Main Paper:
Essay on

Bringing our Children Back to the Church:
Combating "Scientism"

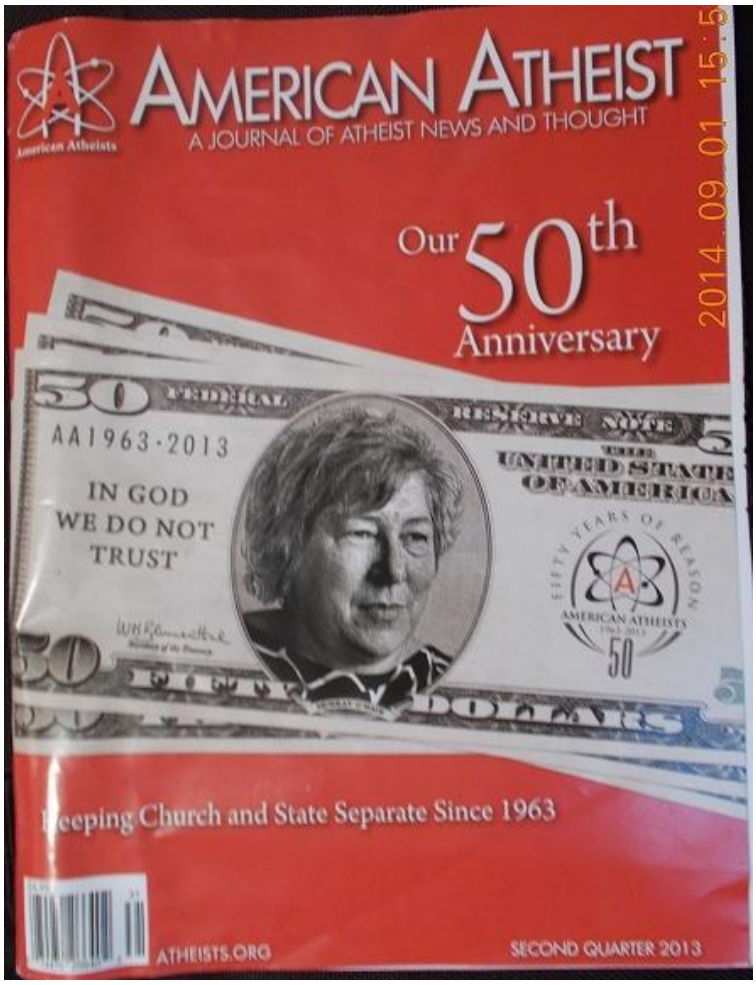
by
Neil Kazen

towards
Course # TRT3675Y
"Applied Orthodoxy"
September 1, 2014
(Revised for typing errors, March 19, 2018)

Introduction:

Last year, the American Atheist journal celebrated its 50th anniversary. On the cover page, they showed their dream $50 bill:

On the left of the bill: "IN GOD WE DO NOT TRUST"



And on the right:
A symbol of the atom with letter "A" in the middle doubling for both "Atom" and "Atheist" that is because, as the statement around the atom says: "FIFTY YEARS OF REASON". After all atheists are the ones with reason who base their arguments on scientific stuff such as Atomic Physics … so they imply.

Our poor children fall for it; after all how can their Faith stand up to such Atomic Science?… And, sadly, they abandon the Faith. Look what happened during the past 50 years.
But wait till you reach the end of this paper, I will be back to deal with their Atom!

…2

Life has never the same since the Christian Titanic hit the iceberg of nihilistic science. The chock threw many of its people off the deck instantly. And with gaping holes in its hull, questioning the very existence of God; and the very foundation of all what Christianity stands on and for, it listed so badly that most of the rest slipped off board into the raging waters. The lucky of them huddled on the dingy lifeboats of New Age "spirituality", tossed around by the waves of insecurity. The not so lucky had to brave the frigid waters of full-fledged atheism that sucked the life out of them. The few who were still on the ship, the die-hard Christians, barricaded themselves in their airtight chambers in a desperate hope for survival regardless of what happens next. Little they knew, once the merciless ocean claims their ship, they will be crushed hard by the heavy weight of reality … die-hard indeed.

While the tragedy is unfolding, Reformers are busy shuffling furniture on board as if that would reverse the listing. They don't seem to be aware of the holes in the hull; either they didn't bother looking over the edge or they were too blind to see. At least they saw the incline while the Performers, of traditional rituals, aren't aware even of that. Watching the Reformers and Performers bumping with each other on that slippery sloped deck would have been entertaining if it wasn't so sad.

Luckily, unlike the other Titanic, this one has unexpected help: Brave divers with effective tools are busy bridging the gaps. In their dedication to save the ship, they didn't bother taking permission of its Officers. After all, it was those "in charge" who steered it on that fatal course. Reciprocally the Officers are not aware of the silent salvage, currently underway by the Divers, since they don't even bother peaking over the edge.

Hopefully, this fledgling rehabilitation, will advance far enough to save the vessel; at least keeping it afloat. Some listing will persist; that is when the Reformers shuffling will bear fruit and the Performers will continue their traditional show.

There are at least two ways in which these scientists use Modern Physics to support the Faith: First they utilize the uncertainty of Quantum Physics as a window of opportunity for the Faith; and they count on the inability of the universe to survive on its own, as a call for the presence of God. With that they help in the removal of major hurdles facing Faith. Second, they show parallels between their science and Theology, i.e. icons of God embedded in scientific discoveries.
The list of such scientists is growing with the deepening of scientific probing into the cosmos. Attached is a flier of a science symposium, presented by four prominent physicists on "String Theory and the Multiverse: Philosophical and Theological Implications" (1). Of these four, I chose Robert Mann for Part I of this paper as an example of dialogue between science and theology. Part II is my own research, with more theological orientation.

Even though I tried to keep the scientific arguments as brief as possible, their minimum length my look too long, and therefore, discouraging for the general reader. For that reason, I highlighted the theological conclusions as encouraging milestones.

Part I
Analysis of R. B. Mann's essay on "Physics at the Theological Frontiers" (2):

Dr. Robert B. Mann is professor physics at the University of Waterloo and former president of both the Canadian Association of Physicists (CAP) and the Canadian Scientific and Christian Affiliation (CSCA). In his essay "Physics at the Theological Frontiers" (copy is attached) he presented an

…3

intriguing description of the latest developments in physics along with insights and challenges that they may raise for Christian faith.

In my selection of his topics, I rearranged their sequence taking theological priorities into consideration.

R. B. Mann starts from purely scientific viewpoint; he is careful not to sound like a theologian bending science to fit his beliefs. Instead, he takes a big-picture perspective of science, trying to make sense of data so huge that, quite often, misses the underlining meaning.

