

6 Simulation of the hydrogen 1s level with Schrodinger equation type solution.

In section 5 we simulated a system similar to Bohr atom as if you had the electron circling the proton at the Bohr radius, and that was because the 1/r law automatically appears. Now, if I assume a particle with a wave almost as large as the hydrogen atom and a particle which is as small as the proton sitting in the middle, then I very much get the hydrogen 1s picture, but this time the wave looks like the Schrodinger equation solution for the hydrogen 1s.

When I choose the size of the electron wave so that I get the same energy as the Bohr model, then two remarkable results are obtained. First, The size of the wave is very very close to the size of the wave that we get when the SE is solved for 1s. Second, even more remarkable the peak of the wave is EXACTLLY at the BOHR radius distance, in exact agreement with SE solution, that is stunning. see fig.7. That is the strongest point of the viability of the theory. And solves the long standing problem of why Bohr model works. The reality of these lines is clearly shown in this result.

in the simulation I use 1380 for the size of the wave, and you get 250 for bohr radius. the simulation is scaled down by 1000 so as to be able to plot fig 7 more easily. So then Bohr radius is 250000 which is 1/(alpha*m_e). and the energy is the same as in section 4 about 1.2009548424e-005.

program link

Even more amazing, it seems to predict the hydrogen size by giving the electron/proton mass ratio correction to the electron energy.

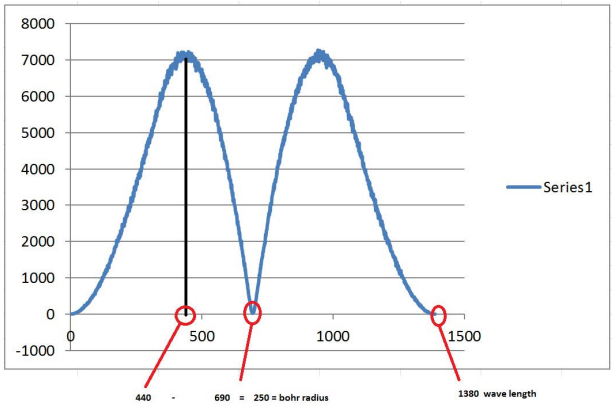

figure.7

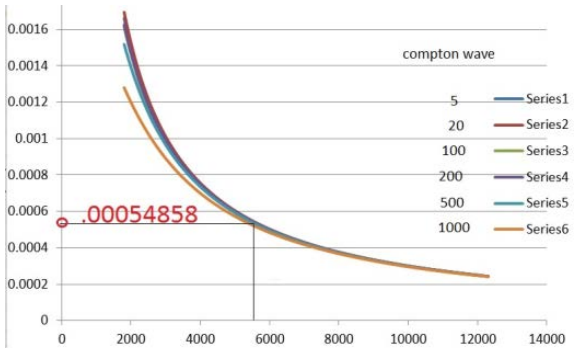

figure.8

7 Mass of the electron and the proton size

In the Bohr model simulation two particles with electron Compton wave size(1823) was used, now if the size is changed from let's say to a set like 10 ,100,500,1500 and simulate for each particle from the minimum distance which is the particle size all the way to about r=100000. When that is done for all the different Comptonwaves and plot the results as shown in Figure. 8 another amazing result is obtained. All the curves merge almost at an energy which equals the mass of the electron numerically at a distance of three times the electron Compton wave. Also for distances less than that the running phase for the charge starts.

Now for another strange result. if the interaction produced the mass of the electron then I ask WHICH interaction produces 1.00727. After inspection I find that it is two particles of size almost 2.33 sitting just next to each other, what a find! But wait, the size of the proton is taken to be the (electron compton/137.036) /2.817 almost(classical electron radius /2.817) in the appropriate units. Lets calculate

(1823/137.036)/2.817= 4.72 that is almost the size of the two particles 2.33*2=4.66

Strangely, when the integers are used the proton sits just at the beginning of the scale. This indicates a very profound relation between the integer and the real number simulations. That is not all. If I simulate two small particles (less than 2) that are siting at a distance equivalent to the classical electron radius. then I get the energy to be .2255256 which is mc^2 just like known physics. That shows the consistency of the system.

program link

8 Spin of particles

In this section I will present the most bizarre and perplexing result of this system. The results can be only obtained when the integer simulation is used, NOT the real numbers.To simulate a spin the two lines d0/d1 are put on top of each other and the interaction is calculated in the usual line crossing manner. Intuitively, the density waves should be similar but I get a very asymmetrical wave for the two particles. Calculating the probabilities when integers are used in the simulation (lines **li, li1** and **p, p1**) I find the electron g-factor in the vicinity of electron Compton wave. The very big surprise is that also I find the proton g-factor in the vicinity of the proton size. Also, interpreting the sign of the expectation value as spin, then one will be up and the other down.