Perhaps the most representative concept of new science is that of Quantization, which R. Mann uses with abundance; but he doesn't stop there; he takes notice of other sciences reaching similar conclusions. He observes that both science and theology confronted similar issues with similar challenges, and sometimes, paradoxes. Both can benefit from a dialogue between the two.

By raising more questions than giving answers, he hopes that will draw the attention of scientists to think about the implications of recent scientific developments for the Christian faith.

He identifies five major points of interface, between science and theology, that have been affected by recent scientific developments: typicality, plurality, reduction, quantization and eternity. The order of these five topics is directed more towards building a gradually increasing interest, among his scientific readers, than to preaching by placing the high-impact topic first. That is not the order I would like to present in a theological paper with a clear preaching intent. For that reason, I took the liberty of placing the last one first (eternity) then quantization, reduction, typicality and plurality (the last two needed to maintain the order that he used):

Eternity (2, pp.16-23):

Plank's Time:

R. Mann views the concept of eternity through an over-all reflection on the subject of "time". He compares its complexity within both theology and physics in the hope of stimulating a dialogue between the two. But I would rather start with the opposite end of eternity: The question of shortest possible time interval. Is there such an interval? Or can time be infinitesimally small with ever-shortening length?
It is a problem the potential of which was simmering early in the twentieth century. It was ignored for the havoc it might wreck on science as it would expose the impossibility of fitting its two major theories together: The General Theory of Relativity of gravity, describing the cosmos at large; with Quantum Mechanics describing the subatomic world (2, p.16). The former describes the world as a continuum, while the second describes it as discrete quantum leaps. Scientists had an uneasy feeling about it but they managed to use each theory successfully within its sphere of application. It was a practical approach to what looked like a schizophrenic universe. The moment of truth arrived when the two had to meet each other at regions of the universe that are both of cosmic-scale mass, yet with subatomic dimensions: Black holes and, prior to that, the Big Bang. Gravitational force increases so rapidly with decreasing dimensions that any attempt to measure a distance less than 10 exp-35 meter (ten to power –35, or one over a hundred billion trillion trillion) of a meter (also called Plank's dimension), will create gravitational force so powerful that it will collapse into a black hole destroying the device. The corresponding time interval of light trying to cross that distance is in the order of magnitude of 10 exp.-43 seconds (called Plank's time). Any clock that will attempt to measure such an interval of time will collapse into a black hole too (2, P.20). That interval of time can not exist in this universe, even in principle. If the universe can only be observed with quantum leaps of time, like in snap shots, what happens in between these gaps? What sustains the

…4

universe while its existence is constantly being interrupted? R. Mann concludes that it means a moment-by-moment dependence on the Creator. Not only the universe needed a Creator, but needed the constant sustenance by the Creator as well. *Other scientists might resist such a conclusion leap, but then they would have to assume that our universe is a projection of some higher-dimensional entity where continuity is sustained. In that case, I would look for characteristics of that entity that would point towards a Creator. The path will just be longer. (Italics are mine)*

The Arrow of Time: (2, pp. 20-22)

The directionality of time, that time seems to flow in one direction, might not look like a big issue; but it's a mystery for science. The laws of both Newtonian *(and Relativistic)* physics are neutral to the direction of time. They remain unchanged if time was running in reverse. *Take the equations describing a falling and crashing glass, reverse the direction of time and you a get a description of glass pieces assembling themselves into a whole glass. Yet no such an event has ever been observed.*

R. Mann refers to seven arrows of time that have been identified by physicists:
- Cosmological: The universe is constantly expanding with no sign of contraction.
- Thermodynamic: Entropy (disorder) always increases, never decreases *(perfume in an open bottle will spread around; the perfume around will not condense itself into the bottle)*
- Radiative: Sound, light and heat always spreads out, never concentrate in.
- Gravitational: Black holes absorb all forms of matter but emit only very limited kind of radiation.
- Metrological: Once a quantum system is changed because of being observed, it will never go back to its original state
- Subatomic: Certain subatomic particles disintegrate slower than their corresponding antiparticles.
- Psychological: Remembering the past and anticipating the future; never remembering the future and anticipating the past.

The above contradicts the time-neutrality of Newtonian *(and Relativistic)* Mechanics; but it is in perfect harmony with the Faith in ultimate purpose that is irreversible. From the Alpha to the Omega, our purpose is charted by God. Each "individual" *(Mann's terminology)* is called according to his purpose (Ro. 8:28).

R. Mann goes further into connecting the above to God's cosmic purpose of love (2, p.21).

Quantization: (2, pp.13-16)

R. Mann focuses on one outcome of Quantum Mechanics:

"Entanglement"

Entanglement describes connectedness, between elementary particles, that defy explanation. *For example, tow electrons on one atomic shell can't spin in the same direction: one has "clockwise" intrinsic-spin while the other has "counter-clockwise" intrinsic-spin. If one of them is flipped, so that it reverses its spin, then the other will reverse its spin instantaneously. This is called "Pauli exclusion principle" (3, p.11). It just states an empirical fact that has no explanation by any of the known forces of nature. The two electrons are mysteriously "entangled". In this case, the entanglement takes an exclusion form.*

Mann chose another entanglement: Polarized photons (2, p.14). If two photons, originating from the same source are entangled (spined in the same direction), then they will remain entangled even if they were

…5

later separated by a large distance. If one of them changed the direction of its spin, the other will do the same instantaneously. That puzzled Albert Einstein who refused to believe that there could be instantaneous transmission of information, even in principle. A verification experiment was performed and Einstein lost the challenge. Entanglement between far-away particles is a fact. It can be used to transmit instantaneous information in totally secured ways, it can be used in quantum computing, and it can offer a parable for theology concerned about connectedness-in-separation.

As the Orthodox theologian Ziziooulas noted, entanglement in quantum physics offers invaluable support to our understanding of the Holy Trinity: The three persons of the Holy Trinity are connected while separate. The Holy Trinity is not just three faces of one God (otherwise, how can we explain the baptism of Jesus); nor it is a committee of three gods. It is three separate persons entangled in infinite love (4). Many heretical ideas can be swept aside by inspiration from quantum entanglement.

Duality:

Another quantization outcome, listed by Mann, is the duality of wave/particle that he called: "schizophrenic" (2, p. 13). *Every particle in the universe is also a wave. And the waves of light are also particles. Each is perfectly a particle and perfectly a wave.* While he did not pursue its theological correlation, it is not difficult to see it as a model describing two natures of one entity. I feel that makes it easier to see the two natures of Christ in His one person.

Reduction: (2, pp. 10-12)

The main purpose of scientific thought is reduction: The belief that disparate phenomena are connected at a deeper level that can be understood though science (1. p.10). Scientists hoped that such understanding could be reduced to concise mathematical equations that unify our understanding of all phenomena. There has been some success in this regard: Newtonian Mechanics unifying earthly with celestial observations; Maxwellian Electrodynamics, unifying electricity and magnetism; four decades ago, electromagnetism was unified with the "weak force" governing radioactivity into "electroweak" theory; then currently attempts are made to unify electroweak force with "strong force" (nuclear force); and finally, "string theory" is trying to unify all of them with the gravitation.

This constant reduction is seen by none-theists as a steady closing off any large gaps that believers can use as evidence for the existence of God. In a leap of faith those unfaithful believe that all mysteries will disappear, leaving no room for any belief in God.

R. B. Mann examined the record of science as a reality check on the assumptions of none-theists. The results don't seem to support their claims; there are too many ad-hock facts that defy explanation. *The percentage of what is scientifically understood compared to what is observed did not increase; probably, it has decreased.* He gives the following examples:

- The "Standard Model" of physics, depends on 27 parameters, each of which has to be determined empirically with no deeper principle explaining their values. *Just ad-hock facts.*

- Further, the Standard Model matter seems to correspond to only 5% of observed mass-energy of the cosmos. "Dark Matter" , that does not interact with electromagnetism (and therefore can't be detected by our telescopes) makes 23% of the cosmic mass-energy. The remaining 72% of the mass-energy of the cosmos is made of "Dark Energy", a totally mysterious entity that causes the universe to accelerate in its expansion.

- The mathematical equations used in Standard Model *(and more so in String Theory)* are so complicated and even unintelligible; defying the original purpose of science: Reduction

…6

To sum it up:
Our science corresponds only to 5% of the mass-energy of the universe. The rest is fundamentally beyond the possibility of observation. Our understanding of that 5% relies on 27 ad-hock parameters that have no underlying unification that we know off. Further, the equations that describe the little that we know, are anything but concise or elegant. The claims of none-theists are unfounded. There is ample room for believing in God.

Typicality and Plurality: (2, pp. 2-9)

This is a delicate issue that poses a challenge to theology-science dialogue: A "privileged" location for humanity at the centre of the universe vs. a typical location in a plural universe.

The notion that humanity was privileged by God, from Genesis to incarnation of Christ, seemed to be consistent with the Ptolemaic system that visualized Earth at the centre of the universe. No wonder that when Nicolaus Copernicus proposed his theory that the earth rotates around the sun the Church reacted with alarm. The earth has been demoted to a mundane location around the sun like any other typical planet. That was regarded as a demotion of humanity and undermining of Christian theology.
Further "demotions" continued as the solar sun was found to be just a typical star out of billions of stars, at a very humble location of our galaxy, which is just a typical galaxy out of billions of galaxies in our universe. In turns out that even our universe is just one out of infinite number of universes (Multiverse theory). Out of those universes there is at least 10 exp.500 (one with 500 zeros to its right) of universes that might support life (low energy universes). That means that there are many worlds identical to ours, with possibly many duplicates of each one of us. If that is true, how does our theology deal with that?

On the other hand, the requirements for a life-supporting universe are extremely tight: a small change in dark energy resulting in change in the expansion rate of the universe, or a slight change in the mass of the proton, results in a universe inhospitable to life. *Furthermore, even if the cosmic parameters were not in conflict with life, other local parameters can present an obstacle to the emergence of life: If ionized belts around the earth were different, harmful cosmic rays could have zapped life; if it wasn't for the accidental bombardment of earth by water-carrying objects there wouldn't have been water on earth (it was a puzzle trying to explain how did the earth retain water while it was a hot sphere of lava), etc.* So, the availability of other life-supporting planets is not exactly a done deal. There is a tension in science between typicality and uniqueness.

Similarly, there is "a dynamic tension in Christian theology between typicality and uniqueness". Typicality, as Jesus reminds us that the sun rises on the evil and on the good, and rains on the righteous and on the unrighteous (Mat. 5:45); and uniqueness as our loving Father counts the hairs on our heads (Mat. 10:31).

Here, R. B. Mann tries to diffuse the conflict between theology and science on the issue of uniqueness vs. typicality by showing that both have a tension along that fault-line. While I would agree with him in-principle, I don't think that the current scientific environment is ready to accept that the two have the same degree of tension. In science, there is currently very little support to any concept of uniqueness; it is predominantly a typicality within a huge plurality. In theology, the human spirit remains unique with the typicality reserved for very broad outlines such as the rising of the sun or falling of the rain.

While it is very hard to defend uniqueness in a deterministic science framework, it is a different matter when science is not as deterministic as it looks. Apophatic holes revealed in quantum science (including life sciences) offers channels for uniqueness of the person and windows for the Faith to come in. .

…7

Part II
The Harmony of Theology - Science: (My research)

Apophacy, in Science, is on the Increase:

Apophacy in science seemed to be dead by the end of the nineteenth century.

Science was perfected, or so it was thought, into deterministic, clockwork view of the universe. That was optimized by the French mathematician Pierre-Simon de Laplace who asserted that the perfect determinism of Newtonian mechanics means that, in principle, everything in the universe can be predicted if enough data was available. There is nothing that can be uncertain. (5, p.341). Late in that century, Maxwellian electrodynamics seemed to complete the picture by incorporating electricity and magnetism into an equally deterministic framework. By the end of the century, it seemed that science had it all known: Nature follows its own rules that are all embedded in this world; that leaves nothing for free-will, which is the essence of Faith, and there would be no need for God either, since everything is perfectly understood. God is pushed away.

Leaving nothing for Apophacy, that science, became like a brick wall separating the longing for Faith from the respect for one's own mind. No wonder, atheism became an indication of one's sophistication and "thinking-out-of-the box". No wonder that Carl Marx who came in that era, adapted its atheism as a pre-requisite for being "illuminated". So was liberalism that was even ahead of its time such as in the French revolution.

But, as we will see, that fools-paradise came to an abrupt end with the "Ultra Violet Catastrophe" of "blackbody" radiation in 1900. The intensity of ultraviolet radiation was drastically less than what was predicted by classical science; throwing its credibility into question. The name given to it: "catastrophe" highlights the panic that classical science went into; as if it sensed that its end, as a teller of fundamental truth, is near. Indeed, what came out of that catastrophe stripped classical science from any claim to the ultimate truth; reducing it to serving only as applied science.