1780	**888.9171726**	**0.002949821**	**0.499388369**	**2.002449522**	**2.002436284**
1790	**893.9148535**	**0.002933438**	**0.499410552**	**2.002360575**	**2.002427852**
1800	**899.0391877**	**0.002917319**	**0.499489434**	**2.002044352**	**2.00213742**
1810	**903.9312993**	**0.002900999**	**0.499419188**	**2.002325949**	**2.002364562**
1820	**908.9896088**	**0.002885346**	**0.499454521**	**2.002184298**	**2.002223108**

The first column is the comptonwave length, the second is expectation value, the last is the first divided by the second. The one before last is the probability(i/f in the program) and they seem to be very close. The average of the last column is 2.0023178 which is so close to electron g-factor 2.002319304.

here are the results for the proton g-factor, the proton size is about 5

3	0.666259673	1.501840704	0.222045036	4.503590885	4.502748885
4	1.201119977	1.21353625	0.300591184	3.326777537	3.330225187
5	1.706725415	1.007588964	0.341415204	2.928984968	2.929586656
6	2.200318323	0.859250986	0.36668915	2.727105509	2.726878169

The proton g-factor is off from the measured 5.8 but still the result is incredible. More investigation is needed.

Moreover, assuming two particles interact as in Bohr model for the X axis and in the Y axis as in the spin method. Meaning that the particle in the Y (and Z axis) axis can only interact with their Compton wave length, then no matter how far are the particles they are linked. One will be up spin and the other down, but you can never differentiate between them. All this is forced upon the model to keep the rotational invariance, just like relativity produces spin in Dirac equation. That means the non-locality in the EPR automatically arises as a natural consequence of the system. No more brain racking, I hope. program link

9 Gravity

At the outset I have to admit that gravity has been enigmatic, however, I have not spent enough time on it. I will present my findings so far. And since I will provide the programs, you might try to find the solution yourself. If an assumption is made that gravity is a result of only when the lines meet, then you will get an incredibly small force translated into a very very tinny expectation value shift. However, it does not seem to be affected by the mass of the particles. Hence it seems that more constraint need to be put. And indeed I try that like puting the condition that only P when it hits the center of the particle I will register. Then I do get the effect of the mass, however, I have to change the normalization that has been successful so far, so it looks inconsistent. There are many other constraints that can be tried, I will present them on the website.

program link

10 Conclusion

Unfortunately the space of the essay is too short to make more robust arguments with details; however, I think any reasonable person with good grasp of physics should see that the system merits serious investigation. The system arose as the result of the only possible design on the line from its own characteristic, which are indeed nothing but relations between random numbers.

The system has been extended also to nD with interaction and there again you get fantastic results also. Since space of the essay is limited I will just point out some intersting results. For example, it mimics some string theory but it shows that particles interacting in small regions they can be done in higher dimensions but if they interact at a distance then it is imposible, only 3D space is possible.

More remarkably after some studying of what my system was saying I concluded that it not only unified physics but also mathematics, although yet again I got to know about unifying mathematics much later upon reading Woit's blog.
The reason why I thought it unifies mathematics is because as I tried to put my system in an old fashion mathematical formalism (which I have done the basic work) and not by the simulation that I am using, I discovered that it connects to just about every major branch of mathematics. from category to probability to intersection theory to network, you name it.
The starting thread that connected to all these branches was that my system was really nothing but a generalized Buffon's needle. Now, Buffon's needle once generalized even more it connects to geometric probability (which connect to endless branches of math) to TWISTORS(surprise!) to many others. However, my system shows that while you can go to the manifested complex number of twistors, but you do not need to, geometric probability is enough at least to get major results.

References for connection between Buffon's needle and twister
http://en.wikipedia.org/wiki/Buffon's_needle
http://en.wikipedia.org/wiki/Geometric_probability
http://en.wikipedia.org/wiki/Integral_geometry
http://en.wikipedia.org/wiki/Radon_transform
http://en.wikipedia.org/wiki/Penrose_transform
http://en.wikipedia.org/wiki/Twistor_theory
Also, more conformation came from this concept
http://arxiv.org/pdf/quant-ph/0608251.pdf

A similar system has been the dream of the century, a system that can produce the universal constants and show the ontological origin of reality with no ambiguity. There is no ambiguity in this system; reality is just a mathematical structure which does not need an explanation as to its origin. Mathematics is just is. I will close with Wheeler's quote "How could it have been otherwise".