With the first successful mathematical representation of blackbody radiation, quantum mechanics was born and, with it, apophacy-in-sciene. More to that in the QM Introduction, below.

Being too attached to the past, or perhaps too proud to concede Apophacy, physicists called it "quantum weirdness" (5, p.112). They hoped that this Apophacy, or "weirdness" as they called it, would go away with more research; but they ended up with new Apophacy/ "weirdness" that was increasing. They were not just kicking the can down the road; they were rolling a snowball down the hill. Apophacy has been increasing for over a century. It reached a point where failure to acknowledge it is plain "absurdity", in Feynman's words (5, p.111). To reach that conclusion, I summarized the evolution of physics, for the past 113 years, in a way that is comprehensible to none-physicists.

1- Year 1900, Max Plank succeeded in finding mathematical equations that described blackbody radiation accurately, including the problematic ultraviolet radiation. But that came at a price: He had to use summation (of discrete wavelengths) instead of integration (of a smooth continuum of wavelength). This was to say that not all wavelengths are allowed, without giving any reason for it. This ad-hoc assumption was a total mystery that ran contrary to known science of that era. Quantum mechanics was born. (QM, Introduction, below). He was awarded Nobel Prize in physics in 1918.

2- To explain that mystery, Albert Einstein proposed, in 1905, that light comes in lumps that he called

…8

quanta. (5, p.94). Beyond the fact that it worked, there was no explanation for it; no answer to "how" light is lumped, just another ad-hoc assumption. The new mystery seemed to exceed the preceding one by adding a dual nature to light: mass and wave at the same time. He earned Nobel Prize in physics in 1921.

3- To explain the lumps mystery, Niels Bohr proposed, in 1913, that light is emitted when an electron jumps from one orbit to a lower one, and further, that those orbits are discrete with nothing in between (6, p.83). Once again, it was another ad-hoc assumption which, other than that it explained the previous one, has no explanation to it. The new mystery seemed to exceed the previous one. He won Nobel Prize in physics in 1922.

4- To explain the mystery of Bohr's orbits, Prince Louis-Victor de Broglie proposed, in 1923, that electrons are accompanied by waves that have to fit around the orbits in whole numbers. That forces the orbits to be discrete. (5, p.103).Other than explaining Bohr's orbits, there was no explanation as to why or even what are those waves. The new mystery seemed to exceed the one it replaced by adding the puzzling wave behavior to a mass. He won Nobel Prize in physics in 1929.

5- The wave behavior of electron was verified by George P. Thomson and by Clinton Joseph Davison, separately in mid 1920s, using diffraction through a crystal. (5, p.110). The mystery of dual behavior of electron was confirmed but not explained. They shared Nobel Prize in physics in 1937.

6- The wave/ particle mystery deepens. Waves of what? In 1927, Erwin Shrodinger developed equations for probability waves. That the electron is "smeared out" everywhere and distributed around the cosmos according to a probability wave: So, we don't really know where the electron is! The mystery continues to deepen. (5, p.105). He won Nobel Prize in physics in 1933.

7- The ambiguity of the probability wave, was even widened further by Richard Feynman, in 1948, by showing that a particle "sniffs" all possible paths everywhere in the cosmos, each with its own probability. The sum of all those paths with their probabilities, produces the observed wave behavior. (8, p.24 & 5, p.110). This mysterious "sniffing" concept became a pillar of quantum mechanics, and as we will see later, played a very important roll in String Theory. However, with Feynman himself describing it as an "absurd" feature of nature (5, p.111), Apophacy became official. He won Nobel Prize in physics in 1965.

… Apophacy continued to snow-ball with every new frontier of our vision of the cosmos.

Since so much of this essay relies on Quantum Mechanics, a brief introduction is warranted.

What is Quantum Mechanics?

1- Introduction:

QM is what describes the atomic and subatomic world (let's call it "small-scale world") (5, p.86). While the world around us looks continuos in space, time and energy, the small-scale world is not. It is made of discrete jumps: First, energy was observed to come in lumps; later, String Theory (ST) added discreteness in space and time. With these jumps come uncertainty starting with the "Uncertainty Principle" that was the first indication ever, of a fundamental Apophacy, even though limited, in science. Later that uncertainty showed manifestations in wide range of areas, some of which are related to life.

It all started by the curious experiment, in late 1800's, of "The Blackbody Radiation" (6, pp.43-44; 7, p.3). "Blackbody" is defined as a mass that absorbs all electromagnetic radiation applied on it. It can be made

…9

of a cavity in a bloc, such as carbon, with small hole connecting the cavity to outside the block. If the hole is small enough and if the cavity is lined with material that absorbs all incident energy, then the hole will look perfectly black, and acts as "blackbody".

When this block is heated to high temperature (900 K to 1650 K), it radiated energy. The energy within the cavity takes the form of waves bouncing back and forth within the walls like in a harmonic oscillator (like waves on a vibrating string). Some of that energy escapes out of the hole, as "blackbody radiation" carrying with it the outcome of harmonic oscillation within the cavity (very much like the music from the string of a violin). Vibrations of violin strings can be analyzed and predicted accurately by classical mechanics. So, it was thought that blackbody radiation will do the same (with classical electrodynamics, Maxwell's equations, and statistical mechanics added to classical mechanics). Based on that, Rayleigh and Jeans derived, in 1900, the expected distribution of blackbody radiation spectrum. It tuned out to agree well with experimental results for long-wave radiation (like the red light) but disagreed violently for short-wave radiation; in particular, their analyses expected high intensity of ultraviolet radiation (wavelength shorter than that of the visible violet light) (7, p. 5 & 6. pp.43-44), but experiment showed much less value. The discrepancy was so huge that it dealt such a heavy blow to classical physics that it was called "the Ultraviolet Catastrophe" (6, p.46).

That was a rude awakening that ushered the downfall of what is now called "classical physics"; the time has come for a new science, with a totally different frame-of-mind that humanity has never seen its like before. Indeed, in that same year, 1900, Max Plank made an inspired guess by replacing integration (representing assumed continuity in radiation wavelengths) by the unthinkable summation of discrete wavelengths; the resulting predictions matched experimental results. With that Quantum Mechanics was born. Today, Plank has several entities called after him: Plank Constant (a proportionality factor that was included in his original work), Plank Dimension and Plank Time (the smallest possible distance and time interval according to String Theory).

2- The New Truth:

QM offers a radical departure from the deterministic, clockwork of classical science which was behind the death of Faith. Just when they thought hey knew it all, by the end of 19th c, their science was facing three fundamental anomalies:

- Speed of light seemed to be constant regardless of the motion of its source. That was a contradiction to Newtonian Mechanics.

- Electromagnetic laws seemed to be vulnerable to variation resulting from the motion of the experimental device relative to the observer.

- Blackbody radiation and the "Ultraviolet Catastrophe".

God must have been laughing at them

the But they didn't give up. The first two anomalies were resolved, in 1905, by Albert Einstein through his Special Theory of Relativity. He showed that the laws of electrodynamics remain unchanged with the condition that space and time have to be integrated together into a four dimensional constant. Further he showed in his general theory of relativity, in 1915, that space-time integration, when applied to gravitation, resulted in a more complex structure of space and time that curves by the presence of mass (5, pp. 56-76). Shocking as it seemed to some at that time, that was nothing compared to the "catastrophe" that

…10

will come from the third anomaly: The blackbody's ultraviolet radiation. At least, the theory of relativity maintained the continuity of space, time and energy with no fuzziness involved. Its equations are perfectly deterministic, once the location and motion of the observer are factored in, leaving no room for Apophacy. In retrospect, it looks like a refinement and integration of classical physics. On the other hand, the "Ultraviolet Catastrophe" as it was called, lived up to its name: a catastrophe to classical science, and I hope, to the atheism that came out of it. Its result, Quantum Mechanics (QM), is so different from every day experience that even 65 years later, it still looked out of this world; not only to a layman but to one of its own greatest scientists, Richard Feyman. This Nobel Prize in physics laureate said in 1965: "… a lot of people understood the theory of relativity in one way or other, certainly more than twelve. On the other hand I think I can safely say that nobody understands quantum mechanics". I say Amen ... unless you look at it through the lens of Faith: as an indication of mystery of creation. Like the fingers of Pantokrator barely touching; an indication that God meets creation at an infinitesimally small point. That was the origin of the discrete points in QM.

The lesson we learn from QM is that the fundamental workings of the universe are vastly different from our day-to-day experiences. (5, p.108)

While QM has been around for more than a century, the prevailing frame of mind in science and in society at large is still built around classical determinism. Many prominent modern physics scientists, like Hawking, are atheists even though they unwittingly produced work that can help the faith. It is a mirror image of the early classical scientists like Newton and Pascal who were devout Christians, yet produced a science that was later used for atheism. As I see it, QM and the findings that were built on it, provide great help for our Faith. By changing the angle from which we examine those findings, we can see glimpses of the Faith where others might not.

3- Quantum "Weirdness" (in the words of the renowned Theoretical Physicists Brian Greene (5, pp.112-116) and Elmer E. Anderson (6, pp.62-64))

Uncertainty Principle (The primary Apophacy in QM):
In our everyday experience, it looks as if the position of any object around us can be determined with infinite accuracy, at least in principle. That is not the case in QM, according to the "uncertainty principle" noted by German physicist Werner Heisenberg in 1927: The accuracy of determining the position of any object is limited by the wavelength of the radiation that is used to detect it. When we apply that to an electron, the wavelength needed to detect it has to be equally small. But that corresponds to a radiation with a large photon mass that will result in large change in the electron's momentum. To reduce the disturbance to the electron's momentum, we can use radiation with small photon mass; but that corresponds to a radiation with long wavelength, resulting in a large error in determining its position. To have both position and momentum determined accurately, we need a radiation of short wavelength and small photon mass as well. Sadly, that entity doesn't exist: either short wavelength but with large photon mass, or small photon mass with long wave. Tough luck; that is what is given to us. With that, we have to live with a minimum error that can't be reduced regardless of how good our equipment are. That was shocking even to Albert Einstein who argued that in principle, the electron has a well determined position AND momentum. But physicists John Bell and Alain Aspect showed experimentally that Einstein was wrong. The uncertainty principle was confirmed and is described by:

The error in determining position times the error in determining momentum can't be less than a finite quantity called Plank's constant.

…11

By similar reasoning: The error in determining time times the error in determining energy can't be less than Plank's constant.

The later leads to another QM weirdness:

4- QM Tunneling (and the Virgin Birth of Jesus):

Can you walk through a wall?

In QM, yes if your particles are coordinated enough and if you can move fast enough: A particle trapped behind an "energy wall" can borough energy from the universe provided it can repay it back within the time period determined by the uncertainty principle. Once out of the well, it can pay the borrowed energy back. But for you to walk through the wall, you need to have ALL he particles of your body borrowing energy at the same time, then moving through in full tandem. That has very low probability that is nearly impossible, but not exactly so. For a cosmic event like the birth of Jesus, that very small possibility can happen so that He can still be born from a virgin who remains virgin all through the birth. He has QM tunneling available to Him if He wished so.

5- Dual nature: Is it a wave or is it a particle?

Strange things happen in QM:

- Light, which shows every sign of being a wave, was found to have properties of particles (called photons) with all the impact that comes with it. (5, pp. 97-103)

- Electrons that are well known to be particles, surprised scientists by behaving like waves (the double-slip experiment) *(Diagram to be added, 5, pp.103-105)

In the end, it was found that all matter in the universe have wave character while being made of particles too. How can matter have dual nature?

Feynman's statement that "nobody understands quantum mechanics" clearly applies here. But for a Christian, who believes in the dual nature of Christ, that is easy to understand: matter is simply an image of its Creator carrying the fingerprints of His dual nature.

6- The weirdness of "sniffing":

The wave-like behavior of the electron, as discovered by the double-slit experiment, raises the question: Wave of what? It was found to be a wave related to the probability of finding the electron at a certain location at a certain time. Feynman showed that this probability comes from the electron "sniffing" all possible paths from its starting location to its final destination ... that is "sniffing" all possible paths all over the universe *(5, p.110. fig. 4.10 to be added)

But how can the electron "sniff" all possible paths around the universe before even starting? Feyman would say it's one of the weird features of quantum mechanics. But would it be so weird if we look at our universe as a projection of a higher existence that "sees" everything in this world at once? From Christian point is it is not weird at all; in fact it should be expected: The Eschaton sees everything at once all the time; our matter gets direction from Him. Once again, our world relies on Him for direction all the time

…12

7- The mystery of "Entanglement" (as shown above under Part I):

Entanglement describes connectedness, between elementary particles, that defy explanation. For example, too electrons on one atomic shell cannot spin in the same direction: one should have "clockwise" intrinsic-spin while the other should have "counter-clockwise" intrinsic-spin. If one of them is flipped, so that it reverses its spin, then the other will reverse its spin instantaneously. This is called "Pauli exclusion principle" (3, p.11). It just states an empirical fact that has no explanation by any of the known forces of nature. The two electrons are mysteriously "entangled". In this case, the entanglement takes an exclusion form.

Mann chose another entanglement: Polarized photons (2, p.14). If two electrons, originating from the same source are entangled (spined in the same direction), then they will remain entangled even if they were later separated by a large distance. If one of them changed the direction of its spin, the other will do the same instantaneously. That puzzled Albert Einstein who refused to believe that there could be instantaneous transmission of information, even in principle. A verification experiment was performed and Einstein lost the challenge. Entanglement between far-away particles is a fact. It can be used to transmit instantaneous information in totally secured ways, it can be used in quantum computing, and it can offer a parable for theology concerned about connectedness-in-separation.

As the Orthodox theologian Ziziooulas noted, entanglement in quantum physics offers invaluable support to our understanding of the Holy Trinity: The three persons of the Holy Trinity are connected while separate. The Holy Trinity is not just three faces of one God (otherwise, how can we explain the baptism of Jesus); nor it is a committee of three gods. It is three separate persons entangled in infinite love (4). Many heretical ideas can be swept aside by inspiration from quantum entanglement.

8- Too much unconnected data:

The number of fundamental particles increased exponentially, with diverse properties that defy explanation (5, pp.7-12), and QM principles seem to be nothing more than ad-hock collection of statements that are not connected to each other. That led to great unifying effort that resulted in String Theory.

9- String Theory:

9.1- "Strings": *(5, p.14, add Fig. 1.1)

Matter is made of atoms, which are composed of electrons spinning around a nucleus. The nucleus is made of protons and electrons (only the hydrogen atom has no neutron). Electrons and neutrons (called nucleons) are made of three quarks, of almost equal mass that are bound together by a very powerful "Strong Force". Both quarks and electrons are the excitations of vibrating strings. These strings are of finite dimensions in the order of magnitude of Plank dimension (mentioned earlier). This finiteness of dimension, rather than being point-like particles, solves the problem of infinite gravitational force at a point-particle and replaces it by a manageable force. However, in doing so, it creates a demand for extra dimensions: six tiny curled space dimensions at every point in our three dimensional space. Both their size and spacing is in the order of Plank dimension.

9.2- The Fabric of Space-time:

Common wisdom tells us that empty space, is just that: Empty. If there is nothing in it, then there is no meaning to the three coordinate system (up-down, left-right, froward-backward, or simply x, y & z). That

…13

was changed as scientists started ascribing existence to empty space. Isaac Newton visualized it as x, y, and z reference coordinate system spanning the universe that can be used to define positions of matter. Albert Einstein developed it further by showing that it curves around matter which results in altering the movement of other masses in what ends up being called "gravitational field". Both of them visualized it as infinitely smooth, whether it was curved or not.

QM showed that the apparent "smoothness" of space is only approximate: While it is almost perfectly true at large-scale space, it is drastically different at ultramicroscopic dimensions scale: At that scale "smoothness" is destroyed by the violent fluctuations of the quantum world. At Plank length scale (the smallest possible dimension), space becomes very unstable * (5, p. 128, Fig. 5.1). That is where Superstring Theory comes into the picture.

However, early String Theory, in 1968, was not interested in the fabric of space; it was only about matter. It was observed that some "elementary particles" with what seemed like ad-hock properties, can be unified if looked at as vibration resonances of some virtual strings (5, pp. 136-137). While the different vibrational modes of a violin string gives different musical notes, the different vibrational pattern of such strings gives different particles (masses and force charges) (5, p. 143). I wonder, who is playing the violin, the music of which is our world?

In 1974, String Theory was able to include gravity within quantum physics, a feat that was impossible by the Standard Model (Gravitation according to Einstein's General Theory of Relativity when combined with QM at ultramicroscopic dimensions produces infinite forces that are an indication of fallacy).

Later, as frustration over the explosion of elementary-particles physics into an unruly zoo of particles, huge effort was put into abstract mathematics in tandem with theoretical physics to create the first Superstring Theory revolution in 1984-1986 (5, p.139) resulting in more agreement with already established physics (Called Standard Model) but without the above-mentioned problems of that model. However, the resulting mathematics was so complicated that only approximate solutions could be found. That was partially solved by ushering the second Superstring Theory revolution in 1995 (5, p.40). The "Super" in "Superstring Theory" refer to its quest for unifying "everything": All known mass particles and forces (messenger particles). String Theorists like to call it "Theory of Everything" (T.O.E). However, the harder they work, to bring it closer to observed results, the more complicated it gets. Strings had to be accommodated on additional curled up tiny dimensions. Initially, it was thought that one extra space dimension would suffice, but work progressed, more dimensions were needed until it reached six dimensional spatial entities called Calabi-Yau shapes. These shapes, of Plank length, are located at every possible point in our 3D space (so they are spaced apart by about the same Plank length) * (5, p. 208, Fig. 8.10).

That leads us to Quantum Geometry where the very fabric of space becomes the frontier of Superstring Theory. Mathematical spaces become entities of real existence that carry strings, the vibration of which is our world. (Think of the six-winged angels that sing ceaselessly) (Is. 6:2 & Rev. 4:8)

For those string vibrations to generate the three known families of particles (Electron, Electron-Neutrino, Up-Quark, Down-Quark; Muon, Muon-Nutrino, Charm-Quark, Strange-Quark; Tau, Tau-Neutrino, Top-Quark, Bottom-Quark) (5. p.9), the 6-D Calabi-Yau shapes needed to generate three groups of resonances. That requires them to have three loops within * (5, p.257, Fig. 10.4). These three loops have independent characteristics, yet are they all of the same essence: A unitrinity (like an image of the Holy Trinity).

9.3- Tearing the fabric of space/ The "Cosmic Cross":

The fabric of space can tear if it was stretched to the limit. Black holes are possible examples; however,

…14

their cosmic "singularity" is believed to be shielded from the rest of the cosmos by the "event horizon" (the outer limit of the zone of no return). Tears also do happen in the Calabi-Yau 6-D shapes as they undergo transformations (5, p. 266). Unlike black holes these shapes have no "event horizon" shield; yet we don't see any catastrophic consequences to the fabric of the universe. Two explanations were proposed:

- Brian Greene (the author of ref. 5) with his team, were able to explain it by showing that the torn shape happens to have a mirror image that is not torn, and that both shapes are coupled, in that they give the same results. So, they concluded that the torn shape has been spared a catastrophe (5, p.276-278). That is reassuring, but it doesn't tell us why that coupling works. It was like an empirical result without any fundamental explanation.

- A more detailed answer was proposed by Edward Witten (whom Greene considers as the world's greatest living physicist). He showed that the tear within Calabi-Yau shape is actually surrounded by a shield created by a string * (5, p.279, Fig. 11.6). But how can a string, being an infinitely thin loop, would make an effective barrier? It is like you are trying to shield yourself from a cluster bomb by hiding behind a hula-hoop! Witten answered that the string places itself at the right place at the right time, by "sniffing" all possible trajectories. It's the same "sniffing" principle proposed earlier by Feynman to explain the behavior of electron in the double-slit experiment. Here, the only explanation is the "sniffing" principle.

If you were bombarded by cluster bombs, while having a hula-hoop as your only shield. And if the hula-hoop actually managed to protect you by positioning itself at the right spot at the right time as to deflect every shrapnel of the bombs, would you believe that:
- The hula-hoop was "sniffing" all possibilities and acting on its own to protect you? Or:
- God's hand was moving it as needed?

There is nothing scientific about either answer as neither one of them tells us "how" did the hula hoop know how to move, but at least the second answer places the mystery where it belongs, and is consistent with the belief in a caring God. Further, the first scenario has nothing to say about why "sniffing" would be concerned about our safety; while the second answer has that automatically covered by a loving God.

The enormous and eternal effort needed to keep shielding the fabric of space from tearing apart all the time is like a cosmic cross carried by God since the beginning of the universe.

10- Delicate balance:

The existence and survival of the universe as we know it hangs on a very delicate "calibration" of matter and force particles. Some of the examples:

- The stability of atomic nuclei (composed of protons and protons, collectively called nucleons) rely on delicate balance between the forces that bind them together: Electromagnetic forces try to repel protons apart, while "strong forces" binds nucleons together (This strong force originates within each nucleon where it combine its three-quark constituents together). Should electromagnetic forces be slightly stronger, they would rip the nuclei apart, resulting in a world without atoms and without anything that we call existence (5, pp. 12-13). Should the strong force be slightly higher, nuclear transformations from one element to another, would be very different, resulting in a very different universe.

- Should the mass of electron be slightly larger than what it is now, then the electron of the hydrogen atom will bond with its proton to form a neutron, thus collapsing the hydrogen atom into a single particle. With the disappearance of hydrogen, there will be no stars (including our sun) and no complex elements (that originate from hydrogen fusion) (5, p.13)

…15

- Should the gravitation be slightly stronger, stars will burn much faster. Our sun wold have burned so fast that there would have been no life on earth. A change in the opposite direction, slightly weaker gravitation, would hinder the formation of stars; our sun wouldn't have even existed. (5, p.13)

- Should there be a change in either the mass of the proton or in the "dark energy", the rate of the expansion of the universe would be so different rendering it inhospitable to life. (5, pp. 7 & 11)

And the list goes on and on.

Even, on earth alone there are many factors, essential to life, that rely on delicate balance. To give one example: Should the ionized zone around the earth be a little different, life would have been zapped by harmful rays from the sun and from the universe at large.

With so many factors in delicate balance (the list could possibly grow infinite) one would ask: "Why" do all these entities have these exact properties? Some suggest that science has no answer for that (5, p.7); others suggest that String Theory provides an answer by predicting the existence of an infinite number of universes ("Multiverse" theory). With infinite number of universes, covering all possibilities, there has to be a universe like ours (even with all the delicate balances in it), and possibly many universes like it.

As we have seen earlier, if String Theory is true, while it answers the delicate-balance question, it creates an even stronger indication of the presence of a Creator: The very fabric of space is in constant need for mending as it keeps ripping itself apart. That raises the question: "Who" is mending it?

None-theists would ignore the questions like: "why" and "who" and focus on "how" things proceed from these given parameters. The assumption that the "why" and "who" questions would lead to the suggestion that there is a creator is irrelevant to them because such a creator, if really existed, is so cosmic that we will not be able to communicate with Him anyway.

My response to them is that the Creator cares about our very sustenance: His constant mending of our very fabric of space that continues to rip apart; and His ceaseless kick-starting our universe as it keeps disappearing all the time, are indications of His love and care.

11- Theory of Everything?

"Could God have made the Universe in a different way?" Pondered Einstein (5, p.283). Would the necessity of logical simplicity leave any freedom at all?

Einstein spend the last three decades of his life pursuing the Unified Field Theory, the ultimate theory, that will describe the universe objectively without running into any internal inconsistencies or logical absurdities. Even though he did not achieve his goal, he inspired many others, to pursue it. I was one of those who dreamed of it, and geared my graduate study in physics towards that goal. So far, reality check went against that dream: Not only no elegant theory was found, but inconstancies and "weirdness" has been on the increase ever since. QM didn't fit with his General Theory of Relativity. When String theory managed to unify the two, it created very complicated mathematical equations that are far from the simplicity Einstein dreamed of, and it was not one theory but five (Type I, Type II, Type IIA, Type IIB and Heterotic-O). They differ in the geometry of their 6-D curled -up shapes and in the string vibrational patterns that they support (5, pp.284-288, 314).

In their quest for unification of all theories, string theorists discovered correlation's between the five

…16

theories, that gave them a hint for a unifying grand string theory called M-Theory (Master-Theory) * (Fig. 12.2, p. 287). This "Second Superstring Revolution" required adding another spatial dimension to become 10 (our familiar x, y & z coordinates + the six curled dimensions + another unifying dimension), for a total of 11 dimensions with the addition time. (5, p. 287). Further, the M-Theory added more vibrating objects to the strings: vibrating membranes and vibrating blobs increasing the mathematical complexity much further. Yet, all what they are getting from it were just ballpark results. Complications continued, with the addition of a six theory to the M-Theory: 11-D Supergravity * (5, p.315, Fig. 12.11).

That is a far cry from Einstein's dream of an elegant and accurate ultimate-theory. All what we are getting is more and more complexity with no accurate results. Isn't it time to recognize that "Anyone who claims to know something does not have the necessary knowledge; but any one who loves God is known by Him" (1Cor 8:2, 3)

12- Black Holes and Free Will:

With Laplacian determinism the belief of free will was at its lowest point (5, p. 341). Heisenberg's uncertainty principle placed limits on determinism at the small-scale world by proving that there will always be a small uncertainty regardless of the accuracy of measuring devices. In principle, that alone should be enough to put an end to Laplacian determinism since a none-perfect determinism is no determinism at all. But, somehow, determinism survived albeit in a softer form. In particular, it was felt though, to be almost perfectly preserved at the large cosmic scale. But, in 1976, Hawking noted that even at cosmic scale, determinism is violated by the presence of black holes (5, p.342). When any matter is sucked into a black hole, its information is irreversibly destroyed. The fabric of space-time is not smooth as was assumed by Einstein's theory of general relativity; it is filled with creases and knots that destroy information (5, p.343). That is destruction of information at a new level in physics above the level of usual uncertainty of quantum mechanics.

Determinism is dead; free will lives on.

13- Humility/ Faith:

With science growing up out of its juvenile years, it sounds today more like a mature person reflecting on his naive-bravado youth.

"The history of science teaches us that each time we think that we have it all but figured out, nature has radical surprise in store for us that requires significant and sometimes drastic changes in how we think the world works"", B. Greene (5, 373)

Isn't it about time to realize that our failing in understanding the universe means that we would better focus on reflecting on what is observed rather than trying to put it in an even more complicated theory that would lead to no where? (5, p.385)

As Brian Greene wrote: "May be we will have to accept that certain features of the universe are the way they are because of happenstance, accident, or divine choice" (5, p.385). So, here we are now: We see 100,000 times further away than what we did a century ago and we see one billion time deeper into subatomic dimensions; a total widening of our observation range by 100 trillion times since Einstein's general theory of relativity, only to feel that we are chasing a mirage in the desert.

That brings us a full circle to the Bible: "Avoid the profane chatter and contradictions of what is falsely

…17

called knowledge" (1Ti. 6:20). "He has made known to us the mystery of his will, according to His good pleasure that He sestets forth in Christ" (Eph. 1:9)

Back to the "American Atheists":

The atom symbol, at the centre of the "American Atheists" logo, and the focus of their pride of their "reason", is actually an outdated cartoon. It represents the early atom model by Rutherford more than a century ago. That model, with well determined electron trajectories, was laughed at by Erwin Shrodinger who, in 1927, developed equations for probability waves. That the electron is "smeared out" everywhere and distributed around the cosmos according to a probability wave: So, we don't really know where the electron is! (5, p.105). He won Nobel Prize in physics in 1933. The atom looks like a cloud, not like a solar system. This cartoon is for the ignorant public, not for those who boast about their "reason".

If I was to debate "American Atheists" I would:

- Start by deflating their hot air balloon using the above observation.
- Debate their article "Some Tricks of the Brain", of that issue by noting that their classical description of the brain misses the concept of Quantum Mechanical Consciousness of the brain at a molecular level. That QM feature senses QM fluctuations at a molecular level, and opens the door to cosmic connectivity as inspiration surpassing reason.
- That their understanding of evolution, based on random mutations and survival of the fittest, is contradicted by the observation that biological changes are abrupt: In large quantum leaps. A new species arises "suddenly" (by the geological scale). It does not evolve gradually, but all at once and fully formed.(11, P.158-159).
- Their understanding of all biological processes, including evolution, misses Ilya Prigogine's theory on "Dissipative Structures" that won him the 1977 Nobel Prize in chemistry. He solved the riddle of how life has been running uphill in a universe that is supposed to be running downward. Irreversible processes towards higher and higher orders of life (11, p.163). "Life eats entropy" (11, p. 165). Prigogine acknowledged that his theory has strong resemblance to the visions of Eastern philosophers and mystics (11, pp. 166-167). The Holy Spirit at work.

That is an introduction to QM applications in biology. My future work will explore this further, in evolution, brain science/consciousness, botany/ photosynthesis by QM. Then, looking for the Holy Spirit presence behind QM phenomena.

Theology without Quantum Physics? Yannaras as an example:

This is an example of a theologian who strive to define morality in the Church as an existential reality but whose understanding of science was based on the old classical science (that would provide him with mere information). His Freedom of morality was "Freedom as love and freedom as knowledge" but "knowledge as we understand it today- that is as information- doesn't interest me" (Yannaras, 12).

Unaware of the difference between QM and classical science, he alienated himself from any science of nature. That led him to focus exclusively on the extreme notion of person transcending nature, that our path to theosis must lead to transcending our human nature. By that, he limited his morality to morality of love, with only rhetorical morality of knowledge. The result was a lopsided morality that is too dependent on transcending nature; that brought him too close to the Christ of Arius. …18

Only by including natural sciences in theology, we can have theology that is authentic to the dual nature of Christ

Summary and Conclusions:

It has been a long journey since the human race ate the forbidden fruit believing the evil promise of reaching the ultimate knowledge; to be just like God. For thousands of years, humanity worked hard chasing that dream; quite often mistaking the dream for a reality; giving a blind eye for any glimpse of reality pointing to the contrary: The Pythagoreans demonized the only member of their group who saw an irrational number… so far for seeking the truth.

No wonder, the synthesis they created with Biblical Christianity, carried the seeds of its own destruction, right from the beginning. The Devil was cleverer than what many thought; but God's patience paid off: Humanity reached the end of its leash. Now, wisdom calls for recognizing our limits; or be strangled by a leash that is stretched to the limits.

In everything around us, from the Sun-shine to the green leafs and human consciousness, the science of brokenness is unavoidable; and at its core is un-known ability, un-calculability, like an upright stick balanced on the palm of a hand with constant attentiveness by the hand's owner: God.

…….

References:

1. *"String Theory and Multiverse: Philosophical and Theological Implications"*, Science Symposium, Department of Physics, Wheaton College, Wheaton, Illinois, March 26-27, 2008

2. R. B. Mann, *"Physics at the Theological Frontiers", draft invitation essay on Perspectives on Science and Christian Faith*, Canadian Scientific & Christian Affiliation, June 25, 2012.

3. Walter E. Meyerhof, *Elements of Nuclear Physics*, McGraw-Hill book Company, 1967

4. J. Zizioulas in *"The Trinity and an Entangled World:"*, Ed. J. C. Polkinghorne (Eerdmans 2010), p.146

5. Brian Greene, *The Elegant Universe*, Vintage Books 2003

6. Elmer E. Anderson, *Modern Physics and Quantum Mechanics*, W. B. Sunders Company 1971

7. Robert H. Dicke and James P. Wittke, *Introduction to Quantum Mechanics*, ADDISON-WESLEY PUBLISHING COMPANY, INC.1960

8. Leonard I. Schiff, *Quantum Mechanics*, McGraw-Hill Book Company 1968.

9. Brian Green, *The Fabric of the Cosmos,* Vintage Books 2005

10. Neil Douglas-Klotz, *Prayers of the Cosmos*, HarperCollins Publishers, 1990

11. Marilyn Ferguson, *The Aquarian Conspiracy*, J. P. Tarcher, Inc. 1980.

12. Christos Yannaras, *Towards a New Ecumenism,* Sourozh, nr. 70, November 1997

13. Christos Yannaras, *The Freedom of Morality*, St. Vladimir Seminary Press, Crestwood, N.Y., 1984